

brood was destroyed, and had these seals been left alone for eight or ten days, I am quite within the mark when I say that, instead of only taking 300 tons of oil out of them, 1,500 could as easily have been got, and that without touching an old one." In one day by the men of the five ships upwards of 4,000 old seals were taken, "the young ones in thousands yelling for their mothers, following the skins as the men dragged them to the ships, and sucking the crangs, *i.e.* skins, in desperation." The maternal love for its offspring was made use of to save the men trouble, as a seal killed when giving suck was more easily secured, and often seals desperately wounded were seen administering nourishment to their young ones. The plight of the young ones which had lost their mothers was pitiful in the extreme; they were seen huddling together for heat, "and trying to suck one another," till they at length succumbed. Capt. Gray exclaims, "surely there is influence enough left in Great Britain to prevent a continuation of such barbarity. I overheard some of my men saying to one another, 'It is a shame this sort of work;' and so it is. It is a shame that any civilised Government should allow its subjects to perpetrate such cruelty when it could so easily be prevented. The remedy is simply, *let the ships be kept from sailing before March 25*; ships now sail from Feb. 25 to March 1. This would give a fortnight to make the passage, and find the seals in; by that time the young would be beginning to be worth taking, and a fearful waste of life put a stop to that now annually occurs." The accounts of the cruelties practiced in sealing are sickening in the extreme, the only thing considered being how to deprive as great a number of their skin and blubber in as short a time as possible. Mr. Brown (Proc. Zool. Soc., 1868) remarks: "Seals are very tenacious of life, and difficult to kill, unless by a bullet through the brain or heart. They are so quickly *fleshed* (the operation of removing the blubber and skin) that after having been deprived of their skin they have been seen to strike out in the water; so that the sympathies of the rough hunters have been so excited that they will pierce the heart several times with their knives before throwing away the carcass." These movements Mr. Brown attributes to reflex action, but considering the haste of the operation, and the seal's known tenacity of life, it is quite as likely that it was merely a stunned and not a dead animal thus deprived of its skin and blubber. It is terrible to dwell thus upon the horrors of this cruel trade, which make even the hardened participators sicken and relent, but it is necessary that it should be done, in order, if possible, to reach the hearts of Englishmen, and enlist their sympathies. If these beautiful and harmless creatures must be sacrificed for our requirements, it is a duty incumbent upon us to see that their destruction is carried out mercifully, and with the infliction of as little suffering and waste of life as possible.

In a commercial point of view the reasons for exercising some supervision over the seal fishery are as strong as those dictated by mere humanity. The revenue produced by this branch of industry is considerable. Mr. Brown estimates the annual value of the Greenland fishery alone at 116,000*l.* (Proc. Zool. Soc., 1868, p. 439), and ominously adds: "Supposing the sealing prosecuted with the same vigour as at present, I have little hesitation in stating my opinion that, before thirty years shall have passed away, the 'seal fishery' as a source of commercial revenue will have come to a close, and the progeny of the immense number of seals now swimming about in the Greenland waters, will number comparatively few." We cannot plead want of warning, for we have numerous instances of marine animals which have been exterminated by untimely slaughter (See Prof. Newton's "Extirpation of Marine Mammalia," NATURE, vol. ix. p. 112). Steller's Mantee survived its discovery only about twenty-seven years; the Atlantic Right Whale, which formerly gave employment to a great number of hardy fishermen in the Bay of Biscay and English Channel, is probably exterminated; the Northern Right Whales are gradually driven farther and farther north, and the risk of following them is becoming proportionately greater; the same may be said of the walrus. The northern fur-seal was rapidly passing away, and but for the timely intervention of the Russian and American Governments would probably have been lost; and from our antipodes comes an appeal repeating all the cruelties and waste of life to which our northern seals are subjected, and pleading for protection on behalf of the southern fur-seals (W. A. Scott, "Mammalia, Recent and Extinct," Sydney, 1873).

The question arises, how is this wanton destruction to be stopped and the fishery to be placed on a sounder footing? In order that it may be done effectually, the regulations must,

without doubt, be "international;" and no time should be lost in carrying them into effect. The British Association has rendered good service in obtaining an Act to protect sea-birds during their breeding-time, and if, assisted by men of practical experience such as Capt. Gray, they were to urge upon the Government some course of action, they would be supported by all the scientific bodies and leading naturalists in the kingdom.
Norwich, May 12. THOS. SOUTHWELL

THE COMING TRANSIT OF VENUS*

VII.

