Brazilian expeditions to observe the transit of Venus of December 1882. The volume, which is a handsome quarto of some 750 pages, and is fully illustrated with photographs of the various stations and instruments, contains reports from three stations, the weather at the Imperial Observatory at Rio de Janeiro itself, which should have been a fourth station, having proved cloudy and wet. It had been at first intended to send an expedition to Cuba, but as the French astronomers were to occupy a position there, the little Island of St. Thomas, belonging to Denmark, was chosen instead. St. Thomas paired well with the southern station, Punta Arenas, in Patagonia, for the duration was much shortened at the former place and slightly lengthened at the latter, the sun being high at both stations, and ingress and egress at both taking place nearly symmetrically with regard to the meridian. The entire transit was also seen from the remaining station, Olinda, near Pernambuco, where ingress was somewhat retarded and egress much accelerated. The observations were all made by the method of projection, in order that the disturbing effects of irradiation might be got rid of as far as possible. The St. Thomas expedition which was under the command of Baron de Teffé, possessed three equatorials, and Dr. H. Draper had promised to supply a photoheliograph, but his lamented death prevented the carrying out of his generous intention. The Olinda expedition, commanded by M. J. de Oliveira Lacaille, had two equatorials; whilst M. Cruls, the chief of the Punta Arenas party, had but one; the largest telescope in each case being 6¼ inches in aperture. M. Cruls selected a site for his party within a mile of that occupied by Dr. Auwers with the German expedition; for the Brazilian Parliament having delayed the necessary credit for the expedition to the last moment, the expedition did not arrive at the place until late, and it seemed better to take advantage of the German choice of position rather than lose time by surveying for a fresh site at a distance. The observations at each of these three stations were successful, the second internal contact being observed at all, but the first internal contact was lost at St. Thomas. The method of chords could not, therefore, be employed, but the combination of the second contacts of the two northern stations with both contacts of the southern gave 8″·808 as the resulting parallax. A large part of the volume is devoted to a report of the voyage of the corvette *Parnahyba*, by Captain L. Saldanha de Gama, the captain who conveyed the southern observing party to their station, and to a description of the natural history of Tierra del Fuego.

THE TAIL OF COMET 1887 *a* (THOME).—Prof. Bredichin has discussed in the *Bulletin* of the Imperial Society of Naturalists of Moscow, 1888, Nos. 2 and 3, the observations of the direction of the tail of this comet. The comet was discovered by Mr. Thome, of Cordoba, on January 18, 1887, and it was remarkable for the smallness of its perihelion distance, the complete absence of any nuclear condensation in the head, and the length, straightness, and narrowness of the tail. Prof. Bredichin finds that the tail manifestly belongs to his third type, viz. those in which the repulsive force, $1-\mu$, does not exceed 0·1. He suggests, as the rate of outflow in comets of short perihelion distance is much more rapid at perihelion passage than later, and as the comet was not discovered until a week after perihelion, that the lighter materials may already have been driven off and reduced to such a degree of tenuity as to be invisible, leaving only substances of heavy atomic weight. As is well known, he associates his first type of tail, that in which the repulsive force is greatest, with hydrogen, the more ordinary second type with the hydrocarbons; and he suggests in the case of the present comet that elements with atomic weights like those of gold, mercury, and lead, would furnish a tail of the character observed. Some comets, however, which do not approach the sun closely, have tails only of the third type. If, then, Prof. Bredichin's explanation is to be received in its entirety, hydrogen and hydrocarbons are not always constituents of cometary tails.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1888 *NOVEMBER* 25—*DECEMBER* 1.

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on November 25

Sun rises, 7h. 38m.; souths, 11h. 47m. 19·0s.; sets. 15h. 57m.: right asc. on meridian, 16h. 6·7m.; decl. 20° 54′ S. Sidereal Time at Sunset, 20h. 17m.

Moon (at Last Quarter November 26, 17h.) rises, 21h. 1m.*. souths 4h. 56m.; sets, 12h. 40m.: right asc. on meridian, 9h. 14·7m.; decl. 18° 7′ N.

