AURORA AUSTRALIS

ON Sunday the 4th instant, at 9h. 28m. P.M., my attention was suddenly called to a "fire." Looking in the direction indicated, I saw at S.S.E., about 15° above the horizon, a glare of reddish light. Curious to know whereabout the supposed fire was, I kept my eyes upon that part of the heavens. Presently, similar patches of light broke out on either side of the first, and in a few seconds I could see, on the assumption made, that there must be several fires blazing away over a wide range, for the sky was here and there lit up with a peculiar dark red light over an extent of at least 70° of the horizon. My attention being now aroused, I had recourse to various conjectures, which were speedily abandoned. The idea of an aurora had occurred almost at the outset; but as I had never, with certainty, seen one in Mauritius, and never heard or read of any having been observed there by others, I felt some reluctance to admit the fact that I was actually witnessing one. My doubts, however, were soon dispelled. I noticed that patches of cloud floating across the illuminated portions of the sky reflected no light, and on one or two occasions, a faint flickering, like lightning, was seen among the upper cirrus clouds. These and other facts, coupled with the knowledge that the magnets had been occasionally disturbed to a considerable extent on Friday and Saturday, and on the morning of Sunday, left no doubt on my mind.

Hastening to the house, I immediately mounted a portable inclinometer and declinometer, and took all the measures I could to observe what might take place, dividing my time and attention between the instruments, which I put up in a verandah facing the south, and the aurora right in front of me.

The needle of the inclinometer did not give the slightest indication of a disturbance, but the declinometer magnet was affected to the extent at times of 9′.

It was 9h. 48m., or 20m. after I saw the luminosity supposed to have been caused by a fire, that I began to observe the aurora systematically, and I append a copy of the notes which I took from that time up to 1h. 20m. A.M.

What struck me particularly was the apparent quietness of the whole scene. Unlike the "merry dancers," which I have often seen and admired in Scotland, rapidly changing shape and colour, and rushing in variegated columns and bands in different directions with great velocity, thereby conveying an impression of energy and violence, the display of Sunday night was calm and serene, giving one an idea of peace and repose. Except shortly after I first saw the phenomenon, I could not make out any motion of the arches, segments, or luminous bands. They appeared and disappeared without change of locality, the intensity of the light increasing or decreasing without any flickering. I could see no shooting, darting, or rushing of the bands or beams. Each made its appearance and disappearance simultaneously along its whole length, as if the action was vertical.

The spectacle presented by the beams from 11 P.M to 11.20 P.M. was at once grand and lovely beyond description. Almost from the extreme left to the extreme right, and from as low down as I could see up to a meridional altitude of about 72°, the sky was furrowed with alternate white and dark bands, all of which, so far as I could judge, were parallel to each other and to the magnetic meridian. They were generally at unequal intervals, sometimes crowded together, and sometimes considerably apart; but in this respect I could only judge of those near the meridian. At times they presented the appearance of graceful folds and convolutions, but the action seems to have been performed so gently and imperceptibly as to convey no idea of motion. They presented the same colour during the whole time, namely, a steel grey to a silver white.

The arches and segments were of a blood, cherry, or Indian red, and every now and then, when the intensity of the light increased, the stars twinkled like gems seen through a delicate pink curtain or veil placed before them. Occasionally one could fancy that he was looking at the Southern Cross through very transparent glass or crystal of an exquisite ruby tint into an inner chamber lit up with light of a similar colour.

The light was never very strong. I saw no part of the landscape lighted up by reflection. It is to be borne in mind, however, that I was occupied with the instruments, and that much may have escaped my attention.

During some parts of the night black clouds passed over the field of view, and I believe, although I could not see them, except on one or two occasions, that they were light cirrus and cirro-stratus clouds in the upper regions, as had been the case throughout the day.

The wind was light from E. by S. throughout, and the barometer was ·100 inch below the mean for the season.

After 1 A.M. the aurora speedily died away. At 3 A.M. I could see nothing; but looking out at 4.30 A.M. I saw a red glow in the southward, which at first I took for aurora, but which turned out to be cirrus clouds lit up in the early dawn.

Throughout Monday the magnets were quiet. A great many cirri appeared, which, in the evening, assumed at eastward and westward a dark red colour, very much resembling that of the aurora.

The Magnetic Observatory, which had barely commenced operations, may be said to have been inaugurated on Sunday night, and it is possible that its future records will show, amongst other things, that aurora is not so unfrequent in Mauritius as is supposed, although such a display as that which has just occurred may not be seen for many years to come. In the end of August and beginning of September, 1859, aurora was observed over a considerable portion of both hemispheres, and on one night during that period I saw a reddish glow in our southern sky, which may have been the Aurora Australis. Probably the present display has been seen over a great part of the globe. Has any unusual solar activity been observed? On Friday a chain of spots stretched over nearly the whole of the sun's disc, and a large group occupied another part of it. On Monday the chain had disappeared. Any one who may have made observations in the colony or at sea on Sunday night would oblige me by sending them to the Observatory. It would be interesting to know the height of the aurora.

