minute living *Nebalia*, and that these early forms may have given rise to, and have been the forerunners of, the modern Malacostraca. 'In *Nebalia*,' says Claus, 'we probably have to do with an offshoot of the phyllopod-like ancestors of the Malacostraca, which has persisted on to the present time.'

"The genus *Estheria* existed in the fresh and brackish waters of the Devonian Period, in Livonia, Caithness, and Orkney, and also in Nova Scotia and Scotland. It flourished in the European area at several of the Upper Carboniferous stages, and was well represented in the Secondary and Tertiary rocks; it is also living, and has a world-wide distribution.

"The Phyllocarida seem in some cases to afford examples of persistency of type, and in others of local or temporary specialisation. One of the oldest known is the Cambrian *Hymenocaris*, a prototype of the recent *Nebalia*. *Caryocaris* of the Arenig series possibly belongs to the same group; and the Upper Silurian *Ceratiocaris* carries the form to a high degree of perfection; but until we meet with the *Nebalia* of to-day we have no tangible links in this series in intermediate geological times. Walcott's Cambrian *Protocaris* is quite susceptible of being regarded as a predecessor of the living *Apus*. The Carboniferous *Dithyrocaris* and its allies stand probably in the relation of genealogical links. But much more research among these interesting lower crustacean fossils is required before their phylogenetic relationship can be fully elucidated.

"The Ostracoda, which have the entire body enclosed in a shell or carapace composed of two valves united along the back by a membrane (represented by such forms as *Cypris*, *Cypridina*, *Candona*, *Beyrichia*, *Primitia*, &c.), are chiefly dwellers in shallows, and occur both in fresh and salt water; they are usually of minute size; but there are deep-sea types which attain comparatively large dimensions (an inch long). They are met with in rocks of almost all ages from the Cambrian upwards. To speak of them here is to recall the nearly life-long labours (from about 1840) devoted to their elucidation by Prof. T. Rupert Jones, who has described many hundreds of these primitive crustacea from rocks of every British formation as well as from very many foreign countries.

"Great as are the transformations which these organisms have witnessed in the long cycles of geological change from Lower Cambrian to modern time, they present, nevertheless, a general facies, and (like the genus *Lingula* amongst the brachiopoda) must be looked upon as one of those persistent types which possess enormous power of multiplication, so that entire beds of rock may be said to be composed of their microscopic tests. The living species also possess exceptional powers of endurance and provision for the preservation of their lives in periods of drought, often retaining their vitality in a dormant state perhaps for years; thus they have persisted through all the vicissitudes of geological time, represented by the entire succession of the stratified rocks; 'all things changing, but themselves unchanged.'

"None of the older Ostracod genera exist now; but some of the existing forms of the Cypridide, Cytheridæ, and Cytherellidæ are fully represented by predecessors in the Palæozoic rocks. The wonderfully well-preserved *Palæocypris Edwardsii*, discovered by Dr. C. Brongniart, enclosed in transparent silica, displaying the soft parts of the animal as perfect as in life, from the Coal Measures of St. Etienne, is evidence of the existence of Cyprids in that far-off time.

"I have endeavoured to depict in a diagram (p. 115) the evolution of the Arthropoda in geological time.

"In concluding this brief excursion over the abysses of Palæzoic time, I have only been able to bring under your notice a few isolated points of interest in the crustacean fauna which lie in the depths of these ancient deposits. They may, however, serve to show that this group of lowly existences is not destitute of interest for the biologist. There may also be a possibility of connecting these isolated observations so as to show their bearing upon the greater question of the development of life.

"In order, however, to do this effectively I must ask you to accompany me next year in a second excursion over the newer Palæozoic and Kainozoic seas, where, nearer land and in shallower waters, we shall find a still greater variety of life-forms to study.

