

- XV. "Supplementary Note on a Spectrum of a Solar Prominence."
By J. NORMAN LOCKYER, F.R.A.S., in a Letter to the Secretary.
Communicated by Dr. SHARPEY, Sec. R.S. Received November
5, 1868.

SIR,—I have the honour, in continuation of my letter of the 20th ultimo, to inform you that I have this morning obtained evidence that the solar prominences are merely the expansion, in certain regions, of an envelope which surrounds the sun on all sides. I may add that other facts observed seem to point out that we may shortly be in a position to determine the temperature of these circumsolar regions.

J. NORMAN LOCKYER.

- XVI. "Spectroscopic Observations of the Sun."—No. II. By J.
NORMAN LOCKYER, F.R.A.S. Communicated by Dr. SHARPEY,
Sec. R.S. Received November 19, 1868.

The reading of this Paper was commenced.

November 26, 1868.

Lieut.-General SABINE, President, in the Chair.

In pursuance of the Statutes, notice was given from the Chair of the ensuing Anniversary Meeting, and the list of Officers and Council proposed for election was read as follows:—

President.—Lieut.-General Edward Sabine, R.A., D.C.L., LL.D.

Treasurer.—William Allen Miller, M.D., LL.D.

Secretaries.— { William Sharpey, M.D., LL.D.
George Gabriel Stokes, Esq., M.A., D.C.L., LL.D.

Foreign Secretary.—Prof. William Hallows Miller, M.A., LL.D.

Other Members of the Council.—Frederick Augustus Abel, Esq. ; Sir Benjamin Collins Brodie, Bart., M.A. ; William Benjamin Carpenter, M.D. ; J. Lockhart Clarke, Esq. ; Frederick Currey, Esq., M.A. ; Warren De La Rue, Esq., Ph.D. ; Sir William Fergusson, Bart. ; William Henry Flower, Esq. ; Capt. Douglas Galton, C.B. ; John Peter Gassiot, Esq. ; John Hawkshaw, Esq. ; John Marshall, Esq. ; Joseph Prestwich, Esq. ; George Henry Richards, Capt. R.N. ; Archibald Smith, Esq., M.A. ; Lieut.-Col. Alexander Strange.

Lieut.-Col. Cameron, Mr. Crofton, Mr. Griess, and the Rev. Dr. Tristram were admitted into the Society.

The following communications were read:—

- I. "Account of Explorations by the Swedish Arctic Expedition at the close of the Season 1868, in a Letter to the President." By Professor A. NORDENSKIÖLD. Communicated by the President. Received November 20, 1868.

Tromsö, October 23, 1868.

SIR,—The second geographical part of our expedition anchored a few days ago in the harbour of Tromsö, after a difficult and adventurous autumn cruise of a month in the polar basin north of 80° lat. ; and as these regions were never before visited in such a late season, I hope that our observations will be of interest for the arctic men of Great Britain, as contributing to settle some points of the polar question recently much debated.

According to the plan adopted for the Swedish Expedition, five of its naturalists returned, in the middle of September, to Tromsö with one of the small ships that brought coal to our depot at Amsterdam Island, and the same day the 'Sofia,' with the remaining part of the expedition (consisting of v. Otter, Berggren, Nyström, Palander, Lemström, and myself), steamed northward for Seven Islands, where it was our intention to wait for a favourable occasion to go further. But finding these islands so surrounded by ice that no anchorage was accessible, we were compelled to abandon this plan and go directly northward, following a tolerably large opening in the pack. After a cruise of some days among the ice we, on the 19th of September, at $17\frac{1}{2}^{\circ}$ long. east of Greenwich, reached $81^{\circ} 42'$ N. Lat. ; but, as may be seen by the adjoined photograph, the ice further northward was so closed that it was impossible even for a boat to advance. We turned westward, in vain looking for another practicable opening. Following the border of the pack, we were, on the 24th September, at a longitude of 2° W. already south of 79° lat., after often having passed fields of drift-ice covered with particles of earth, which seems to indicate that land is to be met with further northward. Despairing of finding the ice westward more favourable, and anxious to make a new survey later in the autumn of the position of the ice-field between 0° and 20° long., we returned to our coal-depot.

North of $80^{\circ} 30'$ the season was already far more advanced than one would presume from the observations at Spitzbergen during the first part of September. The temperature of the air being -6° to -8° (Centigrade) below zero, the surface of the sea was, when calm, covered by a layer of new ice more than an inch thick ; and after sunset the obscurity, increased by constant intense frost-rime, made the sailing or steaming among the ice both uncertain and dangerous. As the salt water has no maximum of density, the freezing of the surface over a depth of 1000 to 2000 fathoms would be difficult to explain, were it not that the sea-water in the polar regions is by the melting of the ice and the heavy autumnal snowfalls *less salt, and accordingly lighter, even when at a temperature lower than that of the layers beneath.*

The last week of September was employed in filling our coal-boxes and refitting our steamer for a new struggle with the ice. During these days a strong easterly snow-storm prevailed, which made us hope to find the newly-formed ice broken and the pack more dispersed than before. Our

intention was to employ this favourable circumstance for making a last attempt to go northward, and if this should prove to be unsuccessful to winter at Seven Islands. This plan was frustrated by an accident similar to that which happened to the expeditions of Buchan and Ross in 1818.