Aurora Australis seen at Mauritius on the 4th to 5th February, 1872.

9.48 P.M.—An irregular convex arch of dark red light extending over about 60° of the horizon, and having its vertex in the line of the magnetic meridian. Brightest below the Southern Cross.

9.58 P.M.—An arch of a dark red colour having a cord of about 70°. Vertex in or near the magnetic meridian. Patches of black cloud passing over the coloured segment from E. by S., but they reflect no light.

10.1 P.M.—The segment is of a more intense dark red colour. Its eastern limit is about 3° east of the Cross, and its brightest portion from 1° to 2° above the Cross. It is broken off towards the west, and extends in that direction to about only S. by W.

10 4 P.M.—No segment now seen, but patches of Indian or cherry red on either side of the magnetic meridian at a distance of 30° to 40° from it.

10.8 P.M.—The whole has almost disappeared.

10.19 P.M.—An intense blood-red patch at S.S.E. having its centre 2° to 3° below the Cross. The stars shining through it with subdued light.

10.20 P.M.—The red light all gone, but a broad conical space of an ash-grey colour, with a slight green tinge, low down on the horizon, and apparently bisected by the magnetic meridian. Resembling early dawn.

10.22 P.M.—A dimly defined arch of a smoky red colour extends from about E.S.E. to S.W. by W. The height of its vertex is about 40° above the horizon.

10.24 P.M.—All gone.

10.25 to 10.30 P.M.—Appearing and disappearing. Some faint streaks of whitish light seen low down.

10.34 P.M.—Six bands of faint whitish light near horizon at S. by E.

10.37 P.M.—A bright meteor of first magnitude travelled slowly from α Centauri towards N. by E. It had a train of light and left sparks behind it. Colour white with a yellow tinge. The auroral bands brighter and higher.

11 P.M.—Sixteen luminous bands of a steel grey to a silver white colour, extending from as low down as I can see to within 20° of the zenith. The extremity of one of them is close to Canopus. Light of the Great Magellan cloud enfeebled. No apparent convergence of the beams; they seem to be quite parallel.

11.6 P.M.—The parallel bands are still seen. They cover the greater part of the hemisphere, extending (at the meridian) to about 72° above the horizon. On their eastern and western extremes there are patches of blood-red light, but none in the intermediate space. Some of the bands appear to be folded in a direction from west to east.

11.7 P.M.—Dying away.

11.15 P.M.—A deep red glow from E. to W. by S. along the horizon. Fourteen parallel bands of a silvery colour, with dark bands between them. They lie south and north, occupying nearly the whole southern hemisphere as far as the eye can reach, and are flanked at east and west by patches of blood and cherry red.

11.24 P.M.—The bands have disappeared. There is a deep red glare at E.S.E. and a lighter one at W.S.W.

11.28 P.M.—A few faint bands on either side of Canopus. A red light on their western, but none on their eastern side.

11.31 P.M.—A dark red glow at W.S.W., about 12° above the horizon.

11.33 P.M.—Clouds gathering in the lower regions of the atmosphere.

11.37 P.M.—Two parallel faint beams of whitish light 2° to 3° east of Canopus. A faint red glow at W.S.W., about 10° above the horizon.

11.42 P.M.—Two broad bands of faint whitish light to westward and three to eastward of Canopus. A patch of red light still at W.S.W. near horizon.

11.46 P.M.—Clouds gone. Aurora gone.

11.49 P.M.—A faint red glow at W.S.W. about 10° above the horizon, and a band of faint greyish light about 2° west of Canopus.

11.51 P.M.—The glow at W.S.W. is brighter and higher.

11.58 P.M.—Much fainter.

0.34 A.M.—A segment of dark red light from S.E. by S. to W.S.W., and rising at its middle to about 45° above the horizon.

1.20 A.M.—A bright red glow from S.E. to S.W. Intensest below the Centaur. Soon died away. J. MELDRUM

Royal Alfred Observatory, Mauritius, February 6

GEOLOGY

Supposed Legs of Trilobites*

MR. HENRY WOODWARD, of the British Museum, in a reply to the paper by the writer in vol i., p. 320, of the present series of this Journal, supports the view that the supposed legs are real legs. He says that the remark that the calcified arches were plainly a calcified portion of the membrane or skin of the under surface is "an error, arising from the supposition that the matrix represented a part of the organism." But Prof. Verrill, Mr. Smith, and myself, are confident that there is on the specimen an impression of the skin of the under surface, and that this surface extended and connected with the arches, so that all belonged distinctly together.

Moreover the arches are exceedingly slender, far too much so for the free legs of so large an animal; *the diameter of the joints is hardly more than a sixteenth of an inch outside measure; and hence there is no room inside for the required muscles.* In fact, legs with such proportions do not belong to the class of Crustaceans. Moreover the shell (if it is the shell of a leg instead of a calcified arch) is relatively thick, and this makes the matter worse.

