

the same Asterophyllites bearing spikes of the type Bruckmannia, Stur, and in such relations that it can only be the offset from a Calamites found lying with it, of which no definition is given, but which has previously been designated *C. sachsisii*, Stur. From this Stur draws the following conclusions:—1. Sphenophyllum is a branch of Asterophyllites. (2) Both Sphenophyllum and Asterophyllites are branches of a Calamites. (3) Sphenophyllum is not a distinct botanical genus, but the Macrosporophorous branch of an Asterophyllites—that is of a Calamites. This, if correct, would be one of the most remarkable results in Palaeophytology. A Calamites bearing not only twigs, ascribed hitherto to different genera, but to such different fructifications! and besides, we have the incompatibility in the anatomical structure of the stems of Calamites and Sphenophyllum, to which Williamson's remarks are directed. It is not every one that can step so lightly over these difficulties in order to unite the three genera into one. Some grounds, one would think, are still left, not only to indicate, but to compel the separation of these genera, and even to warrant their location in different families, and to call for caution in the interpretation of such facts as the above. To estimate the importance of these facts, we will call attention to the present state of the question.

The widespread genus Calamites, whose structure has been elucidated by Williamson and others, is now almost universally associated with Equisetum in the group Calamariæ, while, as is known, Sphenophyllum has been repeatedly classed with Lycopodiaceæ within the last few years. Williamson insists on the anatomical incompatibility between Calamites and Sphenophyllum (with which he includes Asterophyllites) as brought out by his own microscopical researches; and indeed all previous investigations in botany would protest against the insertion of twigs with the structure of Sphenophyllum on stems or branches, with the structure of Calamites. They possess, in common, only the external characters of the transverse segmentation of the stem, and the conformity of the separate internodes; but this conformity of segmentation is the chief ground for Stur's view, that all such genera as Annularia, Asterophyllites, and now also Sphenophyllum, pass into Calamites. Many stems, such as that bearing *Stachannularia tuberculata* (see my Carboniferous Calamites in *Abhandl. zur geolog. Specialkarte von Preussen*, Band ii. Heft i., Taf. ii. Fig. 1), are Calamites in his eyes, which others do not recognise as such, and he will not allow of any [systematic] severance of a section of the Calamarioid stems from Calamites proper. Hence it is that from Calamites, Stur, most divers things ramify.

In the second point of importance, however, the close conformity of Asterophyllites and Sphenophyllum, Williamson agrees with Stur. According to him, either the two genera have altogether the same anatomical structure, or, at least, there are plants resembling the former having the stem-structure of the latter. Renault, on the contrary, is convinced that some of Williamson's preparations really belong to Sphenophyllum, agreeing with the fragments from Autun and St. Etienne investigated by himself.¹ The twigs which show Calamite structure are referred by Williamson to Calamites, and appear to be those which, without a knowledge of their internal structure, would be placed in Asterophyllites. These would come under Calamocladus of Schimper, whilst Williamson's Asterophyllites appear to be next related to Sphenophyllum.

These two forms agree so closely in the external characters of their sterile parts as to be undistinguishable without microscopic investigation; so that one is inclined to leave them together under the old provisional generic name of Asterophyllites, despite their probable essential difference. That section of Asterophyllites which shows the same stem-structure as Sphenophyllum may be allowed to be closely allied thereto, and, in some cases, even to belong to the same individual as Stur's discovery would indicate. It is possible that in well preserved fossils we may still find some single [external] character, which will distinguish this section of Asterophyllites from those which approach Calamites. It would lie in the decided trimery of the leaves in the verticils of the former (when regularly developed), corresponding with the triangular bundle of the axis, from the angles of which the vessels of the leaf spring. The difference of leaf-form as an absolute character, separating Asterophyllites and Sphenophyllum must now be given up.

From the botanist's point of view there is another very im-

¹ On this point M. Renault is mistaken; they differ in the chief features which distinguish Sphenophyllum from Asterophyllites, viz., in the number and shape of the leaves and in the number of the separate vascular bundles given off to these leaves.—W. C. W.

portant ordinal or generic distinction, to be found in the fructification. Every one must be astonished at Stur's pointing out both Bruckmannia and Volkmannia spikes on his plant. By the former he means Calamarioid spikes with sporangiophores and sporangia between pairs of approximated verticils of Bracts (*Calamostachys*, Auct.). By the latter, spikes with sporangiophores and the sporangia axillary (*Palæostachya*, Weiss.) Whether these two arrangements are really present here is not yet clearly shown; at least, in answer to my inquiries, Stur gives no definite information on that point, but refers to the forthcoming fuller memoir which he promises. Hence it is still an open question whether the arrangement is not that hitherto alone recognised as that of Sphenophyllum—that is, sporangia without sporangiophores, sessile in or near the axils of the leaves. This mode of attachment may certainly also be concluded from Renault's last excellent communication ("Nouvelles Recherches sur la Structure des Sphenophyllum," *Ann. d. Sc. Nat. Bot.*, 1877). My own observations on a beautiful spike from Wettin, give the same result.

