On a Diagram of the Earth's Eccentricity and the Precession of the Equinoxes, illustrating their Relation to Geological Climate and the Rate of Organic Change. *By* ALFRED R. WALLACE, *F.R.G.S.*

The author exhibited a diagram of the eccentricity of the earth's orbit and the precession of the equinoxes, from which he deduced certain important views as to the climates of past geological ages and the changes of organic life. During the past three million years the eccentricity has been almost always much greater than at present, on the average twice as great, and for long periods more than three times as great. It was shown that when the eccentricity was greatest the heat received from the sun at the greatest and least distances was as 3 to 4; and, owing to the precession of the equinoxes, the winters of the northern hemisphere would be rendered intensely cold and much longer for periods of 10,500 years, while during the alternate periods the winters would be mild and short, the summers cool and long, leading to an almost perpetual spring. We thus have cold or glacial epochs for about 10,000 years, alternating with mild epochs for the same period, whenever the eccentricity was high, and this was the case for fully the half of the last three million years; and, as such alternations must have occurred during every glacial epoch, the fact of intercalated warm periods and the migrations consequent on them, which have been detected by geologists, must be looked upon as the normal condition of things. But during the last 60,000 years (probably the whole time elapsed since the close of the last glacial epoch) the eccentricity has been very small, and the alternations of climate and consequent migrations very slight; and as Mr. Darwin holds that alternations of climate are, by means of the consequent migrations, the most powerful cause of modifications of species, there must have been a comparative stability of species during that period of time, from which alone we obtain our idea of the rate of specific change. This idea will therefore be erroneous; and the rate of change during past geological ages may have been, and probably was, much more rapid than has hitherto been thought possible. During three million years before and one million after the recent epoch, no less than 130 alternations of climate occurred (each of 10,000 years' duration), when the eccentricity was more than double what it is now; and these incessant changes were thought, on Darwinian principles, to supply a *vera causa* for a rapid change of species, and thus enable us considerably to reduce the duration of geologic periods, which had heretofore been measured by data derived from the period of organic stability since the last glacial epoch.

On the Organization of the Stems of Calamites.
By Professor W. C. WILLIAMSON, *F.R.S.*

The author pointed out the unity of type observed amongst the British Calamites, and the consequent improbability of the existence anywhere of two types (the one Cryptogamic, the other Gymnospermous), as believed by Prof. Adolphe Brongniart. He then described the various portions of the jointed stem, the centre of which is a cellular ring of fistular pith, having transverse dissepiments at the nodes. Around this is a woody zone, composed of wedges of barred and reticulated vessels. These wedges are separated from each other by large medullary rays, and smaller rays separate the constituent laminæ of each wedge, which latter spring at their innermost angle from a longitudinal canal running from node to node. The organization of these wedges, canals, and medullary rays was described in minute detail, their variations in several species being noted, as well as the differences between the arrangement at the nodes and at the internodes, which differences are often very characteristic. The structure of the epidermal layer, or bark, was then shown to be cellular; it consisted of an irregular parenchyma, with cells of variable dimensions. Its exterior appears to have been smooth, unlike the exterior of the woody groove zone, which, like the interior of the latter portion, was longitudinally fluted, the longitudinal ridges and furrows of each internode usually alternating at the nodes. The branches were shown to be of small size, being given off from the woody wedges exactly opposite the centre of each node, whilst the roots were described as originating from the lower extremity of each of the internodes at the