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4. On the Secular Cooling of the Earth.

Professor William Thomson

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The mean of both series may be tolerably represented by a uniformly diminishing conductivity as the temperature increases. When reduced* to the usual units of conducting power expressed in terms of the amount of heat necessary to raise by 1° Centigrade a cubic foot or a cubic centimètre (one gramme) of water respectively, we have the following absolute measures :—

Temperature, Centigrade.	Conducting Power of Wrought Iron.			
	Units, the Foot, Minute, and Cent. Degree.		Units, the Centimètre, Minute and Cent. Degree.	
0°	·0133	.....	12·36
50	·0120	.....	11·15
100	·0107	.....	9·94
150	·0094	.....	8·73
200	·0082	.....	7·62

It is to be observed that thermometric readings have not yet been finally corrected, so that these numbers may receive some slight modification. The author hopes to complete the verification of the calculations, so far as wrought iron is concerned, in the course of the present summer. The state of his health has been the cause, not only of the suspension of the experiments, but of the long delay which has taken place in publishing the results so far as obtained.

2. On Certain Vegetable Formations in Calcareous Spar.

By Principal Sir David Brewster.

3. On the Existence of *Acari* between the Laminæ of Mica in Optical Contact. By Principal Sir David Brewster.

4. On the Secular Cooling of the Earth. By Professor William Thomson.

The fact that the temperature of the earth increases with the depth below the surface, implies a continual loss of heat from the interior by conduction outwards, through or into the upper crust. Since the upper crust does not become hotter from year to year, there must therefore be a secular loss of heat from the whole earth. It is possible that no cooling may result from this loss of heat, but

* The numbers in the preceding table refer to the thermal capacity of iron instead of water.

only exhaustion of potential energy, which in this case could scarcely be other than chemical affinity between substances forming part of the earth's mass. But it is certain that either the earth is becoming, on the whole, cooler from age to age, or that the heat conducted out is generated in the interior by temporary dynamical action (such as chemical combination). To suppose, as Lyell has done,* that the substances combining together, according to the chemical hypothesis of terrestrial heat, may be again separated electrolytically by thermo-electric currents due to the heat generated by their combination, and thus the chemical action and its heat continued in an endless cycle, violates the first principles of natural philosophy in exactly the same manner and to the same degree, as to believe that a clock constructed with a self-winding movement may fulfil the expectations of its ingenious inventor by going for ever.

Adopting as the more probable, the simpler hypothesis that the earth is merely a heated body cooling, and not, on the whole, influenced to any sensible degree by interior chemical action, the author applies Fourier's theory of the conduction of heat to trace the earth's thermal history backwards. From data regarding the specific heat and thermal conductivity of the earth's substance, he investigates the time that must elapse from an epoch of any given uniform high temperature throughout the interior, until the present condition of underground temperature could be reached. Taking into account the very uncertain character of the data when high temperatures are concerned, he infers that most probably either the whole earth must have been incandescent at some time from 50,000,000 to 500,000,000 years ago, or that at some less ancient date, but still anterior to the earliest human history, there must have been up to the surface a temperature above the boiling-point of water. Either alternative—or indeed any theory whatever consistent with the principles of natural philosophy regarding previous conditions of the earth—is as decisive against the views of those naturalists who acknowledge no creation of life on the earth within fathomable periods of time, as the plainest elements of dynamics are against those who maintain that we have no evidence in nature of an end.

* Principles of Geology.