the geologist has been able to recognize, some of these higher types had propably no existence at all.

Each successive discovery, like those which I have mentioned, of the remains of animals of the higher types in the older rocks, is regarded by some geologists as an addition to the cumulative evidence by which they conceive that the theory of non-progression will be ultimately established; while others consider the deficiency in the evidence required to establish that theory as far too great to admit the probability of its being supplied by future discovery. Nor can the theory derive present support, it is contended, by an appeal to any properties of inorganic matter, or physical laws, with which we are acquainted. Frof. W. Thomson has recently entered into some very interesting speculations bearing on this subject, and suggested by the new theory of heat of which I have spoken. The heat of a heavenly body placed under the same conditions as the sun, must, it has been said, be ultimately exhausted by its rapid emission. This assertion assumes the matter composing the sun to have certain properties like those of terrestrial matter with respect to the generation and emission of heat; but Prof. Thomson's argument places the subject on better grounds, admitting, always, the truth of the new theory of heat. That theory asserts, in the sense which I have already stated, the exact equivalence of heat and motive power; and that a body, in sending forth heat must lose a portion of that internal motion of its constituent particles on which its thermal state depends. Now we know that no mutual action of these constituent particles can continue to generate motion which might compensate for the loss of motion thus sustained. This is a simple deduction from dynamical laws and principles, independent of any property of terrestrial matter which may possibly distinguish it from that of the sun. Hence, then, it is on these dynamical principles that we may rest the assertion that the sun cannot continue for an indefinite time to emit the same quantity of heat as at present, unless his thermal energy be renovated from some extraneous source. The same conclusion may be applied to all other bodies in the universe which, like our sun, may be centres of intense heat; and, hence, recognizing no adequate external supplies of heat to renovate these existing centres of heat, Prof. Thomson concludes that the dispersion of heat, and consequently of physical energy, from the sun and stars into surrounding space without any recognizable means of reconcentration, is the existing order of nature. In such case the heat of the sun must ultimately be diminished, and the physical condition of the earth therefore altered, in a degree altogether inconsistent with the theory of non-progression.

Mr. Rankine, however, has ingeniously suggested an hypothesis according to which the reconcentration of heat is conceivable. Assuming the physical universe to be of finite extent and surrounded by an absolute vacuum, radiant heat (supposing it to be propagated in the same way as light) would be incapable of passing into the vacuum, and would be reflected back to foci corresponding to the points from which it emanated. A reconcentration of heat would thus be effected; and any of the heavenly bodies which had previously lost their heat, might, on passing through these foci, be rekindled into bright centres of radiant heat. I have alluded more particularly to this very ingenious, though, perhaps, fanciful hypothesis, because some persons have, I believe, regarded this view of the subject as affording a sanction to the theory of non-progression; but even if we should admit its truth to the fullest extent, it may be deemed, I think, entirely inconsistent with that uniformity and permanence of physical condition in any of the heavenly bodies which the theory just mentioned requires in our own planet. The author of this hypothesis did not possibly contemplate any such application of it; nor am I aware how far he would advocate it as really

applicable to the actual constitution of the material universe, or would regard it as suggesting a possible and conceivable, rather than a probable, mode of counteracting the constant dispersion of heat from its existing centres. He has not, I think, attempted to work out the consequences of the hypothesis as applied to *light*, to which it must, I conceive, be necessarily considered applicable if it be so to heat. In such case the foci of the reflected heat would be coincident with those cf the reflected light, proceeding or ginally from the same luminous bodies. These foci would thus become visible as the images of stars; so that the apparent number of stars would be constantly increasing with the increasing number of images of each star produced by successive reflexions. This will scarcely be considered the actual order of nature. It would be easy to trace other consequences of the application of this hypothesis to light; but I would at present merely state that my own convictions entirely coincide with those of Prof. Thomson! If we are to found our theories upon our knowledge, and not upon our ignorance of physical causes and phenomena, I can only recognize in the existing state of things a passing phase of the material universe. It may be calculated in all, and is demonstrably so in some respects, to endure under the action of known causes, for an inconceivable period of time; but it has not, I think, received the impress of eternal duration in characters which man is able to decipher. The external temperature any physical conditions of our own globe may not, and probably cannot, have changed in any considerable degree since the first introduction of organic beings on its surface ; but I can still only recognize in its physical state during all geological periods, a state of actual though exceedingly slow progression, from an antecedent to some ultimate state, on the nature of which our limited powers will not enable us to offer any conjecture founded on physical research. The theories, even, of which I have been speaking, may probably appear to some persons as not devoid of presumption; but for many men they will ever be fraught with deep speculative interest:---and, let me add, no charge of presumption can justly lie against them if entered upon with that caution and modesty which ought to guide our inquiries in these remote regions of physical science.

I feel how imperfect a view I have now submitted to you of recent scientific proceedings. I have given no account of the progress of Chemistry, of Practical Mechanics, or of the sciences connected with Natural History; nor have I spoken of Ethnology, a science which, though of such recent date, is become of great interest, and one which is occupying the minds of men of great learning and profound research. I can only hope that the chair which I have now the honor to occupy, will be henceforth filled by men qualified to do full justice to these important branches of science. I trust that what I have said, however, will convey to you some idea of the activity which pervades almost every department of science.

I must not conclude this Address without some mention of what appear to me to be the legitimate objects of our Association —nor without some allusion to circumstances calculated, I think, to give increased importance to its general working and influence.

There are probably few amongst us of whom the inquiry has not been made—after any one of our meetings—whether any striking discovery had been brought forward?—and most of us will also probably have remarked that an answer in the negative has frequently produced something like a feeling of disappointment in the inquirer. But such a feeling can arise only from a misapprehension of what I conceive to be the real and legitimate objects of the British Association. Great discoveries do not require associations to proclaim them to the world. They proclaim themselves. We do not meet to receive their announcement, or