I HAVE read Mr. Sellick's letter about the rainfall of Southern Rhodesia with great interest. It was certainly not my intention to revive a theory of the origin of Rhodesian rainfall that has been disproved. My source of information was Kendrew's "Climates of the Continents" (1922). Kendrew makes a statement (p. 72 of that work) that implies that the monsoonal indraught in the South African summer is fed by the south-east trades, for he refers the moisture to evaporation over the South Indian Ocean. The case against this, it appears, rests upon a consideration of the trajectories of the inflowing air streams and not on the geographical distribution of the normal summer rainfall, for the ordinary diminution of rainfall (after elimination of the orographical factor) with distance from the coast would presumably be shown, whether the indraught were an eddy in the south-east trades or an eddy in a north-west current representing deflected north-east trades that have crossed the equator. Kendrew admits that in summer the north-east trades reach the north-west of Madagascar as north-west winds. The extended charts referred to by Mr. Sellick evidently show that these are then drawn into Southern Rhodesia during the monsoon. It is hoped that this important fact will be mentioned in future works on climatology. E. V. N.

Spectrographic Observations of Infra-Red Lines in the Auroral Spectrum

I HAVE read with great interest Prof. L. Vegard's recent communication[1] on this subject, in which he reports that in the auroral spectrum in the infra-red he has found two bands, a strong one at λ7883 A. and a weak one at λ8095 A., with sharp edges towards longer wave-lengths. Prof. Vegard considers that if the auroral green line is to be identified with the oxygen line at 5577 A., it is expected that other oxygen triplets, 7772-74-75, 8233-30-22, 7952-50-47, and 7481-79-77, will appear in this region, but none of these could be identified with the observed auroral lines. Taking into consideration the high intensities of these two bands, and the emission of the second positive bands of nitrogen in the auroral spectrum, he has interpreted these two bands as the appearances of the first positive bands of nitrogen with the special distribution of intensity.

In the course of investigations on the distribution of the intensity in the α-bands of active nitrogen, I have studied also the distribution of the intensity in the first positive bands in the case of passing an electric discharge of very weak current through nitrogen at low pressure and cooled with liquid air, and it was found that the bands due to the transitions from the initial levels which correspond to the vibrational quantum numbers 7 and 6 in the $B(^3\pi)$ state of nitrogen molecules are enhancingly emitted in the first positive bands. With reference to the results above described, the two bands which Prof. L. Vegard has found seem to be identified with the bands at 7896-80-58 (7→6) and 8047-30-08 (6→5) respectively in the first positive bands of nitrogen, though there are some differences in the wave-lengths. It may be considered that the experimental conditions above described are very close to those in the aurora with respect to pressure, temperature, as well as the conditions of weak excitation, and as a consequence of the Franck-Condon principle there will result fair concentrations of the excited nitrogen molecules in the vibrational levels corresponding to the quantum numbers $v' = (\sim 11)$, 7 and 6 in the $B(^3\pi)$ state. Therefore it is expected that in the infra-red region the bands due to the transitions (7→6) and (6→5) will be emitted intensely, and these two bands will be identified with the bands which Prof. Vegard has reported and nicely interpreted ($n_1 \rightarrow n_2 = 7 \rightarrow 7$).

The detailed description of the experimental results will be published shortly elsewhere.

H. HAMADA.

Physical Institute,
Sendai, Japan,
May 13.

[1] NATURE, 129, 468, March 26, 1932.

Liquid Carbon Dioxide in the Depths of the Ocean

A PARAGRAPH in NATURE of April 23, p. 607, refers to a paper in which the Russian geologist W. Vernadsky states that carbon dioxide is in a stable liquid state in the depths of the ocean. He assumes that this may be the reason why there are no appreciable amounts of plankton below about two hundred metres. It must be remarked that the carbon dioxide is physically dissolved in the sea water, therefore the laws of gases do not apply. The pressure would only be of importance if springs of carbon dioxide exist on the bottom of the deep sea; in this case the carbon dioxide would issue as a liquid but quickly be dissolved by the water. According to the results of the *Meteor* expedition, it seems highly improbable that such sources of carbon dioxide are present in the ocean—at least, in the Atlantic.

However, the pressure causes an effect on the carbonic acid. The dissociation of this acid rather increases with the greater depths. The deep water is more acid than the shallower, provided the carbon dioxide content is the same.[1]

Concerning Vernadsky's conclusions, it may be mentioned that Hentschel[2] found considerable amounts of phytoplankton down to several thousand metres. Further, that the oxygen in the bladder of deep-sea fishes may be the result of a decomposition of liquid carbon dioxide seems quite impossible in view of the energy needed for this reaction.

H. WATTENBERG.

Institut f. Meereskunde,
Berlin, May 28.

[1] Cf. K. Buch, H. W. Harvey, H. Wattenberg, and St. Gripenberg, "The CO_2 System of Seawater", *Rapp. et Proc. Verb. Cons. Internat. pour l'explor. de la Mer*; 1932.
[2] *Ber. d. "Meteor" Expedition*, 2, Ges. f. Erdk. Berlin; 1927.

Meteorite Craters

THE very interesting article by Dr. L. J. Spencer on "Meteorite Craters", in NATURE of May 28, suggests a possible explanation of the fact that, while the bedding of the surrounding country may be horizontal, the strata exposed in the inner walls of the crater usually dip radially outwards from the centre.

The air photograph of the Cañon Diablo crater reproduced in the article bears a close resemblance to the well-known 'splashes' produced at the surfaces of armour-plate by the impacts of projectiles. The analogy between such 'splashes' and those of drops falling into liquids was pointed out by Roberts-Austen in *Fielden's Magazine* of August 1899.

It may be of interest to recall that A. M. Worthington was the first to synchronise photographic records with the movements occurring during the 'splash of a drop'. His classical work formed the subject of a discourse at the Royal Institution in May 1894.

S. W. SMITH.

Royal Mint,
London, E.C.3,
June 6.