But it must also be borne in mind that those spikes to which I have thought right to restrict the name Volkmannia, which in all probability belong to twigs with the foliage of Asterophyllites, have the same sessile, axillary sporangia, so far as can be determined. If this be correct, however, there can be no difficulty from this point of view in uniting these Volkmanniæ (not Sturs, which belong to *Palæostachya*) with the spikes of Sphenophyllum into a single group. This is a further corroboration of my formerly expressed conclusion, that the two form a group which must be removed from the Calamariæ.

On summing up the results of these critical comparisons, we find (what has not yet been thoroughly contradicted) that Sphenophyllum may be grouped under Lycopodiaceæ, anatomical structure and fructification alike removing it from Calamariæ. Only it becomes more and more impossible to dispute that the convenient generic names Calamites, Asterophyllites, &c., are purely provisional—unfitted, it is true, to show the real relations of the plants that bear them, but indispensable, in the great majority of cases, where the material is insufficient for complete investigation, important though it be. Plants with stems and leaves of undistinguishable appearance, especially in the ordinary state of preservation, but with such different fructifications as *Calamostachys* and *Palæostachya*, for instance, must retain their autonomy, and Sphenophyllum still more so. It is not every arboresecent Calamarioid stem, not every so-called Calamites that belongs to this botanical genus. It has now become very evident that what has been hitherto termed Asterophyllites, comprises plants of several groups; yet *Cingularia* and *Bowmannites* had already been distinguished, though they both possessed the stem of Asterophyllites, as regards external structure and foliation. We see that the practical difficulties in the distinction and nomenclature of fossils are augmented; but this lies in the very nature of the case. It is thus unnecessary to doubt the co-existence of Asterophyllites and Sphenophyllum twigs on one plant, as Stur has observed, without going on to admit his conclusions that Asterophyllites, as a whole, is identical with Sphenophyllum, and that both are Calamites. If the spikes cited are really *Calamostachys* (*Bruckmannia*, Stur) and *Palæostachya* (*Volkmannia*, Stur), this would show the distinctness of the fossils regarded by him as identical. Renault has found both macrosporangia and microsporangia on the same spike of Sphenophyllum; this tells against the view that Volkmannia, Stur (that is, in this case, the Sphenophyllum spike) is the female, and *Bruckmannia*, Stur, the male fruiting spike of one and the same plant. It will be seen how desirable it is to have further cautious investigation and careful publication upon the interesting find on which we are to base such far-reaching conclusions as those which Stur has lately drawn.

ANTHROPOLOGICAL INQUIRY IN FRANCE

THE published reports of the proceedings of the Société d'Anthropologie of Paris, for the year ending in the autumn of 1878, testify as usual to the diligence and zeal of a large number of its members. Limiting ourselves to the notice of papers which deal with questions of French local palæontology and sociology, we will begin our *résumé* by drawing attention to the interesting labours of M. Prunières, who has laid before the Society the result of several years' exploration of the Beaumes-Chaudes caverns in Lozère, the largest prehistoric ossuary yet brought to light. Here he recovered the remains of

300 individuals, besides a mass of more than 200,000 fragmentary pieces. These human bones were white, showing no trace of the action of fire, although charred animal bones and broken pottery were found near them, the whole being embedded in stalagmite and stalactite as hard as marble. The dolichocephalic crania, protruding jaws, and flat tibiae, showed a close affinity to the Cro-Magnon and l'Homme-mort remains; and M. Prunières is of opinion, that at Beaumes-Chaudes we have evidence of the existence of a race differing essentially from those which have occupied France in modern times, and even from the pre-historic men of the neighbouring dolmens of Lozère. In the latter, and in the dolmen founders of western France generally, he recognises the more civilised agricultural race which waged war against the ruder cave-men, and finally exterminated them. And he believes we have indisputable evidence of this conflict of races in the fact, that while several of the Beaumes-Chaudes bones were found to have slender flints impacted in them of the kind discovered in the dolmens, and differing wholly from the flint arrow heads characteristic of the cave-men, only a few of the same form of silex were found lying loose in the débris, and these he thinks we may fairly assume to have become detached in the process of decomposition from the softer tissues of the body, in which they had been arrested. Some of the crania exhibited a hitherto unnoticed form of double-trepanning of the right and left parietals, whose different cicatrices appeared to show that a considerable interval had elapsed between the first and second operation, which probably was the pre-historic surgical remedy for convulsions, and all affections included in later ages under the term "possession."

