

more occult (and therefore the chief) portion of it. Most of what had hitherto been discovered resulted from the casual visits of entomologists (not always trained to the subject). In Coleoptera alone he discovered about 430 species, of which nearly four-fifths appear to be strictly endemic, which is certainly noteworthy in considering the fauna of an insular group of volcanic origin. The minority of more recent "introductions" look largely in the direction of Western North America, with a sprinkling of Polynesian or Australian forms. The Rev. Mr. Blackburn's Hawaiian discoveries in entomology have an important bearing on the selection of naturalists to accompany exploring and other expeditions. A trained observer knows where and how to look, even if in doubt as to what he may find, and is always rewarded by new discoveries. An untrained hand scampers over the country, and, with every desire to distinguish himself, comes back and complains of the barrenness of the land.

**VEGETABLE PARASITES OF CODFISH.**—Some years ago Prof. Farlow called attention to the presence of a red fungus which was destructive to the dried codfish of the American fisheries (NATURE, vol. xxiii. p. 543). Since then Dr. E. Bertherand has given an account of poisoning which had occurred among the French troops at Algiers, caused, it was believed, by eating dried codfish, which had a vermilion hue owing to the presence of a fungus described by M. Mègnin in the *Revue Mycologique* (vol. vi. p. 114) as *Coniothecium bertherandi*. Specimens of fish with the same colour were also met with at Bordeaux and Dieppe, these latter presumably from Newfoundland. It would appear probable that Mègnin's fungus is the same as that originally described by Farlow as *Clathrocystis rosco-persicina*, Cohn.<sup>1</sup> In addition to this species, however, Farlow has described another parasitic form on the cod, *Sarcina morrhue*, which name had to yield in priority to *S. litoralis* of Poulsen, found on mud near Copenhagen, and which has lately been recognised by Saccardo and Berlese as occurring on codfish from Algiers. These botanists seem to think the *Coniothecium bertherandi* identical with *Sarcina litoralis*, and this latter to be but a condition of *Beggiatoa rosco-persicina*; but although they are found in company Farlow sees no good reason to think they belong to the same species. It is curious the form should occur in regions so far apart as New England, Algiers, and salt-marsh mud in Denmark, and it suggests the idea that salt may be the means by which the disaster is spread. Still another species, called *Oidium morrhue* by Farlow, by forming small brown spots on the surface of the dried codfish injures its sale, and has been found not only in New England, but also at Algiers.—(W. G. Farlow, *Bull. U.S. Fish Commission*, i. p. 1, February 8, 1886.)

**SUPERIMPOSED STAMENS.**—Mr. Thomas Meehan suggests a new interpretation for the appearance of superimposed stamens. Stamens are by most, if not by all botanists, regarded as exogenous lateral outgrowths from a caulome, in which latter there has normally been an arrest in its axial development. Stamens, however, occasionally will spring from the inner base of petals, and Mr. Meehan would account for this by taking the petal as the analogue of a leaf on an elongated branch, and the stamen as the development of an axial bud to the petal. "Branching and articulated stamens are frequent in those families that have these organs springing as it were from an axial bud at the base of the petal, as in a diminution or suppressed secondary branch we might expect them to do." In illustration of this idea Mr. Meehan refers to the flowers of *Mahernia verticillata*, Cav., a well-known Byttneriaceous plant from the Cape of Good Hope. The genus is separated from *Hermannia* chiefly by a cup-shaped gland at the middle of the stamen. A comparison with the axial development of the inflorescence shows the stamen to be formed on precisely the same plan, Mr. Meehan thinks, as the biflowered peduncle. This latter is simply a diminutive branchlet; after forming one node the longitudinal development becomes nearly arrested, and there is a short pedicel flower, then the bud in the axil of the bracteolate leaflet pushes up and over this, giving rise to the longer-stalked flower. So in the development of the stamen, a bud arises in the axil of a petal, the common peduncle is represented by the filament, and the cup-like gland at the middle stands for the bracteole of the bipedicels. Here one of the flower-buds wholly disappears, the innermost becomes the upper part of the filament, the real node may be at the connective,