"Two conclusions may be drawn from our observations, namely, (1) that the ancient faunas of the earth were far more widespread, more simple and more uniform than are our recent faunas; and (2) if, as the researches of geologists seem to indicate, other sedimentary rocks exist, *older* than the Lower Cambrian, then we may hope to gather evidence of still earlier and more simple forms of life than are met with in the '*Olenellus*-zone.' We are fully justified in concluding that such must actually have existed, because we find in the Lower Cambrian evidence of a quite considerable fauna belonging to several divisions which, although lowly in themselves, are nevertheless already so clearly differentiated one from the other as to prove to us that we are still, both biologically and chronologically, very far removed from the commencement of life on the earth."

SCIENTIFIC SERIALS.

American Journal of Science, May.—On the colour relations of atoms, ions, and molecules, by M. Carey Lea. Part I. The colour or absence of colour of an element is a function of its atomic weight. No element having ions coloured at all valencies can belong to the same natural group with elements having colourless ions only. The entire class of elements with colourless ions is divided into nine great natural groups, as follows:—H, F, Cl, Br, I; Li, Na, K, Rb, Cs; Ca, Sr, Ba; Sc, Y, La; Be, Mg, Zn, Cd, Hg; B, Al, Ga, In; C, Si, Ge, Sn, Pb, Th; N, P, As, Sb; O, S, Se, Te. This first great division of the elements includes all those whose ions function as anions, and also part of the cathions. Intermediate between the two chief divisions are eleven transitional elements, viz. Ti, V, Cu, Nb, Mo, Ag, Ce, Ta, W, Th, Bi. These have ions which at some valencies are coloured and at others colourless. These are cathions only. With atomic weights ranging from 1 to 47 the atoms are colourless; 52 to 59 coloured; 65 to 90 colourless; 103 to 106 coloured; 112 to 139 colourless; 145 to 169 coloured; 192 to 196 coloured. Elements whose place in the numerical series falls between these periods have both coloured and colourless atoms. The six heaviest metals at the end of the series are alternately coloured and colourless.—Argon, Prout's hypothesis, and the periodic law, by Edwin A. Hill. A very interesting question connected with the discovery of argon is what will be the effect of these researches upon Prout's hypothesis? It is possible that argon has been an unsuspected cause of error, which, when properly allowed for, will show the ratio of H to O to be almost exactly 1 to 16. This would make so many atomic weights even or half multiples of H as to render probable the generation of the elements from a common form of matter by the continued addition of some one or more constant increments of mass.—Relation of the plane of Jupiter's orbit to the mean plane of 401 minor planet orbits, by H. A. Newton. The secular perturbation of the orbit of a minor planet by Jupiter is such that the inclination of the orbit plane is not greatly changed, but the node has a constant motion. Whatever may be the distribution of the poles of these orbits at one epoch, the tendency of the secular perturbation by Jupiter is to finally distribute them symmetrically around the pole of Jupiter's plane. The present inclination of the mean plane to Jupiter's plane is 0°·43.

American Meteorological Journal, May.—The cause of cyclones, by Prof. A. Woeikof. The article deals chiefly with two points mentioned in a former paper on this subject by Mr. Dines. Dr. Woeikof considers that the balloon ascent from Munich on December 11, 1890, showed that, while there is no cooling of the free air in calm anticyclonic weather, the radiation of the surface of the snow cools the surrounding air, even on an isolated mountain. With regard to the suggestion that the latent heat set free by condensation is sufficient to cause a storm, he points out that the heat set free by copious condensation in India does not produce storms.—Meteorological problems for physical laboratories, by Prof. C. Abbe. Few physical laboratories have conveniences for studying aero-dynamics, but the author, with the assistance of Prof. C. F. Marvin, gives a list of thirty-seven subjects for experimental investigation which demand attention from meteorological students.—Long range weather forecasts, by Prof. H. A. Hazen. The author puts forward a series of crucial tests of weather forecasts, more particularly with the view of showing the fallacy of the predictions based on the positions of the moon, planets, &c.—There is also an article by F. B. White on topographic influence on the winds of the weather maps, which frequently show erratic winds, having no dependence on the barometric gradients charted with them.