At Cravanche, near Belfort, a somewhat similar mortuary cavern has been examined by M. Bernard. Here the seven nearly perfect crania, extricated from an enormous mass of human bones, were all remarkable for their large cubic capacity (1680 centims.), the vertical index being 70, and the cephalic index 72. No iron or bronze implements were found, but numerous flints and serpentine rings were obtained. M. Leguay has done much to settle the question of the implements with which pre-historic men cut and carved schist and bone objects, by his successful imitation of a schist amulet, found by M. Rivière 24 feet below the floor of the Mentone caverns. In the fabrication of this spurious antique, M. Leguay used some of the flint knives so common in pre-historic caverns, which are blunt at the extremity, and curved towards the middle; with these he was able after a little practice to effect all the graving and cutting required to produce exact facsimiles of the pre-historic originals, and he believes, that wherever we find an excessive accumulation of flint-splints and fragments we have evidence of being on the site of a work-place or factory, rather than that of an ordinary primeval dwelling. It should be observed that M. Broca has used a cave-silex in trepanning a dog, which recovered with less than ordinary inconvenience from the operation. The neighbourhood of Luchon in the French Pyrenees has long been recognised by geologists as an admirable locality for the study of glacial action, evidences of which abound in the moraines and huge erratic boulders which cover the southern flank of Mont Espiaup, and block up the valley of the Oô; but it is only within the last few years that French archæologists have directed their attention to the innumerable megalithic remains which occur in the district, and which, as in other parts of the Pyrenean range, still maintain some of their ancient sanctity in the eyes of the peasantry. These remains have now been carefully studied by MM. Piette and Sacaze, the results of whose most important investigations were given in detail in a paper printed in *Bulletin d'Anthropologie*, tome 12, série 2, 1877. From these and subsequent researches, it would appear that the megalithic circles and rows have generally been made to follow the direction of the granite boulders, smaller stones having been used to complete the desired outlines. Under the cromlechs and within the stone circles numerous urns were found, containing for the most part only ashes; but in one instance, two bronze armlets, nearly identical with those of the Swiss lake dwellings, were discovered. Local tradition and still existing practices warrant the assumption that the so-called fire-stones—menhirs—were long associated with fire-worship; while the form of certain stones, which in defiance of the clergy continue to be made the centres of various local games and dances, together with the character of the mysterious and hidden ceremonials which are practised in relation to them, as clearly point to a not wholly eradicated observance of phallic rites. Near Maintenon, M. Lamy has succeeded in proving the existence of menhirs and dolmens, and

has opened a burial chamber in which, besides two adults, he found a child's skeleton standing upright in the grave.

The attention of several members of the Society has been directed to the improvement of instruments for the attainment of reliable craniometrical determinations; and among these the double graduated square, invented and used by Dr. Harmand during his extensive travels in India and China, and the portable cephalometer, specially designed by Dr. Le Bon for the correct measurement of the vertical height of the head, appear to have met with the greatest approval. The former is described at length in the tome 12, sér. 2 (1877), and the latter in tome 1, sér. 3 (1878) of the *Bulletin d'Anthropologie*. M. Broca has drawn attention to the injurious action of alcohol on the preservation of crania, and recommends the use of nitric acid, followed by immersion in glycerine before the varnish is applied. M. Personne on the other hand prefers the use of chloral, under the action of which he has found that the cranial bones contract, and become as hard as wood. Much interest has been excited in the Society by the report of M. Thulié, on the appearance of the brain of M. Asseline, one of its members who had belonged, like many of his anthropological confrères, to the Société d'Autopsie mutuelle. M. Asseline died in 1878, at the age of 49. He was a republican and a materialist; was possessed of enormous capacity for work, great faculty of mental assimilation, and an extraordinarily retentive memory; and had a gentle benevolent disposition, keen susceptibilities, refined taste and subtle wit. As a writer he had always displayed great learning, unusual force of style and elegance of diction, and in his intercourse with others he had been unassuming, sensitive, and even timid. Yet the autopsy showed such coarseness and thickness of the convolutions that M. Broca pronounced them to be characteristic of an inferior brain. The fossa or depressions, regarded by Gratiolet as a simian character, and as a sign of cerebral inferiority, which are often found in women, and in some men of undoubted intellectual inferiority, were very much marked, especially on the left parieto-occipital. But the cranial bones were at some points so thin as to be translucent; the cerebral depressions were deeply marked, the frontal suture was not wholly ossified, a decided degree of asymmetry was manifested in the greater prominence of the right frontal, while, moreover, the brain weighed 1,468 grammes, *i.e.* about 60 grains above the average given by M. Broca for M. Asseline's age. The apparent contradictions between the weight of the brain and the great development of the anterior parts on the one hand, and the marked character of the parieto-occipital depressions on the other, attracted much attention, and the members of the Société d'Anthropologie have been earnestly invited by M. Hovelacque, in furtherance of science, to join the Société d'Autopsie, to which anthropology is already indebted for many highly important observations. This Society is forming a collection of photographs of its members which are taken in accordance with certain fixed rules.