<sup>1</sup> *Bacterium rubescens*, Lank.

and then the theoretical floral leaves proceed to form the anther. The incised bract is reduced to the fringed cup-like gland from which the stamen proper springs, and he concludes from a survey of the whole subject that in many cases superimposed stamens are the development of theoretical axial buds at the base of the petals, and not the result of an interposition of an extra whorl of leaves for which there seems no warrant in phyllotaxy. It will be seen that even on this explanation the true stamen is phyllomic; the fact that foliage leaves often have stipules ought not, in a consideration of this interesting subject, to be overlooked. Mr. Meehan's observations may throw some light on the herotaxy of the floral organs.—(*Proc. Acad. Nat. Sci.*, Philadelphia, 1886, p. 9).

**STRUCTURE OF LINGULA PYRAMIDATA.**—From a very important memoir on the structure of this species by Dr. H. G. Beyer, we condense the following. In 1870, when Mr. Dall was studying the species of *Lingula*, he separated those species which he found provided with raised fulcra for the attachment of certain muscles, forming a median septum or one or two divaricating septa on the other valve, and formed for them the genus *Glottidia*. All of the known species (four to six in number) are exclusively to be found in American waters, while not a single species of *Lingula* has been found to occur in America. While the true *Lingulas* are almost always attached to a fixed rock or stone, *Glottidia* attaches itself, if at all, only when adult, and usually to a very small pebble or bit of shell. As to the structure of the shell, the author confirms in great measure the observations of Gratiolet, but describes the cuticle as a thin homogeneous layer, and immediately beneath it, sometimes aggregated in clusters, sometimes arranged in linear series, and at other times again irregularly scattered, he found a series of little round bodies, staining with hæmatoxylin, homogeneous, and without nuclei; these are regarded as homologous if not analogous to the bodies occurring within the organic septa in the shell of the Testicardine Brachiopods. Immediately adjacent to the cuticle and this layer of bodies comes a broad layer of horny substance and internally a thin calcareous layer, and these horny and calcareous layers alternate with each other in a number varying with the age of the animal. Towards the periphery the cuticle and horny layer alone are found, and these join the supporting layer of the mantle margin. A very intimate structural relationship exists between the body-wall, the mantle, and the peduncle. It seems doubtful whether the structures described by Vogt, Owen, Hancock, and others as muscle are in reality muscular in character. All the true muscles are smooth muscle-fibres, but other so-called muscles seem to be rather mesenchymatous supporting substance, lacking contractility, but perhaps possessing elasticity. The author's observations on the vascular system confirm rather the views of Shipley, Schulgin, and Morse than those of Hancock, and no central propelling organ over the posterior slope of the stomach was on transverse sections found. The number and division of the nervous ganglia indicated by Hancock for *Waldheimia* seem to be the same in *Lingula*, though Hancock's views have lately been criticised by Van Bemmelen. Hancock's details as to the reproductive organs are in great measure confirmed. Three excellent plates of anatomical details accompany this memoir.—("Studies from the Biological Laboratory, Johns Hopkins University," vol. iii. No. 5, March 1886.)

**THE CUCKOO.**—In the note on the cuckoo in the *Biological Notes* of April 1 (p. 519, line 6 from bottom), *January* was inadvertently printed for *June*.

#### NOTE ON EARTHQUAKES IN CHINA<sup>1</sup>

I HAD prepared for presentation to the Seismological Society of Japan a tabulated account of earthquakes that have been recorded in Chinese annals for the past thirty-seven centuries, but it was destroyed by fire during a riot last winter, and with the paper were destroyed also the works from which the seismic facts were derived. Perhaps, however, some general remarks which those records suggest may not be devoid of value.

Nothing can be inferred as to the relative frequency and destructiveness of earthquakes in ancient and modern times from Chinese history; from the earliest recorded earthquakes of Mount Tai in Shantung 1831 B.C. to the commencement of the

<sup>1</sup> Communicated to the Seismological Society of Japan by D. J. Macgowan, M.D.

