

as great as that deduced from Planck's formula for this case. In connection with similar work of his own, Mr. Jeans (*Phil. Mag.*, July) has just pointed out that I have introduced a redundant factor 8 by counting negative as well as positive values of my integers  $\xi, \eta, \zeta$ .

I hasten to admit the justice of this correction. But while the precise agreement of results in the case of very long waves is satisfactory so far as it goes, it does not satisfy the wish expressed in my former letter for a comparison of processes. In the application to waves that are not long, there must be some limitation on the principle of equi-partition. Is there any affinity in this respect between the ideas of Prof. Planck and those of Mr. Jeans?

Terling Place, Witham, July 7. RAYLEIGH.

### Proposed Observation of Mercury during the Solar Eclipse.

DURING the eclipse of the sun on August 30 next there will be an opportunity of making a very interesting observation on the planet Mercury, to which I ask permission to direct attention.

Mercury at the time of the eclipse will be very close to the line joining the earth and sun—about  $2^{\circ} 54'$  south and  $2^{\circ} 54'$  preceding the sun—i.e. at an angular distance from the sun's centre of nearly  $4^{\circ} 6'$ . Accordingly, the illuminated part of Mercury will be an excessively thin crescent which, if Mercury have an atmosphere, will have its horns prolonged by atmospheric refraction.

If a sufficiently skilled observer is provided with a telescope upon which he can use a power of 200 without loss of definition, and mounted—probably as an alt-azimuth—so that it can be set beforehand upon Mercury, the apparent size of Mercury will be that which would be presented by a circle one-tenth of an inch across, viewed with the naked eye from a distance of ten inches.

This ought to be sufficient magnification to see whether the horns of the crescent are prolonged, and, if so, it is perhaps not impossible that the light would be sufficient to enable a spectrum of the tips of the crescent to be seen.

If the whole of this programme can be carried out, we should find out whether Mercury has an atmosphere, and possibly learn something as to the constituents of the atmosphere.

G. JOHNSTONE STONEY.

30 Ledbury Road, W., July 10.

### The Planet Uranus.

ASTRONOMICAL amateurs will have an excellent opportunity of identifying Uranus on about July 16 next, for the planet will be in conjunction with the star  $\iota$  Sagittarii (mag. 5.3) on the night following that date.

The position of Uranus at transit (10h. 30m.) will be:—

R.A. 18h. 5m. 58s., Dec. S.  $23^{\circ} 42' 21''$ ,

while that of the star will be (1905.5):—

R.A. 18h. 5m. 57s., Dec. S.  $23^{\circ} 43' 16''$ ,

so that the planet will pass about 1 minute of arc north of the star. The latter may be easily picked up, as it is nearly  $4^{\circ}$  S. of the triple star  $\mu$  or  $\iota_3$  Sagittarii (mag. 4.1).

Unfortunately, the objects will be low in altitude ( $15^{\circ}$ ), and the moon happens to be full on the date of conjunction.

On June 24 and July 8 I found Uranus a little fainter than the star  $\iota$  Sagittarii. I have carefully observed the planet on several nights in a 12 $\frac{1}{2}$ in. Calver reflector, powers 100 to 475. The disc appeared faint with a bluish tinge, and no belts or other markings could be detected, but the telescope is too small to deal effectively with an object of this description.

Bristol, July 9.

W. F. DENNING.

### The Exploration of the Atmosphere above the Atlantic.

A PLAN for systematic work of this kind, which was proposed by the writer in 1901 at the Glasgow meeting of the British Association (Report, p. 724) after he had obtained the first observations with kites flown from a Transatlantic

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steamer, is now being partially realised. Last summer Prof. Hergesell, on board the Prince of Monaco's steam-yacht *Princess Alice*, executed sixteen kite-flights above that part of the Atlantic bounded by Spain, the Canaries and the Azores, but without finding the expected south-west anti-trade, although a height of nearly 15,000 feet was reached (*NATURE*, vol. lxxi. p. 467). The present expedition, which will repeat Prof. Hergesell's investigations and continue them further south, is made possible through the cooperation of our distinguished French colleague, M. Teisserenc de Bort, whose steam-yacht *Otaria*, of 350 tons, with a speed of 11 knots, and fully equipped for aerial exploration, has just sailed from Gibraltar, and, at the joint expense of her owner and the writer, will proceed towards the equator by way of Madeira, Canary and Cape Verde Islands, making frequent soundings with kites through the trade winds and equatorial calms. By means of the self-recording instruments lifted by the kites, it is expected that there will be ascertained the thermal and hygrometric conditions of the various strata traversed, and the depth and force of the trade wind in the different latitudes. If the kites do not reach the south-west return trade, which has been observed on the Peak of Teneriffe, the vertical range of observation may be increased by liberating hydrogen balloons from Madeira and noting their drift.

