penumbra and it was stated that its width could be accounted for by supposing the existence of matter outside of the plane of the rings, or in effect by tores or thickenings of the rings; the dark medial core of the band being the projection of the ring proper. It was explained in what way the tores could have been produced and in what part of the rings they should occur. In this connection it was shown how the separations of the rings were produced by the planet's satellites; and it was stated that one should expect that the tores should occur just inside of the paths of the satellites. By observation the tores were found to be just where celestial mechanics would put them under the disturbing influence of the satellites.

In reviewing the conclusions as to the constitution of the rings, and the disintegration that must be taking place as evidenced by the positions of the tores, the ultimate disappearance of the rings was predicted.

R. L. Faris,
Secretary

DISCUSSION AND CORRESPONDENCE

AGE OF A COOLING GLOBE

To the Editor of Science: In my paper on a cooling globe in Science for February 7, pages 231 and 232, the depth of the level of isostatic compensation is stated as 71 miles or 140 kilometers. This last should be 114 kilometers. The blunder arose in copying, and the correct value was used in the computations.

George F. Becker

THE EARTH AS A HEAT-RADIATING PLANET

To the Editor of Science: Of the many far-reaching consequences resulting from the discovery announced in Science for November 22 and December 20, 1907, perhaps no one fact stands out more clearly and strongly than this—*The inherent heat of the earth still plays an important if not controlling part in all terrestrial phenomena* (as, for instance, in the formation of ocean and atmospheric currents, in cloud formation, and the increase in temperature with increase of cloudiness, etc.), *for it now seems certain that without this inherent heat radiation the terrestrial atmosphere could not exist.*

With a surface which, even at its lowest known temperature, is still more than 200° C. above the temperature of surrounding space (ocean temperatures at great depths being about 270° above) and with the temperature increasing with the depth below the surface, there can no longer be much reasonable doubt as to the facts concerning the past or future history of the earth, so far as effects due to temperature changes are concerned.

The earth is now, and has been for ages, radiating heat into space, shrinking in size, and, with a constantly decreasing surface temperature, growing colder.

The mean absolute surface temperature of the earth is, let us say, 300° C. If we regard this as made up of an inherent surface-temperature of 200° C. and a stored or trapped heat equivalent to a temperature of 100° C., the radiation into space is such that the moon, for example, receives about one twenty-seventh as much heat from the earth as it does from the sun.

The sun's influence is rendered overpoweringly conspicuous because this influence is zonal and varyingly differential, thereby obscuring to a great degree the nearly constant but large effect of inherent earth-radiation.

The earth's desert areas are increasing and the glaciers are retreating not because the sun's influence has seemingly become predominant, but because the earth has, even during known historical time, grown sensibly colder.

At any given time in the history of the earth, an ice age was inaugurated at a given place whenever the snow-fall during the colder months of the year was so great that the snow could not all be melted during the warmer months of the year. But since the earth is continually growing colder the supply of moisture, through evaporation from the water surface of the earth, is continually growing less, so that *finally even the land areas in the polar regions will be completely bare,* and the upper limit of the atmosphere will then practically coincide with the surface of a solidly frozen ocean.

With the modifications, resulting from the