Han dynasty 200 B.C., only twelve are recorded; tradition and written archives noting those only that presented extraordinary features; a bald list merely mentioning a disturbance of the rivers of the I. and Lo Hanan, 1808 B.C.; Wei, Chin, and So in Shensi, 778 B.C.; the formation of long chasms in the loess, 345 and 206 B.C. From the Han period, notices of the phenomena of course increase, accompanied betimes with a few details relating mainly to loss of life, and the succour afforded to survivors. Geographically considered, earthquakes in China may be grouped as insular, littoral, and inland.

On the island of Formosa earthquakes are hardly less frequent than in Japan, while on Hainan they are comparatively of rare occurrence. These islands form a portion of the great volcanic chain that girdles the coast of Eastern Asia; the Chinese portion rises from the submarine plateau that overlooks the profound abyss of the Pacific Ocean.

Insular earthquakes affect the mainland but seldom, and to a slight extent, which is noteworthy from the proximity of Japan, the least stable portion of the earth's surface, which seemed inexplicable until Prof. Milne's statistics showed that a large majority of earthquakes in Japan originated beneath the Pacific.

The absence from Chinese and Korean annals of notices of earthquakes in that peninsula long inclined me to regard Korea as comparatively exempt from seismic action, and recently, I addressed Consul E. H. Parker, of H.B.M.'s service in that country, for information, who obtained from the prefect of Chemulpo a communication on the subject, the purport of which is, that earthquakes are so infrequent and harmless that records are not made of their occurrence. It is more than ten years since an earthquake was experienced in that kingdom, and on that occasion no one was injured, nor were buildings thrown down. No information is obtainable on the subject from Manchuria, where presumably earthquakes are uncommon: there is, however, a record of a volcanic eruption having occurred about a century ago in that portion of the empire.<sup>1</sup>

The only existing volcanic action on islands of this coast is on the north of Formosa, near Keelung, where three solfataras are in ceaseless ebullition, affording large supplies of sulphur, and emitting during earthquakes so much hydro-sulphuric gas as to occasion a degree of *malaise* to the residents, and to discolour the white paint of ships.<sup>2</sup>

Facts respecting Formosan earthquakes are so scanty that the following from a Chinese writer is worth citing. It relates to an earthquake that occurred in Northern Formosa in the fifth month of 1693. "During that month the earth shook without cessation. A tract of country in which three villages were situated caved in; the inhabitants, however, had time to escape." Three years after that submergence, the narrator, a mandarin, who was on his way to procure sulphur from the solfatara "could see in a lakelet, where the water was shallow, tops of bamboos and other trees of those villages. While near the solfatara he heard for a day and night noises that resembled a cataract precipitated from a lofty cliff; the sound seemed to be near and all about, but no evidence of the cause of the noise was discoverable. When, however, he arrived at the solfatara the mystery was explained, he there heard the same sounds like a rushing of subterranean waters."

Another active volcano is named in a Chinese account of Formosa. It is in Têngshan district in the southern portion of the island at Red Hill, near the Tanshin Creek, on a plateau. Probably it has not been in open action since Formosa was opened to trade, as it does not appear to be known to foreigners.

Formosan seismic action occasionally causes tremors to be felt on the mainland, which is due to the ordinary direction of earthquakes on that island, which are generally from south to north or the reverse. The Liuchuan group is the centre of seismic force that does not appear to extend beyond those islands.

Submarine disturbances not unfrequently attend the insular earthquakes; the sea sometimes rises on the Formosan coast sixteen feet above the usual height. Independently of the terre commotions of Formosa, its adjacent waters appear to be subject to submarine agitations occasioning what records of the

<sup>1</sup> Perhaps the following may be explained as a result of volcanic action far distant from Peking. In the month of June, 1465, during a gust of wind at the capital a sound was heard as of hail falling on the ground, when pellets the size of cherries were picked up. On breaking them open they emitted a sulphurous odour. The writer says he could not have regarded such a phenomenon as credible had he not himself witnessed it.