Planet.	Rises. h. m.	Souths. h. m.	Sets. h. m.	Right asc. and declination on meridian. h. m.	° ′
Mercury..	5 53 ...	10 38 ...	15 23 ...	14 57·0 ...	14 59 S.
Venus.....	10 37 ...	14 18 ...	17 59 ...	18 37·4 ...	25 2 S.
Mars	11 30 ...	15 29 ...	19 28 ...	19 49·1 ...	22 32 S.
Jupiter....	8 32 ...	12 33 ...	16 34 ...	16 52·1 ...	22 6 S.
Saturn....	21 48*...	5 14 ...	12 40 ...	9 32·2 ...	15 37 N.
Uranus ...	3 31 ...	8 57 ...	14 23 ...	13 16·0 ...	7 23 S.
Neptune..	15 50 ...	23 35 ...	7 20*...	3 56·2 ...	18 39 N.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

Occultations of Stars by the Moon (visible at Greenwich).

Nov.	Star.	Mag.	Disap. h. m.	Reap. h. m.	Corresponding angles from vertex to right for inverted image. ° °
26 ...	37 Leonis ...	6 ...	7 25	near approach	178 —
28 ...	B.A.C. 3996 ...	6 ...	1 44	near approach	301 —
30 ...	B.A.C. 4572 ...	6 ...	5 59	near approach	124 —

Nov. h.
25 ... 13 ... Saturn in conjunction with and 1° 31′ south of the Moon.
Dec.
1 ... 11 ... Saturn stationary.

Variable Stars.

Star.	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei	0 52·4 ...	81 16 N. ...	Nov. 25,	0 27	*m*
			,, 30,	0 6	*m*
S Arietis	2 9·8 ...	24 32 N. ...	Dec. 1,		*m*
λ Tauri...	3 54·5 ...	12 10 N. ...	Nov. 26,	20 44	*m*
			,, 30,	19 36	*m*
ζ Geminorum ...	6 57·5 ...	20 44 N. ...	,, 29,	2 0	*m*
R Canis Majoris ...	7 14·5 ...	16 12 N. ...	,, 25,	0 41	*m*
			,, 26,	3 57	*m*
U Monocerotis ...	7 25·5 ...	9 33 S. ...	,, 27,		*m*
U Hydræ	10 32·0 ...	12 48 S. ...	,, 26,		*m*
S Leonis	11 5·1 ...	6 4 N. ...	,, 30,		*M*
R Scuti	18 41·5 ...	5 50 S. ...	,, 29,		*M*
η Aquilæ	19 46·8 ...	0 43 N. ...	,, 29,	18 0	*m*
T Aquarii	20 44·0 ...	5 34 S. ...	,, 27,		*m*
T Vulpeculæ ...	20 46·7 ...	27 50 N. ...	,, 29,	21 0	*M*
			,, 3[illegible],	22 0	*m*
Y Cygni	20 47·6 ...	34 14 N. ...	,, 25,	2 18	*m*
			,, 28,	2 12	*m*
δ Cephei	22 25·0 ...	57 51 N. ...	,, 25,	4 0	*M*
			,, 28,	21 0	*m*

M signifies maximum; *m* minimum.

Meteor-Showers.

The most interesting periodical shower of the week is that of the *Andromedes*, the stream connected with Biela's comet, but no remarkable display can be expected from it this year: max. Nov. 27; radiant about R.A. 25°, Decl. 44° N. Other showers of the week are as follow:—

	R.A.	Decl.	
Near λ Persei	60°	50° N.	... Very swift.
,, β Canum Venaticorum	190	42 N.	... Swift; streaks.

GEOGRAPHICAL NOTES.