IN our last article the preparations of Britain, Germany and Russia were enumerated; those of the French, Americans, Dutch, and Italians must now be spoken of.

V. The French will occupy the following stations:—Yokohama, Peking, New Amsterdam or St. Paul's, and Campbell Island; all equipped as first-class stations, besides Tientsin, Sagou, Numea, and probably Nukahiva in the Marquesas, as secondary stations. Yokohama and St. Paul's will make an excellent combination for the method of durations; at Campbell Island also the durations will be considerably lessened. But the longitude of these places will be determined, so that if only one contact be observed, De l'Isle's method will be applied. MM. Wolf and André have made a series of experiments on the formation of the "black drop;" numerous trials have also been made with a view of employing the photographic method as successfully as possible, and it is possible that spectroscopic observations of external contact will be made. The preparations are by no means so far advanced as might have been wished. This is partly due to the disturbed state in which the country has been since the late war.

We are glad to be able to state that the French will employ the daguerreotype process of photography. This method has many advantages, and it is much to be regretted that no experiments have been made by other nations to test its applicability. Photographs taken by this process are well known to be much more delicate and give clearer details than any others, while photographic irradiation is reduced to a minimum. It is even possible to correct for curvature of field by employing prepared plates whose surfaces are portions of spheres, a thing which would be impossible by any other process. There can be no shrinking of the film. The only objection is, that we cannot print copies from the plates conveniently. But it is not likely that we should trust to measurements of a printed copy even from a glass negative. The French are relying mainly upon the photographic method, and have chosen their stations for determining thus directly the least distance between the centre of the sun and Venus. With the apparatus proposed by MM. Wolf and Martin, the size of the sun's image will be 60 millimetres; they hope to determine the instants of internal contact with a probable error of one second of time. The commission into whose hands the business has been entrusted has drawn up a detailed report containing contributions not only from the astronomers of France, but also from the most celebrated physicists and experimentalists: 300,000 fr. has been voted for the enterprise. M. Tisserand of the Toulouse Observatory will aid in the actual observations; and M. Janssen will proceed to Yokohama.

M. Dumas takes the lead in the preparations. In a letter dated May 12, he says that the expeditions are on the point of starting, and that the Marquesas probably, and Numea certainly, will be occupied for De l'Isle's method.

VI.—The Americans have a grant of 150,000 dols. They have paid great attention to the application of photography with the assistance of Mr. Rutherford, whose success in photographing the moon is so well known,

* Continued from p. 69.

They employ a lens of 40 ft. focus, as already described. They will measure both angles of position and distances from the centre, and the probable error of any measurement will be less than 1-100 per cent. They have encountered some trouble in the manufacture of their siderostats. Besides photography eye-observations of contact will also be made. A very able report has been drawn up from the computations of Mr. Hill, who deserves great credit for the manner in which he has completed it. This report has reference to the choice of stations; and is accompanied by very valuable charts. Other reports have been made upon the application of photography.

The expeditions are to be composed of five persons each. The stations of observation and the heads of parties are as follows:—Wladivostock, Siberia, Prof. A. Hall, U.S.N.; Nagasaki, Japan, Mr. G. Davidson, U.S. Coast Survey; Peking, China, Prof. James C. Watson; Crozet's Island, South Indian Ocean, Capt. Raymond, U.S.A.; Kerguelen's Island, South Indian Ocean, Lieut.-Commander George P. Ryan, U.S.N.; Hobart Town, Tasmania, Prof. W. N. Harkness, U.S.N.; New Zealand, Prof. C. H. Peters; and Chatham Island, South Pacific, Mr. Edwin Smith, U.S. Coast Survey.

The whole organisation has been entrusted to a commission, the secretary of which is Prof. Newcomb, who has done so much valuable work for astronomy; he has taken great pains to insure success for the expedition, and has visited Europe to discuss the preparations necessary and to examine the instruments to be employed.

VII.—The Italians have arranged to send out three expeditions furnished with spectroscopes for the observation of external contact. Little is known about these expeditions.

VIII.—The Dutch are sending one expedition to the island of Bourbon or Réunion. It will be furnished with a photo-heliograph, which Dr. Kaiser will manipulate; Dr. Oudemans will also make observations with a heliometer.

Having now completed our description of the details, and having also given an account, so far as possible, of the preparations of the various nations for the observations, we shall cast a general view over the whole subject, and recapitulate some of the principal details.