We still hold that the regular spacing of these arches along the under surface renders it very improbable that they were legs. Had they been closely crowded together, this argument would be of less weight; but while so very slender, they are a fourth of an inch apart. Mr. Woodward's comparison between the usual form of the arches in a Macrouran and that in the trilobite does not appear to us to prove anything. We therefore still believe that the specimen does not give us any knowledge of the actual legs of the trilobite. Mr. Woodward's paper is contained in vol. vii., No. 7, of the *Geological Magazine.*

J. D. DANA

PHYSIOLOGY

Blood Crystals

AN interesting volume has just been published by M. W. Preyer on Blood Crystals. The literature of this subject, which dates no farther back than 1840, is already extensive, no less than 143 authors being quoted in the "Bibliography," some of whom, as Böttcher, Hoppe-Seyler, Kühne, Lehmann, Rollett, Valentin, and M. Preyer himself, have written many separate essays on points bearing more or less directly upon the crystallisation of the blood. Though blood crystals were first observed by Hünefeld, the merit of discovering them is due to Reichert, who first recognised their nature. The fact of the crystallisation of a complex organic substance like blood was first received with some amount of incredulity, but the corroborative testimony of many microscopists soon cleared away all doubt, and a variety of methods were suggested by which the crystals could be obtained. The best plan for obtaining them is thus given by M. Preyer. The blood is received into a cup, allowed to coagulate, and placed in a cool room for twenty-four hours. The serum is then poured off, and a gentle current of cold distilled water passed over the finely divided clot placed upon a filter until the filtrate gives scarcely any precipitate with bichloride of mercury. A current of warm water (30°—40° Cent.) is now poured on the clot, and the filtrate received in a large cylinder standing in ice. Of this a small quantity is taken, and alcohol added drop by drop till a precipitate falls from which an estimate may be made of the quantity required to be added to the whole *without* producing a precipitate. The mixture, still placed in ice, after the lapse of a few hours, furnishes a rich crop of crystals. The forms of the crystals obtained from the blood of different animals do not vary to any great extent, and are all reducible to the rhombic and hexagonal systems. The vast majority are rhombic prisms, more or less resembling that of man. The squirrel, however, with several of the Rodentia, as the mouse and rat, and the hamster, are hexagonal. The hæmoglobin of several corpuscles is required to form a single crystal. All blood crystals are double refracting. The animals whose blood has been hitherto examined and found to crystallise, are—man, monkey, bat, hedgehog, mole, cat, lion, puma, fox, dog, guinea pig, squirrel, mouse, rat, rabbit, hamster, marmot, ox, sheep, horse, pig, owl, raven, crow, lark, sparrow, pigeon, goose, lizard, tortoise, serpent, frog, dobule, carp, barbel, bream, rudd, perch, herring, flounder, pike, garpike, earthworm, and nephelis. The spectrum of blood-colouring matter when oxidised with its two absorption striæ between D and E of Fraunhofer's lines or in the yellow part of the ordinary spectrum, and the single band of deoxidised hæmoglobin, are now well known. M. Preyer states he has not been able to obtain a spectrum from a *single* blood corpuscle, but that the characteristic bands are visible where certainly only a very few are present. The specific gravity of dry hæmoglobin he gives at about 1·3—1·4. The solubility of the crystals obtained from different animals varies considerably. Those of the guinea-pig and squirrel dissolving in water with great difficulty. Hæmoglobin is insoluble in absolute alcohol, æther, the volatile and fixed oils, in benzole, turpentine, chloroform, and bichloride of carbon. It is easily soluble in alkalies; acids rapidly decompose it. He calculates out for it the fearful formula of $C_{600}\ H_{960}\ N_{154}\ Fe,\ S_3\ O_{179}$, as agreeing very accurately with the percentage results of its analysis. Its equivalent is 4444, 4. Many pages of M. Preyer's work are occupied with an account of the action of various reagents upon it. The plates contain the forms of the principal crystals, and thirty-two spectra lithographed in colours. He describes five crystallisable products of the decomposition of hæmoglobin, namely, hæmin, hæmatosin, hæmatoidin, hæmatochlorin, and hæmatolutein, and several uncrystallisable, such as methæmoglobin, hæmatin, and hæmathion.

H. P.

SCIENTIFIC SERIALS

Annalen der Chemie und Pharmacie, September 1871.—Kochlin has continued his researches on "compounds of the camphor group." By the action of nitric acid on camphor the author has obtained a new body, $C_9H_{12}O_5$, which he calls camphoronic acid, and which has the property of forming salts in which H_2 and H_3 are replaced by metals. By distillation with potassic hydrate, butyric acid is produced; with bromine in presence of water camphoronic acid is oxidised, yielding oxy-camphoronic acid; this acid forms salts, in which H_1, H_2, and H_3 are replaced by metals.—An important physiologico-chemical paper follows by Hlasiwetz and Habermann on "Proteids," and a paper by Naumann on the length of time for the evaporation and condensation of solid bodies," which, however, do not possess much general interest.—Bender contributes a paper on the "hydrate of magnesic oxychloride." This substance, however, does not appear to be very stable, or to have very marked properties.—Mulder has experimented on allantoin and bodies

* From the *American Journal of Science and Arts* for March 1872.