tested by an appeal to facts, and it will be our duty in the course of our investigations to examine all the data which have been adduced in their support. I have referred to them on this occasion merely to show you that above and beyond the more or less obvious interpretation of geological phenomena, larger questions arise, the consideration of which demands not only laborious and far-extended observation, but must call into exercise all the varied powers of the human mind.

In the initial stages of our geological investigations we are occupied in detecting the more apparent resemblances and correspondences between the present and the past. We readily discover in sedimentary strata the evidence of their accumulation by the action of water, nor do we experience much difficulty in discovering the igneous origin of many rock-masses in regions now far removed from scenes of volcanic activity. But each observation we make and every well-founded correspondence we establish between the present and the past leads on to larger and larger deductions, until, as in the case of our granitic dykes and veins, we eventually find that geological investigations frequently increase our acquaintance with forces now in action and give us some insight into the hidden operations of nature. It is not indeed too much to say that in many cases our knowledge of such operations is derived in large measure from a study of the effects produced by the work of nature in past ages. The examination, for example, of the fragmentary relics of ancient volcanoes, in this and other countries where volcanic action has long been extinct, has enabled us to picture to ourselves many details of the structure of those interior and basement parts of a volcanic mountain, which otherwise must ever have remained unknown. The long-continued action of the agents of denudation has often removed those superficial rock-masses which gather around volcanic orifices, so as to lay bare, as in a dissection, the interior and basal portions—showing us the fractured and baked strata through which the heated gases, molten matter, and loose ejectamenta were erupted, and the dykes and veins of crystalline rock which were injected into the cracks and fissures of the shattered strata. Nay, a study of those vast masses and sheets of granitic, gneissose, and schistose rocks, of which large portions of the Scottish Highlands, Scandinavia, and other countries are composed, induces the belief that these rocks originally existed as ordinary sedimentary strata, and that their present crystalline condition has been assumed at a time when they were deeply buried underneath other and of course younger strata. And thus we have hints given us as to what may be taking place now throughout extensive areas underneath the surface of the earth, where other sandstones and shales may be undergoing a gradual metamorphism and conversion into crystalline rocks.

(*To be continued.*)

THE SENSES OF BEES

AT the meeting of the Linnean Society on Thursday last, Sir John Lubbock read an account of his further observations on the habits of insects, made during the past year. The two queen ants which have lived with him since 1874, and which are now, therefore, no less than eight years old, are still alive, and laid eggs last summer as usual. His oldest workers are seven years old. Dr. Müller, in a recent review, had courteously criticised his experiments on the colour sense of bees, but Sir John Lubbock pointed out that he had anticipated the objections suggested by Dr. Müller, and had guarded against the supposed source of error. The difference was, moreover, not one of principle, nor does Dr. Müller question the main conclusions arrived at, or doubt the preference of bees for blue, which indeed is strongly indicated by his own observations on flowers. Sir John also recorded some further experiments with a reference to the power of hearing. Some bees were trained to come to honey which was placed on a musical box on the lawn close to a window. The musical box was kept going for several hours a day for a fortnight. It was then brought into the house and placed out of sight, but at the open window and only about seven yards from where it had been before. The bees, however, did not find the honey, though when it was once shown them, they came to it readily enough. Other experiments with a microphone were without results. Every one knows that bees when swarming are popularly, and have been ever since the time of Aristotle, supposed to be influenced by clanging kettles, &c. Experienced apiarists are now disposed to doubt whether the noise has really any effect, but Sir John suggests that even if it has, with reference to which he expressed no opinion, it is possible that what the bees hear are not the loud low sounds, but the higher overtones at the verge of, or beyond our range of hearing. As regards the industry of wasps, he timed a bee and a wasp, for each of which he provided a store of honey, and he found that the wasp began earlier in the morning (at 4 a.m.), worked on later in the day. He did not, however, quote this as proving greater industry on the part of the wasp, as it might be that they are less sensitive to cold. Moreover, though the bee's proboscis is admirably adapted to extract honey from tubular flowers, when the honey is exposed, as in this case, the wasp appears able to swallow it more rapidly. This particular wasp began work at four in the morning, and went on without any rest or intermission till a quarter to eight in the evening, during which time she paid Sir John 116 visits.

INVERTEBRATE CASTS VERSUS ALGÆ IN PALÆOZOIC STRATA

THE distinguished Swedish geologist, Dr. A. Nathorst, having made numerous experiments, has come to the conclusion that invertebrate animals, when creeping over a soft sea-bottom, will leave imprints which are identical with the markings which have hitherto been considered those of fossil Algæ. If these Algæ are examined, it will be found, he states, that the appearance of a great many of them indicate that they have not been organisms at all, but formed in some mechanical way, and that analogous forms may even be found in existing species.

Dr. Nathorst considers that with the exception of three groups, the greatest number of Algæ enumerated in Mr. Schimper-Zittel's work on Palæontology as "undefined," are merely imprints of invertebrate animals.

Some time ago Prof. Martens of Berlin demonstrated that ichthyological members of the genus *Periophtalmus* which he had watched on the coast of Borneo when creeping over a clay bottom, left regular and defined impressions from their body and fins on the surface which would, if preserved, easily be mistaken for cryptogamic fossils, and in a paper on casts of Medusæ in the Cambrian strata of Sweden, Dr. Nathorst further shows that the so-called *Eophyton spatangopsis*, &c., which have been considered imprints of certain zoophytes and mollusks, are traces of Medusæ. These "fossils" are, according to his theory, either traces which Medusæ leave when carried by the motion of the water over a soft bottom (*Eophyton*), or imprints of their belly and adjacent organs when at rest. He further shows, that a more solid kind of Medusæ than the common have left traces in the calcareous slate of Central Germany, which makes it possible, in some measure, to define their relation to existing species.

Hitherto, Medusæ have only been traced back to the Jurassic period, but Dr. Nathorst shows that these organisms have existed from at least Cambrian times. The imprints which the lower organisms leave on mud or sand vary in appearance with the creeping or swimming habits of the animals, as well as with the nature of the bottom, whilst it is particularly interesting to note that certain worms produce imprints and vermiculated holes, which are exactly like the radiant Algæ, and which would not be supposed to be the work of invertebrata, if their formation had not been clearly demonstrated.

In connection herewith it should be mentioned, that imprints may also be made in a soft sea-bottom by stones, which are carried along with the tide by floating sea-weeds, regarding which observations have recently been made by the Scottish naturalist, Mr. Symington Grieve. C. S.

BIOLOGY IN ITALY[1]

IN welcoming the appearance of this new journal under the editorship of Prof. Emery, of Bologna, and Prof. Mosso of Turin, it may not be amiss to mention briefly the programme of its originators. They will endeavour each year to give a classified list of all works published in Italy on biology, in its widest sense. The list for 1881, with an index of the names of authors, appears in volume I. They will try and bring together and illustrate original memoirs on subjects which treat of life in every form. In addition to these there will from time to time appear *résumés* and notices of memoirs appearing in other Italian journals; and as far as practicable the *résumés* will be drawn up by the authors of the papers abstracted. The archives will be

[1] "Archives Italiennes de Biologie." tome i., 1882. Tome ii. fasc. i., October 15, 1882. (Rome, Florence, Turin: H. Loescher.)