

kind are not, however, of a very satisfactory nature; and the pond has apparently returned to its legitimate use, viz., furnishing a home for about a million small fishes.

In no place in the world is so much attention paid to magnetic observations and investigations as here at Pawlowsk. We see in this cut the underground magnetic house, and its size can be seen by comparison with the figures in the foreground. The building consists of two chambers, separated and surrounded by air-chambers which are heated; and the heat is thus conveyed through the walls into the observing-rooms. These rooms remain at a wonderfully constant temperature. The building is quite isolated from the remaining portions of the observatory. It was here that the observations simultaneous with those of the recent international polar expeditions were made.

The whole work of this institution is scientific in the highest degree, and there is little of what we may call popular work done; but this is unnecessary, as those who would be influenced by a more evidently practical result have nothing to say in regard to the conduct of the service.

RED SKIES IN CHINA FIVE YEARS AGO.

THE 'red sunsets' which have recently attracted so much attention in so many quarters of the globe, and have called forth considerable discussion in various scientific journals, both in America and Europe, recall very similar phenomena I observed five years ago, under circumstances which seem to me worth recording at this time.

During the early part of the winter of 1878-79, I had occasion to pass several weeks, engaged in geological work, along the base and among the foot-hills of the first mountain range that rises above the plain of northern China, and forms the boundary between the provinces of Chihli and Shansi. Frequently in the month of November my attention had been called to the intense coloring of the sky, and brilliant red afterglows, slowly fading away, and lasting long after the sun had set. On one occasion, Dec. 1, I left the small mountain village of Cheang-Shui, accompanied by my friend Mr. W. N. Pethick of Tientsin, for a long tramp among the hills. We travelled up the long valley, and ascended to the top of the pass commanding an extended view to the westward, over the plateau of Shansi. Although late in the day, we pushed on to the village of Tang-

Cheng-Tsun, a mile and a half to two miles beyond, reaching there about sunset.

On our way back to the pass, I was continually looking backward, astonished at the brilliancy of the sky, the orange-red and peculiar brick-red colors of the horizon, and the length of time the vivid coloring remained after the going-down of the sun. How long this intense afterglow continued I am unable to say; as, on reaching the summit, we retraced our steps down what in the Cordillera would be called the cañon, and the western view was completely lost behind an abrupt wall.

All the phenomena connected with the sunset were quite similar to those recently observed in New York, except, as I now recall the scene, the colors seemed to surpass them in brilliancy.

Through the month of December I was frequently impressed with the deep red glare of the skies, and long twilights, although none of them appeared to equal in intensity the one observed from the top of the plateau. This difference I supposed was due to the view being somewhat shut off by the high ridge to the westward.

As early as November the prevailing winds in northern China blow almost continuously from the north-west, across the broad area of country covered with loess-deposits. In consequence, the atmosphere was never wholly free from fine loess-dust; a haziness being at all times noticeable in the mountains, while frequently the air was gray from the large amount of impalpable dust held in suspension. On those days when the dust was most perceptible the colorings of the skies were never remarkable, and were only fine when the lower atmosphere seemed clear and bright.

These brilliant afterglows continued at intervals throughout December and early part of the new year; the last one being noticed about the middle of January, from a small village seventy-five miles east of the mountains, where I had put up for the night on my way to Tientsin. In the following September I again visited the mountains and plateau of Shansi, but do not recall any thing in connection with the sunsets at all comparable to those observed the preceding winter. But, on the other hand, the atmospheric conditions were also wholly changed; the wind was blowing steadily from the east or ocean side; the air was laden with moisture, which was frequently precipitated in heavy rains; and the atmosphere, so far as the eye could detect, was free from dust. I can but think that the great brilliancy and long duration of the afterglow were intimately connected with loess-dust in some such way

as the recent remarkable displays have been attributed to the volcanic dusts of Krakatoa. The peculiar phenomena in the skies, like those described, were not noticed at Tientsin in the spring. This may be accounted for by atmospheric conditions being changed, and the air at this season of the year being overcharged with too much fine material derived from the dust-storms which form, during March and April, so marked a feature of the climate of northern China. I think it quite probable, however, that red skies, similar to those recently observed in various parts of the world, may at times be seen throughout the winter by foreign residents at Peking and Tientsin.

A few more words about loess-dust. During the winter referred to I was much interested in the question of the loess that was annually being removed from the land and carried out to sea, and not only was impressed with the amount transported by streams, but was led to believe that a not inconsiderable quantity was borne eastward by the prevailing winds, and finally precipitated upon the ocean. Inquiries brought out the fact, that, in the China seas, ships many hundred miles from land frequently report showers of fine material falling upon the decks, which in many cases have been wrongly regarded as deposits of volcanic dust. In conversation with the captain of the steamship *China*, on the passage from Yokohama to Hong Kong in the autumn of 1879, he narrated his experience in a dust-storm, while passing over the same route in the preceding spring. The storm occurred April 25, in latitude 29°, longitude 128°. It lasted twelve hours, with a heavy wind blowing steadily from the north-west. Every thing on board was coated with an excessively fine dust, which, as the captain expressed it, "was so thick that it could be taken up with the fingers like so much snuff." From the rigging, one of the sailors, under orders from the captain, collected with a knife-blade a large amount of the dust, samples of which he forwarded to London for examination. Now, I very well remember that in April the whole plain of northern China was enveloped in several severe dust-storms; two of them, at least, having a duration of three days each, and filling the air at times with dust, so as to completely obscure the sun. There is no question in my mind but that the material which fell upon the steamship came from the loess of China; and I believe that a great deal of the so-called volcanic dusts which are often reported as observed at sea are, at least in Chinese waters, derived from loess-deposits.

ARNOLD HAGUE.

THE EVOLUTION OF THE CEPHALOPODA.—I.

CEPHALOPODS, or cuttlefishes, have structural peculiarities which make them the most favorable subjects now known for the special study of the problems and laws of the evolution of forms in time. In two of the orders the animals were shell-covered; and the shell in these is so built that it preserves, even in the fossils, the embryo, the young shell, and all its stages to the full grown. Then, passing on into old age, it shows in the senile period a series of retrograde transformations, often reversing its adult condition and aspect. This record of the entire life is fuller than any one who has not minutely studied this type can imagine from his experience in other branches of the animal kingdom. It is not only in itself a complete cycle of changes, and these of no slight or doubtful character, but the external records of the shell-structure, apertures, and other parts, are supplemented by the hard portions of two internal structures, which are preserved, and also change in accordance with the age of the shell. We have, therefore, in every well-preserved specimen, the unique advantage of being able to study the complete cycle of its individual life in three distinct sets of organic parts. We can therefore compare the changes which we observe in the individual with the modifications which the group has undergone in its progression or retrogression in geologic times with a certain completeness of the evidences, at present unattainable in any other class of animals. In the Belemnites, the third order, the shell and its parts are much less instructive; and finally, in the fourth, the Sepioidea, it is so much reduced, and so frequently absent, as to lose very largely in this respect.

The class has two sub-classes, Tetrabranchiata and Dibranchiata. These were established by Richard Owen as orders,—a purely technical difference, which does not change in any way the value of the structural distinctions as given by this eminent naturalist. The Tetrabranchiata are shell-covered; and they are represented by the modern *Nautilus*, the only existing genus. The Dibranchiata are descendants of the former, but enclosed the shell, and resorbed it in many forms, so that they appear as naked animals. The cuttlefishes, squid, devil-fishes, etc., are existing types. In studying these types, the author has been led to adopt a new method of characterizing the divisions, and besides the old structural distinctions, which are still available, to apply the