

Letters to the Editor.

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Geology and the Nebular Theory.

THE literature of geology has grown so immense that no man can be familiar with all of it, particularly when it refers to another continent than one's own, yet it comes as a surprise to a Canadian to find eminent Old World geologists still referring to the nebular hypothesis as an established fact of geological history. A few weeks ago Prof. J. W. Gregory suggested that life began on mountains, since these were the first parts of the earth's crust to cool to a suitable temperature, and more recently Prof. Joly, in discussing the age of the earth, assumes the truth of the nebular hypothesis, though he admits that "there was indeed some scanty sedimentation in Archæan times."

Probably no country includes a larger area of Archæan rocks than Canada, and several parts of the area have been studied as carefully as possible because of their importance as mining regions, yet no evidence of a hot earth has been found. The Huronian rocks of cobalt include a glacial deposit which is known to have covered many thousands of square miles. The Sudbury or Timiskaming Series, next in age, consists almost entirely of sediments, such as boulder conglomerates which may be glacial, arkosi with unweathered feldspars, and graywacke with seasonal leaching. Near Sudbury the series has a thickness of more than 20,000 feet.

The oldest rocks of all are the Keewatin and the Grenville Series, the former consisting mainly of volcanics but including thousands of feet of sedimentary gneisses and of "iron formation"; the latter is made up wholly of sediments, reaching a thickness of more than 50,000 feet in places and containing immense deposits of limestone, as well as much carbon in the form of graphite.

It might be thought that the Keewatin lavas imply a hot condition of the earth, but as a fact most of them exhibit pillow structure, showing that they were poured out into water. Liquid water existed over many thousands of square miles, and probably the temperature was low enough for the life of algæ and perhaps of primitive animals, as suggested by the carbon and limestone. The rocks of this most ancient known geological period do not indicate a higher temperature than that of later times.

It is probable, however, that those geologists who think of the earth as hot in Archæan times have in mind the granites and gneisses which underlie the most ancient sediments, the Laurentian rocks of Canada and similar plutonic rocks of other countries, which undoubtedly are of eruptive origin, and have been described as part of the original crust of the molten earth. In reality the Laurentian batholiths are far younger than the sediments and volcanics of the Keewatin and Grenville which they have invaded, and a similar welling-up of plutonic batholiths has occurred at numerous times in the later history of the world, and is perhaps still taking place beneath great ranges of youthful mountains like the Andes and Himalayas.

The coast range of British Columbia, 1100 miles long and 100 broad, consists of just as characteristic batholithic rocks as the Laurentian, but is of Jurassic

age, and the Andes, which are still younger, appear to be largely of the same character. Granite and gneiss may be of any age, and do not imply a cooling earth as some have supposed. We find greater areas of such plutonic rocks in the most ancient geological periods simply because they have been exposed to denudation for a longer time, and so have been more widely uncovered.

The conditions found in the Archæan of Canada are repeated in Brazil, India, and Scotland, and probably other countries of which the present writer has no personal knowledge. The oldest rocks in the world are sedimentary and indicate temperatures like those of later times. If the earth was ever a molten sphere, there is no evidence of this condition in the geological record, and geologists should not cling to an outworn theory which the astronomers themselves have largely given up. In the planetesimal theory a method of world building has been provided which permits of a cold surface from the beginning, and fits far better with the known geological facts than the nebular theory.

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Species and Adaptations.

MR. BATESON'S address to the American Association at Toronto last December, which was published in NATURE of April 29, exhibits features of the same kind as those which were evident in his address to the British Association in Australia in 1914. In the Australian address he maintained that the effect of the discoveries and investigations in recent years in the phenomena of heredity and variation was greatly to increase the difficulty of understanding the origin of any characters which were new in the proper sense of the word. He went so far as to suggest that all characters which have appeared in the course of evolution may have been present in the protoplasm or nuclear structure of the original unicellular forms from which later forms, including man, have descended, all apparently new characters having been due to loss of inhibiting factors and segregation of various simpler combinations from the original complex. Now Mr. Bateson again declares himself an agnostic with regard to the evolution of species, and in spite of all modern discoveries, or because of them, states that we are farther than ever from any satisfactory explanation of the evolution of a new species, or of two or more species, from a single ancestral species.

Mr. Bateson admits that plenty of Mendelian combinations would in nature be given specific rank, and then proceeds to state that the topic of evolution is now dropped in genetical circles. He then illustrates the rule of silence on this favourite subject of a former generation by devoting the rest of his discourse to it, only to lead up to the conclusion that specific difference probably "attaches" to a base of which we know absolutely nothing at all. Our faith in evolution, Mr. Bateson declares, is unshaken; our doubts are merely as to the origin of *species*.

Now I have no intention of stating in opposition to Mr. Bateson that our present knowledge fully explains the origin of new species; I wish merely to offer some criticisms of the difficulties which he describes. In the first place, I dislike the expression "faith in evolution." I do not share the distrust in facts and reasoning which is now in vogue as a reaction against the excessive confidence of the nineteenth century. Evolution is a question of science, of verifiable facts and sound reasoning, and has nothing to do with faith. Mr. Bateson himself in another paragraph