

have not been fused and reduced to lava, but have been softened and vitrified, and afterward cooled. Then the daily radiation of heat from the earth exceeds the amount received from the sun. If the earth is cooling, and has for geologic periods been cooling, it is not difficult to admit that some former temperature was high enough to reduce it to a molten condition. If that condition existed, the process of cooling would result in a film over the exterior, which would be the primitive or fire-formed crust, on which the first ocean descended, and the first sediments accumulated, while the protected interior retained a higher temperature. The fusing temperature now existing within may be but the residuum of primitive heat left after so long a process of cooling. This is one view.

Again, it has been contended that the internal heat results (at least in part) from crushing and friction in the crust, produced by motions and pressures exerted. Mallet showed that the heat generated in crushing small cubes of granite might become sufficient to cause fusion. We know, also, that the cohesion of no substance is adequate to withstand all assignable pressures. No rock has the requisite rigidity to resist the crushing weight of a mountain twenty miles high. Whatever movements may take place in the earth's crust, involve masses so great and forces so enormous that the resistances of ordinary matter are inconsiderable. The most solid rocks are essentially fluid or viscid. Now, such movements must necessarily result from two causes: First, a slow shrinkage of the earth through loss of heat; secondly, the attractions of the sun and moon, which cause tidal protuberances on the surface of the earth, however rigid it may be; and these, continually shifting their positions, as the oceanic tides do, result in daily motions adequate to develop a large amount of frictional heat.

But, whatever the cause of the internal heat existing, we can not demonstrate that the whole interior is molten; nor that the earth is solid to the core; nor that we have a solid core and a solid crust, with an irregular zone between, in which the matter is molten, or, at least, in a plastic state. We have many facts; we are building our theories cautiously, and in the