The coming transit of Venus will be observed from about 75 stations, at many of which there will be a large number of instruments. The expense of the whole of the expeditions will amount to between 150,000*l.* and 200,000*l.* It may seem to some that the results to be arrived at are not worth so great an outlay, but the general voice of the non-scientific as well as of the scientific world has contradicted this. Wherever knowledge can be gained it is worth being gained; and when individuals are unable to bear the cost, it is fitting that the expenses should be incurred by those governments that are really the gainers from many scientific researches for which the investigator himself frequently receives no reward. But apart from this, these expeditions will lead to most valuable results. The sun's distance being known, the Lunar Theory may be vastly improved, and it will be possible to determine longitudes with much greater accuracy than at present. Still more will the tables of Venus be capable of re-adjustment. Even now we can calculate her place with great accuracy, and this is fortunate, since it enables us to predict the exact time at which Venus will first come in contact with the sun, viz. 1874, Dec. 8d. 14h. 4m. The error to which this is liable, owing to the tables, is not likely to exceed five minutes. Mr. W. H. M. Christie, chief assistant of the Royal Observatory, has determined the probable error in the calculated time of contact arising from this cause.* He has employed observations of Venus taken at this node at the following dates:—1872, June 28; 1873, Jan. 18; 1873, Sept. 14; he has thence deduced the error in the tabular position

* Monthly Notices of the R. A. S. xxxiv. 300.

of Venus, and from this the error in the time of contact in the coming transit. It appears from each of these three comparisons that the tables of Venus give us the time of contact too early; according as we adopt the first, second, or third of the above observations, the error will be 7'4m., 5'3m., or 4'2m.

Besides the astronomical advantages to be gained from the coming transit, there are several collateral issues of no small importance. In the first place, the longitudes of a host of stations all over the globe will be accurately determined, and it is a remark by no means unworthy of notice that the simple observation of the local time of contact will give the inhabitants of east Africa and of all Asia an accurate means of determining their absolute longitudes. If, moreover, as has been proposed, San Francisco and Japan are to be compared directly as to longitude, the whole circuit of the globe will be completed by telegraphic and accurate chronometric determinations.

Again, with the host of vessels by which scientific men will proceed to their stations, meteorological, and sometimes even magnetical, instruments will be provided. These vessels will be traversing the different oceans of the globe about the same time, and thus the meteorology of the world will be much better understood. Many observers will be enabled to take note of interesting phenomena, such as hurricanes, volcanoes, and earthquakes. In addition, naturalists will be appointed to accompany some of the expeditions; birds and marine animals will be probably very generally collected; the Royal Society has given funds to aid in this matter. The Rev. A. E. Eaton, who has made valuable collections at Spitzbergen, will examine the marine life of Kerguelen's Island. Rodriguez is particularly interesting from a naturalist's point of view; it is one of the few islands in mid-ocean which have not been raised by volcanic agency. The remains of some extinct birds have been found there. The Royal Society has appointed a geologist, a botanist, and a naturalist to go to this island. There is little doubt that Science in general will gain greatly by these expeditions.

As to the main observation we can have no doubt from the large number of expeditions, and from the multiplicity of methods to be employed, that we shall obtain excellent results, although the actual reduction of the observations will be exceedingly laborious. Each nation, while it generally adopts some special method for its choice of stations, will also utilise other methods. We have seen that the English, while they rely chiefly on De l'Isle's method, will employ all the others except the heliometric, while the Germans depend mainly upon the heliometric method. The French and Americans have chosen their stations with reference to photography. The Russians are to compare observations of all kinds with different nations. These countries have all co-operated in the most harmonious manner, partly by correspondence, and partly by the personal visits of astronomers to different nations.

Although the observations are to be made at the end of the present year, the actual reduction of the observations will take so long that we cannot hope for the complete and final results as to our distance from the sun before the year 1876. At each of the British stations the observers will remain at least three months to determine their longitudes.

Here we may leave the subject. The preparations are for the most part completed; many of the observers of different nations are on their way to their various posts. It says a great deal for the civilisation of the world that on December 8 of the present year those quarters of the globe will be thickly studded with emissaries from so many nations to observe an important astronomical phenomenon.

It will be well to conclude this series of articles with a statement of the arrangements which have been made as to observers on the British expeditions. It is extracted from instructions published under authority:—

Appointments of Observers to the several Districts of Observation, and Subordination of Observers

1. Capt. G. L. Tupman, R.M.A., is head of the entire enterprise, and is responsible through the Astronomer Royal to the Government for every part. Every observer is responsible to Capt. Tupman.