Mr. Clayton, meteorologist of the Blue Hill Observatory, left Boston on June 3 to join the *Otaria* at Gibraltar. During his voyage to the Azores on the White Star liner *Romanic* he flew kites, with instruments attached, almost daily to the height of from five-eighths to three-quarters of a mile, thus securing the highest observations in mid-Atlantic, and it is interesting that this was done on June 7, the day appointed for the international observations in the upper air here at Blue Hill and in Europe. In general, the temperature was found to decrease with altitude at less than the adiabatic rate, and the relative humidity to decrease also, but in one ascent there was a rise of temperature with altitude, preceding a change of wind from west to south. A new form of folding kite was employed, and it is encouraging to learn that the heights attained were limited by the length and strength of the wire on the hand-reel, which did not permit more than one of these kites to be attached. On the two days when no flights were made, a following wind became too light on board the steamer to lift the kites, whereas, on the yacht, this condition would have been obviated by simply lying-to, or steaming against the wind.

While the cruise of the *Otaria*, which is to last only six weeks, can hardly do more than elucidate certain questions relating to the high atmosphere in the tropics, it will demonstrate the possibilities and difficulties attending the extensive survey that the writer desires to undertake, and which received the endorsement of the International Meteorological Committee at Southport in 1903.

A. LAWRENCE ROTCH.

Blue Hill Meteorological Observatory, Hyde Park, Mass., U.S.A., June 26.

### Ancient Antarctica.

PROF. H. F. OSBORN has said that the demonstration of "the former existence of an Antarctic continent is one of the greatest triumphs of modern science." But even if this be true, everyone must allow that it occurred a very long time ago. This is proved by the great differences that exist between the floras and faunas of the three great southern continents. These differences are much greater than those between the floras and faunas of North America and Eurasia, and consequently the land connections must have been broken up in the south long before they were in the north. We infer the former existence of an Antarctic continent from the existence of granite and foliated schists in South Victoria Land, and evidence that it was formerly connected with northern lands is found in the existence of flightless insects living there in the few patches of mosses and lichens which manage to struggle through the winter. These insects are not flightless through degeneration, but belong to an order which never possessed wings.

It is very improbable that the ancestors of these minute insects were carried or blown to where they are now found; they must have travelled to their present positions by land. That is, the Antarctic continent south of New Zealand and Patagonia must, at some time or other, have joined on to northern lands.

In the islands of the Antarctic Ocean we have further evidence of a former land connection in the earthworms belonging to the family Acanthodrilidæ, which are characteristic of Antarctic regions. A spider also lives on Bounty Islands which is closely related to one from Cape Horn. But spiders seem to have special facilities for crossing barriers, and the insects found on Bounty Islands are all related to New Zealand forms. I do not include here the evidence of the plants of the Antarctic islands, for most plants do not require that the land should be actually continuous to enable them to spread.

But if the flightless insects and the earthworms imply a former connection with northern lands, that connection must have been a very long time ago, before the spread of insects and angiospermous plants over the world, that is, not later than the Jurassic period. If there had been any land connection in Tertiary times, there would have been a much greater mixing of the animals and plants.

It is evident that the flora, and perhaps the fauna, of Antarctica were formerly much richer than at present, as is proved by the fossil plants of South Victoria Land, and it is also probable that both fauna and flora were killed off by an increasingly rigorous climate. It is not necessary to assume a former Glacial epoch for this, for higher plants and animals could hardly resist the present climate, and there is no palæontological evidence of a period of greater cold than now having ever existed in the southern hemisphere. On the contrary, the biological as well as the palæontological evidence is against the idea. For the much modified plover, *Chionis*, and the insects of Kerguelen Land, as well as the remarkable flora of the Antarctic islands, show that the islands could not have been covered with ice for a very long time.

The relations between the avifaunas of Australia and South Africa are much closer than exist between those of Australia and South America, and this is just what we should expect if the ancestors of the present birds had spread down from the north under the present condition of land and sea, for the land connection between Australia and South Africa is far more intimate than that between the former place and South America. But the contrary is the case with the Mammalia, some of the tortoises, snakes, frogs, some of the fresh-water fishes, a large number of insects, and the family Cryptodrilidæ of earthworms. This implies that at some former time a closer connection existed between Australia and South America than between Australia and Africa. The question is, Was this connection by means of an Antarctic continent? Or was it by a Pacific continent?