TWO letters relating to Dr. Nansen's expedition across Greenland have been published—one from Dr. Nansen himself to Mr. Augustin Gamel, Copenhagen, who is defraying the expenses of the expedition; the other from Mr. Sverdrup, one of Dr. Nansen's companions, to his father. The letters were sent forward from Godthaab by two *kajak*-men, who delivered them to the captain of the *Fox*, at Ivigtut. The following is a translation of Dr. Nansen's letter:—

GODTHAAB, *October* 4.

I have at last the great joy to report to you that Greenland has been successfully crossed from east to west. I regret that the very short time left to me before despatching my messengers will not permit any detailed account. I can just jot down a few words to be forwarded by the *kajak*-men. I am sending southwards in the hope of stopping the *Fox* at Ivigtut, and getting her to wait for us and take us home this autumn. But

in case the *kajak*-messenger should catch the steamer without inducing her to wait for us, I write these few lines just to inform you that we are all alive and well.

As you will know, we left the *Jason*, the Norwegian sealer, on July 17, and expected to reach the shore the next day. But in this we were sadly disappointed. Screwing ice, maëlstroms, impassable ice, where it was alike impossible to row or to drag the two boats, stopped us. One of the boats was stove in, but we got it repaired again. We drifted seawards at a speed of thirty sea miles in the twenty-four hours. Drifted in the ice for twelve days. Strove hard to get to the shore, were three times on the point of succeeding, but were as often carried out to sea again by a current stronger than our power of rowing. Were once, for a whole day and night, very near perishing in tremendous breakers of the sea against the ice-rim. After twelve days' drifting about, we managed at last to get ashore near Andretok, north of Cape Farewell, at 61° and some minutes of northern latitude. We rowed again northwards, reaching Uminik, from which point the crossing of the inland ice began on August 15.

We directed our course for Christianshaab on the western coast. Encountered severe snowstorms and had heavy ground. Estimating that it would be too late to reach Christianshaab in time for this autumn's vessel, we altered our course and steered for Godthaab, the ice-fields in that direction having, besides, been hitherto trodden by no one. After altering course, reached height of 10,000 feet, with temperature of 40° to 50° C. below zero. For several weeks we remained at an altitude of over 9000 feet. Tremendous storms, loose, new-fallen snow, enormously difficult passage. Towards end of September we reached at last the western side above Godthaab. Had a perilous descent, on ugly and very uneven ice, but got safely down to Ameralik Fjord. Managed to build a kind of boat from floor of tent, bags, bamboo reeds, and willow branches. In that frail craft Sverdrup and I rowed away, and arrived here on October 3. The four men are left at Ameralik, living there on short rations fare, but will be sent for as soon as possible.

There you have in short outline our Saga. We are all perfectly well, and everything has been in the best order. I hope that we may catch this steamer, and that instead of this letter you may see our sunburnt faces.

With many greetings, yours ever devotedly,

FRITHIOF NANSEN.

P.S.—Just now the *kajak*-men must leave, profiting by the favourable weather. They have 300 miles to make before getting to Ivigtut.

The following is a translation of Mr. Sverdrup's letter :—

GODTHAAB, *October* 4, 1888.

We arrived safely here yesterday after forty-six days' wandering from east to west. It did not prove so easy to get on shore from the *Jason* as we had expected. We got into formidable ice-screwings, and the current took us southwards and out from the shore, so that we had twelve days' very hard work before getting to land, and that 300 miles more to the south than we had intended. We began at once to work back along the coast, and this took us another twelve days, so that we did not begin our crossing of the ice before August 15. The ascent was very fortunate, as we chanced to find comparatively easy ice to climb up. We shaped our course for Christianshaab, but after getting up to 7500 feet we were attacked by a northern snowstorm. We resolved, therefore, to set our course for Godthaab, the distance being shorter, and there being a better chance of favourable winds. I may truly say that we had a hard time of it. The snow and ice were very heavy, and the weather was trying. For nearly three weeks we were up at nearly 10,000 feet, and had a temperature of −40° to −50° C. Only for four days were we snowbound. After all, we have to be thankful it was not worse. After getting down from the inland ice on the western coast, we had before us some ninety miles of barren country, of which the half lay along a fjord. We tried to cross here, but found it too hard work ; so we managed to construct a kind of boat from the bottom of the tent and some bags, and in that, after four days' rowing, Dr. Nansen and I reached here, where we had the most cordial reception from all the inhabitants of the colony. Two boats have now been sent to the bottom of the fjord to fetch our comrades. The regular vessel has long since left, but some 250 or 300 miles further south there is supposed to be, at Ivigtut, a steamer loading for Copenhagen, and we are now sending a *kajak*-message in order to stop that steamer if possible. We have but little hope of that, however, and are preparing to pass the winter here. That may be very comfortable after all, but of course we would prefer getting home. I must hurry up, as we are now going to dine with the parson, and, in fact, we have not had time for anything, as since arriving here we have gone from one social party to another. You may see from that how well we are off. I was the only one of our whole party who got over all the tremendous fatigues without the smallest ailment. I am, and have been all the time, as fresh and sound as a fish.

