become conspicuous (as a radiation-line)—at such a stage, for instance, as that of Nova Aquilae, where Paddock (Publ. Ast. Soc. Pacific, vol. xxx. p. 244) records D 3 as an extraordinarily strong line.

I am, Gentlemen,


Yours faithfully,

F. E. BAXANDALL.

A Modern Theory of the Earth.

GENTLEMEN,—

I was much interested in the review by my friend Dr. Holmes of "L'Origine des Formes de la Terre," by M. Emile Belot, and he has given me an opportunity of examining the book. I have no intention of discussing in detail its arguments and conclusions; but some of the assumptions that it makes are, I believe, utterly unfounded, and as they are not confined to its pages you may perhaps allow me to criticise them here.

The author supposes that a nebular mass representing the future Earth is slowly cooling, and tells us that as soon as the temperature has been lowered appreciably ("un peu notablement") below 3000° C., corresponding, I presume, roughly to the upper limit of the critical points of the materials of which the Earth is composed, condensation commences at the centre. Towards 1100° scoria forms on the red-hot surface; between 800° and 700° various volatile saline materials fall from the atmosphere; towards 500° the scoria becomes more abundant, but any crust that is formed is easily broken up by atmospheric currents. The period during which the temperature falls from 3000° to 364° (the critical temperature of water) the author terms the Période ignée*. Then follows the Période diluvienne, during which the surface cools from 364° to 70°, the temperature at which life becomes possible. Its commencement is marked by the condensation of atmospheric water, which is at first very rapid and continues till the atmospheric pressure approximates to its present value.

It is now generally believed that the temperature attained by the celestial bodies is in the main a function of their size, and we have at present no means of knowing whether the Earth is large enough to have reached that postulated by M. Belot; but supposing it did, as is not improbable the case, the actual course of events would have been entirely different from that which he supposes to have occurred.

As soon as a nucleus was sufficiently condensed for the pressure of the interior to approximate to that now prevailing at great depths, its physical properties would be practically identical with those now existing in the Earth's interior. It has been

* Apparently the temperatures mentioned are those supposed to prevail at the molten or solid surface.
shown that the subsequent lowering of the temperature by conduction must have been inappreciable below a depth of, say, a hundred miles from the surface. It is even suggested that a local increase of temperature due to radioactivity may have occurred.

At the high temperature which is supposed to have prevailed generally in the nascent Earth at the beginning of the Période ignée, the variation in composition and physical conditions from the centre outwards would be continuous. In other words, the different constituents would overlap one another without surfaces of discontinuity, except possibly the surface of the supposed metallic core. In the phraseology of Arrhenius, the whole would be gaseous, being everywhere above the critical point, but the greater portion of its mass would have, as it has now, a higher density and rigidity than the present crust. As the cooling progressed, surfaces of discontinuity would ultimately make their appearance, but not that imagined by M. Belot. A dry surface, molten or solid, containing the constituents of the more siliceous igneous rocks could not exist in contact with an atmosphere including our present oceans in the gaseous state; for such an atmosphere implies conditions of temperature, pressure, and density under which the silica and the materials of the alkali felspars are miscible in all proportions with water, in spite of the fact that it is, in the language of the physicists, in a gaseous state.

When the isotherms of the critical temperature of water reached the level where the pressure of the water-vapour was equal to its critical pressure, liquid water would begin to separate, but its density would not differ to any marked extent from that of the water-vapour with which it was associated. If the heat gradient was not too great, the density of the gaseous water below, which had not yet cooled to the critical point, would, on account of the higher pressure, be greater than that of the water above, which would therefore not descend. Even if the newly formed water were slightly heavier than the layer immediately below, it would descend very gently and be reconverted into vapour before it had gone far. It may be safely said that nothing like a deluge of rain such as the author supposes would take place.

Sooner or later, however, a surface of discontinuity would form between an atmosphere formed mainly of water-vapour above and a liquid expanse consisting largely of water below. At the high temperature then prevailing the water at the surface of the latter would contain a very considerable amount of silica as well as saline constituents. This dissolved material would no doubt appreciably raise its critical point. At a greater depth the materials of the alkali felspars would be also present, and then there would be a gradual downward passage, with decreasing water content, to a zone of great depth consisting mainly of the silicates of calcium, iron, and magnesium.
Correspondence.

At a later period another surface of discontinuity would probably arise between a higher stratum several miles in depth, containing the greater part of the water, silica, alumina, and alkalies, and a lower stratum consisting mainly of the silicates of the dyad elements already mentioned. Gradually, as the cooling proceeded, a granite layer would crystallize out in the lower portion of the higher stratum, leaving the water as a deep ocean above it, the forerunner of our present seas. At first this would still contain a large amount of silica, which would gradually, as the cooling progressed, separate out below in a solid state. These relations correspond to the gradual passage, which is known to exist, between pegmatite (coarse granite rich in alkali felspars) and quartz veins nearer the surface.

It need scarcely be said that the evolutionary succession I have sketched out would be everywhere disturbed by the movements set up by tidal action and irregularities in thermal distribution, so that the zones described would never be developed with any regularity or exactness, and it is probably for this reason that no indubitable remains of rocks which owed their existence to them have been recognized in the present crust of the Earth.

Though it is long since the conditions of temperature and pressure which have been considered prevailed at the Earth’s surface, each of the major planets is probably at the present time in some stage of a similar process of evolution.

Imperial College of Science and Technology, S. Kensington,
1919, March 11.

I am, Gentlemen,
Yours faithfully,
John W. Evans.

The Cause of Cepheid Variation.

Gentlemen,—

The recent interesting discussion by Eddington, Jeans, and Lindemann of the cause of variation of stars of the Cepheid type will perhaps lend some value to a few observations of the characteristics of the spectral lines in δ Cephei made at Mount Wilson.

Two photographs of the spectrum of the star at maximum and at minimum of light were obtained with a dispersion of three prisms and a camera of forty inches focal length. The linear scale of the negatives is therefore exceptionally large for stellar spectra, amounting to 5.3 Ångstrom units per millimetre at Hγ. The variation in radial velocity shown by the photographs is 38 km., or 0.563 Å., for the centre of the region measured. The spectral lines are sharply defined, and measurements of their edges can be made with considerable precision. These results as follows for eleven selected lines:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average width at maximum of light</td>
<td>0.214 Å</td>
</tr>
<tr>
<td>Width of intervening space</td>
<td>0.254</td>
</tr>
<tr>
<td>Average width at minimum of light</td>
<td>0.403</td>
</tr>
</tbody>
</table>