The principal objection to the southern route is that the connection between Australia and South America is shown by a number of subtropical animals—such as *Osteoglossum* and *Ceratodus*—none of which have left any trace of their passage through New Zealand. We cannot suppose that New Zealand was disconnected at the time from the Antarctic continent, for it, also, has distinct relations with South America, but for the most part by means of different animals from those which show the Australian connection. If the connection was in either the Cretaceous or the Eocene period, we might suppose that the climate was warm enough for the passage of the subtropical animals by the Antarctic route, but, if so, why are there no traces of marsupials and South American frogs in New Zealand? If, on the other hand, we suppose the ancestors of these animals to have crossed from Australia to South America by a South Pacific continent, we can understand how the subtropical forms would not have come so far south as New Zealand, while the New Zealand forms would have crossed at a higher latitude. In favour of this we have a member of the *Iguanidæ* in Fiji, as well as the evidence of the land shells of *Polynesia*, which are not a collection of waifs and strays, but form a distinct group of a very early type, which, however, has not yet been found in South America.

We still have to consider the floras and the marine faunas of the Antarctic islands. Here we see a number of birds—such as cormorants and gulls—as well as fishes and plants, which could hardly spread round the world under the present conditions of land and water. That this spreading was a comparatively late one is proved by the near relations between the species. But if there had been continuous land at the time, land animals would have spread with the marine ones. It is therefore necessary to suppose that this last spreading of species in Antarctic latitudes was by means of a number of islands. Probably this was in Pliocene times, if we may judge by the amount of differentiation which has taken place since then.

I therefore conclude that the hypothesis which best explains the phenomena is the following:—

- (1) That in the Jurassic period an Antarctic continent existed which connected South America with New Zealand and South Africa.
- (2) That this continent sank in the Cretaceous period, and that Antarctica has never since been connected with northern lands.
- (3) That in the Cretaceous or early Eocene a Pacific continent connected New Guinea and New Zealand with Chili.
- (4) That this land sank at the close of the Eocene.
- (5) That in the Pliocene a number of islands existed in the Antarctic Ocean, which have since then disappeared.

F. W. HUTTON.

#### The British Slugs.

MR. J. W. TAYLOR has just published part ii. of his admirable "Monograph of the Land and Freshwater Mollusca of the British Isles," containing a discussion of the slugs of the genus *Arion*. It is a matter of interest that, notwithstanding the great amount of information gathered in recent years, the beautiful bicoloured varieties of *A. ater* appear to hold their own as truly endemic inhabitants of Britain. These are three in number, though Mr. Taylor treats the third as merely a sub-variety.

- (1) *Arion ater*, var. *albolateralis*, Roebuck, 1883. Back black, sides white.
- (2) *Arion ater*, var. *Roebucki* (*bicolour*, Roebuck, in error). Back brown, sides yellow.
- (3) *Arion ater*, var. *Scharffi*, Cockerell, 1893. Back black, sides yellow.

Mr. Taylor retains the name *bicolour* for the second variety, but it is not the *bicolour* of Moquin-Tandon, as was formerly supposed, and a new name is necessary. It is appropriate to name it after Mr. Roebuck, who first made it known. These magnificent slugs are of western distribution in the British Islands, and have quite a wide range. The only evidence of their occurrence on the Continent is Scharff's statement that Simroth found specimens "similar" to var. *Roebucki* on the shores of the Baltic; and the possibility that the Norwegian var. *medius*, Jensen, may be similar to *albolateralis*, though it is very likely not even of the same species. A quite different variety of *A. ater* is the wholly black form *aterima*, said to be especially northern and montane. According to Mr. Taylor, this is exclusively British, except that it appears to be represented in Spain and Portugal by a similar animal named *hispanicus* by Simroth. However, I had always regarded this *aterima* variety as the one so described from France by Dumont and Mortillet (*cf. Science Gossip*, 1889, p. 212, "the pitchy black variety found in swamps"), and if it is not, the name *aterima*, applied to it by Mr. Taylor, cannot stand. At the opposite pole of variation from *aterima* is the brilliant red form *A. ater*, var. *coccinea* (Gistel), which is hardly ever found in England, but is abundant in the warmer and drier regions of Central Europe.

Incidentally, it may be remarked that the name *Arion hortensis*, var. *subfusca*, employed by Mr. Taylor, cannot be retained, as it is founded on *Limax subfuscus*, C. Pfr., a homonym of *L. subfuscus*, Draparnaud.

T. D. A. COCKERELL.

University of Colorado, June 26.