<sup>2</sup> "Head-dizziness" is said to be an occasional accompaniment of earthquakes on the mainland. Slight shocks that occurred at Weichang-November 3, 1885, are described in the *Shen-pau* as exhibiting that phenomenon.

mainland style "third" or supplementary tides; but these are of rare occurrence. The "tide-rips" that have attracted the attention of hydrographers are notable phenomena, but the following, from a local gazetteer, seems to indicate the existence of phenomena that cannot be referred to tidal action:—"Peculiar noises of the sea are sometimes heard which are commonly regarded as indicative of change of weather, sounds from the north foreboding rain, those from the south being followed by wind. Hissing noises are heard, at times they are low, at others loud; when low, they resemble the beating of a drum or the dropping of beans on that instrument; now, the sounds are near; anon, they are distant; stopping suddenly or continuing for hours. When the noise is loud, it is more noisy than the voices of a hundred thousand men, and the sea bubbles up; in very protracted cases the noises continue day and night for half a month; and when of short continuance the sound lasts three or four days. Coast landers err in supposing that these noises have connection with the weather. They are absent during rains and in drought, in winds and in calms. . . . During the sounds, the sea is agitated by fearful billows and furious waves." If that extraordinary seething and roaring of the ocean were synchronous with earthquakes, the fact could not have escaped observation: indubitably that graphic description applies to submarine volcanic action; to which the submarine plateau of eastern Asia is subject, and to which also I attribute the supplementary tides of the adjacent coast. Some thirty years ago an island was thrown up by a submarine volcano on the south of Formosa; the pumice which is cast on the northern shores of that island is evidently a submarine production.<sup>1</sup>

As proximity to the belt of volcanic islands seldom disturbs the mainland of the northern littoral, so the adjacent coast of Southern China and Annam enjoy like exemption from insular throes: Chehkiang and Fuhkien are sometimes slightly visited by Formosan shocks, and even the Canton coast slightly, but Philippine earthquakes never affect Annam.

Earthquakes on the coast of China are frequent, but slight and harmless. Their harmlessness is evinced by the tall slender pagodas that adorn the hills and valleys, and they are generally very limited in area, with great diversity of direction, but a majority being from south-west to north-east.

The southern provinces of China, and yet more Indo-China, appear to be comparatively exempt from earth throes, which, however, may be due to lack of information from those regions, but there is evidently no seismic zone in tropical or sub-tropical eastern Asia such as exists in our mid-latitudes.

The tremors that are experienced in Chehkiang, Kiangsu, and coterminous regions to the west, are sometimes followed by the appearance on the ground of substances that in Chinese books are styled "white hairs." When I first called attention to records of that kind that are found in local gazetteers, I suggested that they might be crystals precipitated by gaseous emissions, such as were once reported as occurring after an earthquake in the south-west of the United States; from later descriptions of these "horsetail-like" substances I incline to the opinion that they are organic, perhaps mycillum.

In the summer of 1878 the vernacular press gave an account of the occurrence of the phenomena at Wusoh, a city on the grand canal, thirty miles north of Suchau. "At noon, June 12th of that year, shocks of an earthquake were experienced, which lasted several minutes (*Sin.* 'for the space of time taken in swallowing half a bowl of rice'); the motion was so great that sitting or standing was difficult, but no harm was done. Two days later at night there was a severer shock, after which, within and without the walls of the city, white hairs resembling a silvery beard, about three inches in length, were found, which boys pulled out of the ground, gathering handfuls in a short space of time." My list of Chinese earthquakes for the past two thousand years having been destroyed by fire I am unable to indicate the regions in which earthquakes were followed by the emission of "hairs," but my impression is that all, or nearly all, are alluvial valleys.