DR. GEORG SCHWEINFURTH has started upon an Oriental journey. He is going to Arabia first, to continue his studies of the coffee-plant.

THE FOUNDATION-STONES OF THE EARTH'S CRUST.[1]

DO we know anything about the earth in the beginning of its history—anything of those rock masses on which, as on foundation-stones, the great superstructure of the fossiliferous strata must rest? Palæontologists by their patient industry have deciphered many of the inscriptions, blurred and battered though they be, in which the story of life is engraved on the great stone book of Nature. Of its beginnings, indeed, we cannot yet speak. The first lines of the record are at present wanting—perhaps never will be recovered. But apart from this—before the grass, and herb, and tree, before the "moving creature in the water," before the "beast of the earth after his kind,"—there was a land and there was a sea. Do we know anything of that globe, as yet void of life? Will the rocks themselves give us any aid in interpreting the cryptogram which shrouds its history, or must we reply that there is neither voice nor language, and thus accept with blind submission, or spurn with no less blind incredulity, the conclusions of the physicist and the chemist?

The secret of the earth's hot youth has doubtless been well kept. So well that we have often been tempted to guess idly rather than to labour patiently. Nevertheless we are beginning, as I believe, to feel firm ground after long walking through a region of quicksands; we are laying hold of principles of interpretation, the relative value of which we cannot in all cases as yet fully apprehend—principles which occasionally even appear to be in conflict, but which will some day lead us to the truth.

I shall not attempt to give you an historical summary, but only to lay before you certain facts for which I can answer, and to indicate the inductions which these, as it seems to me, warrant. If I say little of the work of others, it is not from a desire of taking credit to myself, but because it is immaterial for my present purpose who first made a particular observation and how far his inductions therefrom were correct. The acknowledgment of good work would involve repudiation of bad, and for that, so far as persons are concerned, it seems hardly fair to use the present occasion. So, in the outset of this lecture, I will once for all make a statement which I have sometimes thought of invariably using, like a prefatory invocation, "You are free to suppose that everything herein has been said by somebody, somewhere," but I will add that, as far as possible, every assertion has been personally verified.

The name Cambrian has been given to the oldest rocks in which fossils have been found. This group forms the first chapter in the first volume, called Palæozoic, of the history of living creatures. Any older rocks are provisionally termed Archæan. These—I speak at present of those indubitably underlying the Cambrian—exhibit marked differences one from another. Some are certainly the detritus of other, and often of older, materials—slates and grits, volcanic dust and ashes, even lava-flows. Such rocks differ but little from the basement-beds of the Cambrian ; probably they are not much older, comparatively speaking. But in some places we find, in a like position, rocks as to the origin of which it is more difficult to decide. Often in their general aspect they resemble sedimentary deposits, but they seldom retain any distinct indications of their original fragmental constituents. They have been metamor-

[1] An evening discourse, delivered at the Bath meeting of the British Association, by Prof. T. G. Bonney, D.Sc., LL.D., F.R.S., &c