The calm that during the summer prevails in the Arctic Sea gave way after September 23rd to almost uninterrupted stormy weather, which caused such a violent and irregular sea on the border of the pack that it was impossible to advance without exposing the ship to be instantly crushed by the large rolling hummocks. Consequently we were obliged to lay to under the 81st parallel, waiting for better weather and a calmer sea. However, everywhere on the surface of the sea large pieces of ice were scattered, dangerous by their rolling movement, their hardness (the temperature was $-14^{\circ} 5$ Centigrade), and the obscurity that prevailed at night. During a south-easterly storm on April 24 our steamer was so vehemently thrown against such a hummock that a large leak ensued, which forced us to make as soon as possible for land. After hard work in keeping the steamer afloat, we reached Amsterdam Island, where the leak was provisionally caulked so as to enable us to reach a safer harbour in Kings Bay the following day. Here we had the ship down, and the damage was repaired as well as possible.

October 12 we left this harbour, going through a large field of *new* ice. Evidently the season was too far advanced for further enterprises to the northward; besides, our steamer, having got two ribs broken, was no longer strong enough for a new encounter with the ice; and as a wintering only on Seven Islands could not be of an interest great enough to outweigh the loss of time, privations, and dangers unavoidably associated with it, we resolved to employ the yet tolerably open sea around the southern part of Spitzbergen to make an attempt to reach Giles Land. But being, at Thousand Islands, prevented by ice from penetrating further, we turned southward and reached Tromsø, April 19, after having at Beeren Eiland sustained a severe storm, during which our steamer was quite ~~ice~~ down by the waves that washed over.

During our cruize in the polar basin interesting observations were obtained on the temperature, currents, &c. of the sea, and a number of carefully examined deep soundings were made with an apparatus resembling the 'Bulldog' apparatus of M'Clintock, by the intelligent and intrepid commander of the 'Sofia,' Captain Baron v. Otter, and I hope soon to be able to present you a copy of his map on these subjects, the position of the ice, &c.

As you already know by the letter of Dr. Malmgren, the scientific results of the first part of our expedition have been very satisfactory, and I hope also that its second part will give important information about several arctic questions.

By the expeditions of Tschitschayoff (1765 & 1766), Phipps, Buchan, Franklin, Scoresby, Sabine, Clavering, Parry, Torell, &c., it was already long ago proved that in the summer compact masses of drift-ice prevented vessels from penetrating far into the polar basin. But during the most

favourable season, *i. e.* the time before the formation of new ice, no vessel had as yet made such an attempt. This was the aim of the Swedish Expedition, and it found—

(1) That the polar sea is far more open in the autumn than at any other season of the year, but that even then the passage is soon stopped by dense and impenetrable masses of broken ice.

(2) That during the winter the polar basin is covered by an unbroken ice, and that the freezing of the surface begins as early as the end of September. From September 23 to October 12 we had almost every day, either with the steamer or with boats, to cross new-formed ice.

(3) That an autumn cruise north of $80\frac{1}{2}^{\circ}$ lat. is attended with unusual dangers, owing to the darkness and storms then prevailing, no ships being able a long time to sustain a night storm among large rolling pieces of ice and a cold of -15° Cent. If the ship has the good luck not to be more or less damaged by the constant unavoidable encounters with the ice mounts, it will soon by the immediate freezing of the washing waves be itself quite covered and pressed down by ice.

(4) The idea of an open and comparatively milder polar basin is quite chimerical; on the contrary, $20'$ – $30'$ north of Spitzbergen a region of cold seems to begin which no doubt stretches far around the pole.

(5) The only plan to attain the pole, from which success can be expected, is that adopted by most English arctic men, namely of going northward by sledges in the winter either from Smith Sound or Seven Islands.

I remain, Sir,

Your obedient humble Servant,

A. E. NORDENSKIÖLD.

P.S. As soon as the magnetical observations of Dr. Lemström shall be duly worked out I will send you a copy of them.

Should you think it worth communicating this letter to the Royal Geographical Society, I beg you especially to inform its celebrated President, Sir R. Murchison, that besides other specimens interesting in a geological point of view (for instance, a mass of *Miocene* and *coal* plants, bones of *Ichthyosaurus*? &c.), we found a number of large fish fragments, probably belonging to the Devonian age, in the red slate of Liebde Bay, constituting the overmost layer of what I in my 'Geology of Spitzbergen' called Hecla block-formation. Accordingly Sir Roderick probably is right in supposing that the deeper layers of this "formation" belong to the Silurian age. The underlying crystalline plates are evidently Laurentian.

II. The reading of Mr. Lockyer's Paper, "Spectroscopic Observation of the Sun, No. II.," was resumed and concluded.

(Abstract.)

THE author, after referring to his ineffectual attempts since 1866 to observe the spectrum of the prominences with an instrument of small dis-