The chief foci of inland earthquakes are Yunnan, Szechuan, Shensi and Kansuh—and less frequently Shansi, Chihli, Shantung, and the central provinces, where they are more violent than in other portions of the empire, and frequently present continuous or protracted action, for example:—

A series of earthquakes occurred at Taiyuan, the capital of Shansi, in 1882, followed by shocks at brief intervals for a year. An earlier series occurred in the province of Chihli; the district

<sup>1</sup> For accounts of the volcanic region of Northern Formosa see Taintor's "Imperial Maritime Customs Report, 1865," and Hancock, 1881.

city Chüchow suffered most, not a house remained standing, many lives were destroyed; frequent shocks occurred for a year after. The province of Szechuan is also liable to continuance of seismic throes, one of these commenced in the fourth month, 1462, and continued eleven months—there were in all 375 shocks.

In the loess formation of Northern China (discovered and described by Baron Richthofen) the land is not unfrequently riven by earthquakes forming long narrow chasms of unknown depth that gradually disappear on account of the vertical cleavage and unstratified nature of loess.

In the first decade of the fourth month, 1828, an earthquake caused a fissure over three miles in length, twenty to thirty feet broad, from which a vapour issued that proved fatal to many: people, animals, houses, and tombs were engulfed. About two months later, during heavy rain, the chasm gradually filled up.

The chief earthquake region of China lies in a great seismic zone, which extends from near the gulf of Chihli to the shores of the Caspian—including Turkestan and the Aralo-Caspian depression. In Eastern Turkestan they present a periodic character (five per annum with remarkable regularity). Yet there are few portions of the world so far removed from active volcanoes. Recent Russian exploration has discovered that the supposed Tienshan volcano is merely a solfatara, or an ignited coal-field.

Observations of officers appointed by the Emperor Chienlung to examine the newly subjugated territory in reference to these "firefields," are several. They say: "Three days travel to the east of Okishu and to the south of the hill at Palikeh there are several firefields. The ground is of a red colour, and a number of variegated stones are piled upon each other in the neighbourhood; from the middle of which flames upward of a foot in height are emitted: they are alternately extinguished and lighted up, while the smell is so strong as to render a near approach to the place impossible. For a distance of about 100 *li* not a blade of grass, not an inch of wood, nor a drop of water can be seen. From the peculiar smell of the fire thus raised, it is imagined that the soil must be strongly impregnated with sulphur."

The same work represents earthquakes as so common in Eastern Turkestan and the desert, that to the inhabitants "they are not considered strong; four or five occur every year; even when violent, they merely cause the doors and windows to rattle, but on account of the firm and adherent character of the soil, and thick walls and light roofs in common use, the houses are never thrown down."

A recent English traveller<sup>1</sup> makes a similar statement respecting Mid-Asian earthquakes generally. At Tashkend they generally average five in a year, but so slight, as not to be noticed by anybody. In that part of the world earthquakes appear to be most frequent at the close season. In the western portion of the seismic zone, they are of greatest frequency and violence in mountain regions.

Anent the opinion of M. Perrey, that a maximum of earthquakes is coincident with the moon's perigee, I submit the following statistical fragment that escaped the loss referred to: it is partially confirmatory of Prof. Milne's observations, that cold weather furnishes the maximum of frequency.

Lists of 738 continental shocks:—

1st month	65	5th month	46	9th month	56
2nd "	82	6th "	63	10th "	43
3rd "	72	7th "	70	11th "	65
4th "	49	8th "	70	12th "	88

(The first day of the first month occurs about February 6th, or at the new moon which falls nearest to the point when the sun is in the fifteenth degree of Aquarius.) In their seismic records the Chinese seldom designate the day of the month (moon) when earthquakes occur. Yet a considerable number may be found. Seventy-two cases show twice as many in the first and second as in the third and fourth quarters of the moon's phases: forty-eight in the former period, and twenty-four in the latter; of that number fifteen occurred at the syzygies. The 6th day shows the largest number, twelve. None took place on the 2nd, 5th, 13th and 14th; one occurred on each of the following, 4th, 7th, 17th, 20th, 22nd, 23rd, 24th, 28th, 29th. Hours are rarely given; so far as they go, they show that a large majority are nocturnal.

<sup>1</sup> Lansdell's "Russian Central Asia," 1885.

### UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—The following list of lectures and classes in Natural Science has been arranged for the summer term:—

*Physics.*—In the Clarendon Laboratory Prof. Clifton lectures on Instruments and Methods employed in the Study of Optics. Practical instruction in Physics is given by the Professor and by Messrs. J. Walker and A. L. Selby. At Christ Church, Mr. Baynes lectures on Electro-Kinematics and Dynamics, and has a class for practical instruction in Electric and Magnetic Measurements. At Balliol Mr. Dixon lectures on Elementary Electricity and Magnetism. At Trinity the new Millard Laboratory will be opened for instruction in Mechanical and Electrical Engineering under Mr. Frederick Smith.

*Chemistry.*—In the Chemical Department of the University Museum Dr. Odling lectures on Some Special Points in Organic Chemistry. Mr. Fisher and Dr. Watts continue their courses on Inorganic and Organic Chemistry respectively. Mr. W. R. Dunstan lectures on Organic and Pharmaceutical Chemistry. Practical instruction is given in the laboratories by Messrs. Fisher, Watts, Baker, and Marsh. At Christ Church Mr. Vernon Harcourt has a class for Quantitative Analysis, and Mr. Dixon for Gas Analysis.

*Animal Morphology.*—In the Morphological Department Prof. Westwood lectures on the Haustellated Orders of Winged Arthropodous Animals. Prof. Moseley lectures on the Mammalia, Mr. Baldwin Spencer on Embryology, and Mr. J. B. Thompson on the Osteology, Distribution, and Odontology of Birds and Mammals. Practical instruction is given by Prof. Moseley and by Messrs. Robertson and Spencer. In Human Anatomy Mr. A. Thomson lectures on the Vascular and Respiratory Systems, and gives demonstrations on Topographical Anatomy. Daily instruction is also given in Practical Anatomy.

*Physiology.*—In the Physiological Department Prof. Burdon Sanderson lectures on the Chemical Processes of the Animal Body, and on Elementary Physiology. Mr. Dixey lectures on Histological Methods. Practical instruction is given daily.

*Botany.*—At the Botanic Garden Prof. Balfour lectures and gives practical instruction in Vegetable Morphology and Physiology. Prof. Gilbert gives four lectures on Rural Economy.

*Anthropology.*—Dr. Tylor lectures on the Origins of Civilisation.

*Geology.*—Prof. Prestwich lectures on the Secondary and Tertiary Series as illustrated by the geology of the neighbourhood of Oxford. Each lecture is followed by a geological excursion.

CAMBRIDGE.—The Special Board for Biology and Geology have recommended the following grants from the Worts Fund: (1) 50*l.* to Mr. W. Bateson, of St. John's College to assist him in investigations into the fauna of lakes in the neighbourhood of the Sea of Aral in 1886, and an additional 50*l.* if he continues his investigations into the summer of 1887. Mr. Bateson's investigations into the development of *Balanoglossus* in the Southern United States have, it is well known, been of great value.

(2) 60*l.* to Mr. A. C. Seward, of St. John's College, to assist him in studying and collecting fossil plants in Belgium and France.

(3) 35*l.* to Mr. Hans Gadow, of King's College, to assist him in exploring the ossiferous caves of Portugal, which he has already partly explored during two former visits. Prof. Boyd Dawkins strongly recommends the continuance of these explorations.

(4) 25*l.* to Mr. C. Potter, of Peterhouse, to assist him in elucidating the life-history of the alga parasitic on the water-tortoise in Portugal.

In the list of lectures issued by the Board of Physics and Chemistry for the present term we note that Dr. Ruhemann, assistant to the Jacksonian Professor, will lecture on Gas Analysis, and also on the Aromatic Bodies. The other chemical courses repeat the usual advanced and elementary courses.

In Advanced Mathematics Mr. Forsyth lectures on Thermodynamics, Mr. Glaisher on Theory of Errors, Mr. Webb on Dynamics of a System. The latter course will be continued during the Long Vacation, when also Prof. Darwin will lecture on the Theory of Attractions, Potential, and Figure of the Earth.

In Geology Prof. Hughes lectures on Stratigraphy and Cam-