Paris 1878. Cours de Physiologie Générale du Muséum d'Histoire Naturelle. Leçons sur les Phénomènes de la Vie. 8vo. 1878.
The Family of the late C. Bernard.

Brodie (Rev. P. B.) Fossil Lepidoptera. 8vo. *Warwick* 1877.
The Author.

"Researches in Spectrum Analysis in connexion with the Spectrum of the Sun." By J. N. Lockyer, F.R.S. Received November 17, 1877. Read January 24, 1878.*

In a map of the solar spectrum, containing a greatly increased number of lines, such as that upon which I am now engaged, it is possible to seek under favourable conditions the coincidence or non-coincidence of lines due to elements hitherto undetected in the solar atmosphere, on account of their existing in quantities insufficient to give very marked spectral lines.

A search has accordingly been made, on the principles laid down in previous communications, for those elements which contain in their spectra long and well-characterised lines in the photographic region.

Although the evidence cannot be said to be complete until the whole spectrum has been examined, it is not too early to adduce the following evidence as to the existence of several additional metals in the sun's reversing layer, and the probable existence of others.

The results obtained up to the present time are shown in the following tables, premising that in the first paper of this series the metals considered as being solar as the result of the labours of Kirchhoff, Ångström, and Thalèn, together with the considerations there brought forward regarding the length of the lines, were as follows :—

Na	Fe	Ca	Mg	Ni
Ba	Cu	Zn	Cr	Co
H	Mn	Ti	Al	

* See *ante*, p. 49.

† "Phil. Trans.," 1873, p. 253.

Metals the presence of which in the Sun is confirmed.

Name of Metal.	Approximate W.L. of lines reversed in the solar spectrum.	Observations.	By whom previously mapped.	Particulars from Thalèn's Tables.		
				Metal.	Wave length.	Intensity. 1=brightest.
Strontium	4029·60	Absent from spectre normal near long Mn line ..	New line.			
	4076·77	A line at 4076·9 in spectre normal assigned to Ca	Thalèn	Sr	4078·5	1
				Ca	4077·0	3
	4215·00	In spectre normal assigned to Ca (W.L. 4215·40)	Thalèn	Sr	4215·3	1
				Ca	4215·3	1
	4607·5	A line at 4604·5 in spectre normal assigned to Ca	Thalèn	Sr	4607·5	1
				Ca	4607·5	4
Lead	4019·28	Absent from spectre normal	New line.			
	4056·80	An unassigned line near required position (W.L. 4057·25) in spectre normal	Thalèn.....	Pb	4058·0	4
	4061·25	Absent from spectre normal	Thalèn.....	Pb	4062·5	4
Cadmium	4677·00	An unassigned line at W.L. 4676·5 in spectre normal	Thalèn..... Kirchhoff ..	Cd	4676·8	1
	4799·0	An unassigned line at W.L. 4698·9 in spectre normal	Thalèn..... Kirchhoff ..	Cd	4799·0	1
Potassium	4042·75	Absent from spectre normal	New line.			
	4046·28	Absent from spectre normal	New line.			
Cerium	3928·7	Absent from spectre normal	New line.			
	4012·0	Absent from spectre normal	New line.			
Uranium	3931·0	Absent from spectre normal	New line.			
	3943·0	Close to Al line	New line.			
	3965·8	Absent from spectre normal	New line.			

Metals probably present in the Sun.

Name of Metal.	Approximate W.L. of lines reversed in the solar spectrum.	Observations.	By whom previously mapped.	Particulars from Thalèn's Tables.		
				Metal.	Wave length.	Intensity. 1 = brightest.
Vanadium....	3901·3		New line.			
	3909·3		New line.			
	3989·65		New line.			
	3992·5		New line.			
	3997·9		New line.			
	4379·0	Assigned by Ångström to Ca.....	Thalèn	Ca	4379·1	4
				Va	4379·0	1
	4384·0	Absent from Ångström's map	Thalèn	Va	4384·0	1
	4389·0	Assigned by Ångström to Ca.....	Thalèn	Ca	4389·4	4
				Va	4389·0	2
	4407·5	Assigned by Ångström to Ca.....	Thalèn	Ca ..	4407·0	5
				Va ..	4407·5	1
Palladium....	3893·0		New line.			
	3958·0		New line.			
	4787·0	Assigned by Ångström to Fe.....	Thalèn	Pd	4787·0	3
				Fe	4785·8	5
	4817·0	Not allocated by Ångström	Thalèn	Pd	4817·0	3
	4874·0	A line near required position assigned by Ångström to Fe	Thalèn	Pd	4874·0	3
Molybdenum.	3902·0	Very near Fe line	New line.			
	4576·0	Not allocated by Ångström	New line.			
	4706·0	Assigned by Ångström to Fe.....	Thalèn	Mo	4706·5	4
				Fe	4706·5	5
	4730·0	Assigned by Ångström to Fe	Thalèn	Mo	4730·5	4
	4818·0 ?	Absent from Ångström's map	Thalèn	Mo	4818·0	4
	4829·0 ?	Line near assigned by Ångström to Ni	Thalèn	Mo	4829·5	4
				Ni	4828·4	5
				Ni	4830·2	5

Metals probably present in the Sun—*continued*.