2. When the different expeditions are separated, the observers in each district of observation are responsible to the local chief of the district, and the chief to the

Astronomer Royal. The districts of observation and the observers will be the following, the name first following that of the local chief being that of the deputy, who will, if necessary, take his place :—

3. District A. Egypt : Chief, Capt. C. O. Browne, R.A., astronomer ; Observers, Capt. W. de W. Abney, R.E., astronomer and photographer ; S. Hunter, astronomer.

4. District B. Sandwich Islands : General Chief, Capt. G. L. Tupman, R.M.A. : Deputy, if necessary, Prof. G. Forbes.

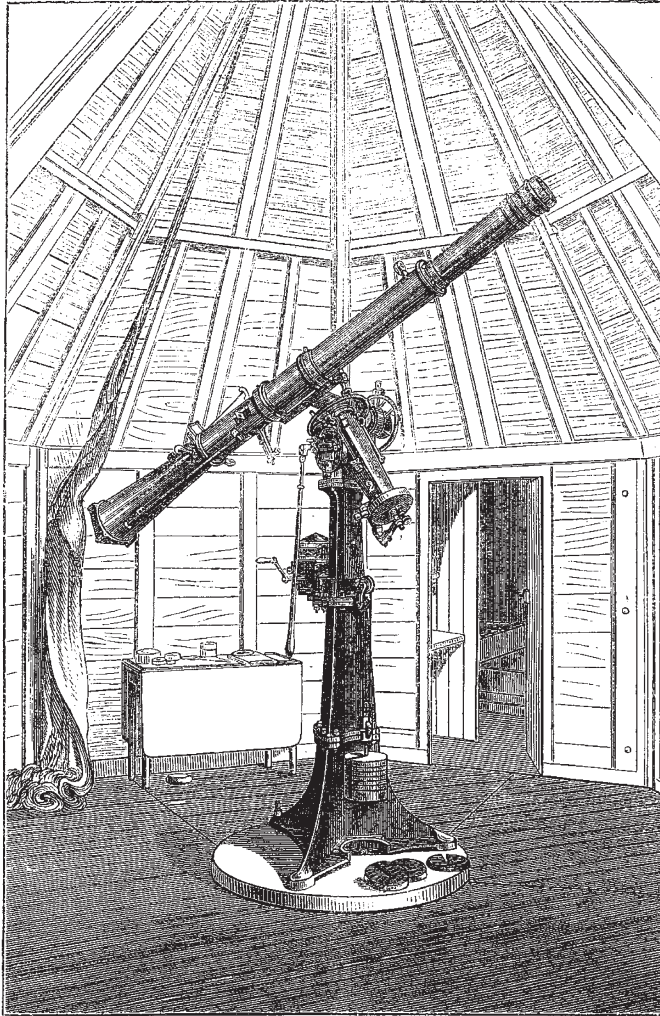


FIG. 19.—Photo-heliograph of the British Expeditions.

Sub-divisions of the Sandwich Islands :—Honolulu : Chief, Capt. G. L. Tupman, astronomer ; Observers, J. W. Nichol, astronomer and photographer ; Lieut. F. E. Ramsden, R.N., astronomer and photographer. Hawaii : Chief, Prof. G. Forbes, astronomer ; Observer, H. G. Barnacle, astronomer. Kauai : Chief, R. Johnson, astronomer ; Observer, Lieut. E. J. W. Noble, R.M.A., astronomer.

5. District C. Rodriguez : Chief, Lieut. C. B. Neate, R.N., astronomer ; Observers, C. E. Burton, astronomer and photographer ; Lieut. R. Hoggan, R.N., astronomer and photographer.

6. District D. Christchurch (New Zealand) : Chief, Major H. Palmer, R.E. ; Observers, Lieut. L. Darwin, R.E., astronomer and photographer ; Lieut. H. Crawford, R.N., astronomer.

7. District E. Kerguelen Island : General Chief, Rev. S. J. Perry ; Deputy, if necessary, Lieut. C. Corbet, R.N.

Sub-divisions of the Kerguelen Island :—Christmas Harbour : Chief, Rev. S. J. Perry, astronomer and photographer ; Observers, Revs. W. Sidgreaves, astronomer ; Lieut. S. Goodridge, R.N., astronomer ; J. B. Smith, astronomer and photographer. Port Palliser : Chief, Lieut. C. Corbet, R.N. ; Observer, Lieut. G. E. Coke, R.N.

8. In addition to these gentlemen, three non-commissioned officers or privates of the corps of Royal Engineers will be attached to each of the five districts, and will be under the direction of the chief of each district.

GEORGE FORBES