Name of Metal.	Approximate W.L. of lines reversed in the solar spectrum.	Observations.	By whom previously mapped.	Particulars from Thalèn's Tables.		
				Metal.	Wave length.	Intensity. 1 = brightest.
Indium	4101·0	Apparently coincident with Fe line in solar spectrum	Thalèn	In	4101·0	1
	4509·0	Absent from Ångström's map	Thalèn	In	4509·5	1
Lithium	4603·0	The line in Ångström's map is placed at W.L. 4601·7 and no metal assigned	Thalèn	Li	4602·7	1
Rubidium	4202·0	The line in Ångström's map is placed at 4201·0 and made winging the adjacent Fe line	Thalèn	Rb	4202·0	2
Cæsium	4554·9	Assigned by Ångström to Fe, no line in Thalèn in this position	New line.			
	4592·0	Absent from Ångström's	New line.			
Bismuth	4722·0	Absent from Ångström's map	Thalèn	Bi	4722·0	1
Tin	4524·0	Not in spectre normal, a neighbouring Bi line at 4524·4 is shown	Thalèn	Sn	4524·0	1
Lanthanum	3948·2	Not in spectre normal	New line.			
	3933·0	Not in spectre normal	New line.			
	3995·04	Not in spectre normal	New line.			
Glucinum	3904·75	Not in spectre normal	New line.			
Yttrium or Erbium	3949·6	Not in spectre normal	New line.			
	3981·8	Not in spectre normal	New line.			

It is important to bear in mind that the lines recorded in the foregoing tables are in most cases the very longest visible in the photographic region of the respective spectra. In some cases they are limited to the region 39–40, which I have more especially studied. So that the fact of their being reversed in the solar spectrum must be considered as the strongest evidence obtainable in favour of the existence in the sun of the metals to which they belong, pending the complete investigation of their spectra.

Where, however, there is only one line, as with Li, Rb, &c., the presence of these metals in the sun's reversing layer can, for the present, only be said to be probable. Neither must it be forgotten that in addition to the long lines which a spectrum may contain in the red, yellow, or orange, long lines may exist in the hitherto unexplored ultra-violet region, so that the necessity for waiting for further evidence before deciding finally upon the presence or absence of such metals in the sun will be rendered obvious.

It will be thought remarkable that if the long lines of such metals as lithium and rubidium are found in the photographic region of the spectrum, the long lines (Li, W.L. 6705; Rb, W.L. 6205 and 6296), should have escaped detection.

To this it may be replied that, although these red lines may be apparently the brightest to the eye, it by no means follows they are the longest, since they are situated in a part of the spectrum which affects the visual organ more strongly than the photographic region does. It is possible also that the reasoning I have lately used in a paper communicated to the Society on the spectrum of calcium may be applied in these cases.

Since a sensitized film is affected by some rays more strongly than by others, in determining the lengths of lines from a photograph, it is not fair to compare together portions of the spectrum separated by too great an interval.

Furthermore the fact of these red lines having been overlooked in the solar spectrum is not conclusive proof of their absence, inasmuch as this portion of the spectrum is both brighter and less refrangible, and a greater degree of dispersion would be necessary when prisms are employed to render visible faint dark lines which are easily detected in the photographic region.* I hope to be able to make special search for these lines on some future occasion.

For metals having long lines in the green a special search was made. The long thallium line (W.L. 5349) was photographed, but no distinct evidence of a corresponding solar line was obtained.

Two long silver lines were found also, about W.L. 4018 and 4212,

* It is significant that there is a dark line near the position of the Li line both in Ångström and Kirchhoff's maps not assigned to any metal.

but these lines, which are reversed, are of such great width that it is at present impossible to say whether they are coincident with lines in the solar spectrum.

April 4, 1878.

Sir JOSEPH HOOKER, K.C.S.I., President, in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

Notice was given that, with a view to facilitate observation of the Solar Eclipse of July 29, the Pennsylvania Railroad Company will convey observers, being private persons, from Philadelphia or New York to Denver and back at reduced fares.

The following Papers were read:—

I. "On the Development of the Parasitic Isopoda." By J. F. BULLAR, B.A., Trinity College, Cambridge. Communicated by Dr. MICHAEL FOSTER, F.R.S., Prelector of Physiology in Trinity College, Cambridge. Received March 14, 1878.

(Abstract.)

The paper contains an account of some points in the development of the *Cymothoa œstroides* and *C. parallela* of Milne-Edwards.

The work was mainly carried on in the Zoological Station at Naples, and the author takes this opportunity of returning his best thanks to Dr. Dohrn and Dr. Eisig for the kind way in which they forwarded his researches.

The eggs were prepared in the way described by Bobretzky in his paper on the development of *Oniscus murarius* ("Zeit. für Wiss. Zool." Bd. xxiv), namely, by heating them in water, and then hardening them, first in bichromate of potash, and then in alcohol, beginning with 70 cent. and gradually increasing the strength to absolute. The sections were stained with Kleinenberg's hæmatoxylin and mounted in Canada balsam.

The eggs when first laid are surrounded by a single membrane.

The earliest stages of segmentation were not observed; the first described is that in which a circular patch of cells has appeared at one pole of the egg. The cells are of considerable size and contain very large granular nuclei; in the centre of the patch they are polygonal, and more than one layer deep, but at the edges they are flattened and form a single layer.

The blastoderm gradually spreads over the yolk, the cells on the