M. Chervin has drawn attention to the frequency of stammering in the south of France, where from 12 to 13 cases are noted for every 1,000, while in the eastern departments the proportion is only 1 for every 1,000. It has been assumed that the defect was in many cases simulated to avoid the conscription; but according to the Abbé Petitot, there are two districts in the Bouches-du-Rhône, where all the inhabitants (15,000), stammer. This he ascribes to long continued inter-marriages among the communities, and to a consequent degeneracy of the race; and M. Chervin is of opinion that meningitis, induced by the great solar heat, which occasions so high an infantile mortality in this region, may possibly, when not fatal, leave an exceptionally great tendency to stammering.

M. Broca, with his usual diligence, has continued to work out his system of *cerebral topography* in man and in the lower animals; and he has lately presented the society with a large number of cranial moulds, on which every convolution, lobe, or other part, is distinctly marked by different colours, in accordance with sex, age, and race. M. Broca has also made the difference of position of the occipital foramen in man and animals the subject of two interesting papers, the former of which was laid before the society in May, 1877. Following up the investigations of Daubenton, who, as early as 1764 made this a subject of inquiry, M. Broca, after a long course of determinations which he gives in detail, has summed up the results of his labours in the proposition that while in all animals but man the orbito-occipital angle is *constantly positive*, in man it is almost always

negative. It is invariably so in European races, where the differences oscillate between -5° and -39° . In the inferior races it may amount to $+5^{\circ}$; in adult anthropoids on the other hand, the minimum is found as high as $+32$, while in some gorillas it amounted to $+45$. In women the orbito-basilar angle is habitually from 2 to 3 degrees less than in men.

The decrease in the population of France still continues to excite much speculation. In tome 12, sér. 2, of the *Bulletins* will be found a suggestive paper by M. Després, on the relation between the birth-rate of a country and its enforcement of restrictive enactments intended to diminish the result of public immorality. In comparing Belgium with France a difficult question suggests itself in the fact, that while both countries are under sanitary official supervision, and Belgium next to France has the lowest birth-rate, it has 279 legitimate births against every thousand married women between the ages of 15 and 50, although France has only 174 in the 1,000. The latter has, however, the large number of 140 married women of those ages in every 1,000, while the former has only 105 in the 1,000. In England, on the other hand, before the enactment of any sanitary restrictions, 248 legitimate births were registered for every 1,000 married women of the given ages, (the proportion of married women from 15 to 50 being 133 in the 1,000). But while in this country 120 for every 1,000 men marry between the age of 20 and 25, in Belgium only 33, and in France not quite that number, out of every 1,000 men marry at the same age. This later marriage of the men M. Després regards as an important factor in the lowness of the French birth-rate.

VOLCANIC PHENOMENA AND EARTH-QUAKES DURING 1878

THE statistical review of volcanic phenomena during 1878, which Prof. Fuchs has recently published, and which forms the continuation of many previous statistical accounts of the same nature (see *NATURE*, vol. xv. p. 557, and vol. xviii. p. 241) shows the unusually large number of twelve eruptions in the course of the year. Most of them occurred in remote localities and gave evidence of the activity of volcanoes which were generally but little known, and which are all difficult of access. It is true, however, that Mount Vesuvius also, the last eruption of which had taken place in 1872, but which already during 1877 had shown symptoms of the re-awakening of the volcanic process, again entered into a period of activity on April 20, 1878. The mountain ejected ashes, frequent slight shocks occurred, a thick column of smoke ascended, and at the end of September a scanty flow of lava took place. This increased during the night of September 22-23 and the lava descended as far as the Atrio del Cavallo; but afterwards the volcanic activity sank down into the ordinary solfatara state, which was only interrupted by little periodical explosions on October 11, and by the flow of little streams of lava from November 1 to November 9.

At the southern point of South America active and hitherto unknown volcanoes were repeatedly seen by passing ships, viz. on January 10 and 18; one of them is situated upon the middle island in the English Narrows, the other on the South American continent in about $48^{\circ} 56'$ lat. S.; this one was conspicuous by a majestic column of smoke, ejected from a high snow-clad mountain, and rising to a height of some 300 metres.

At the same time a great eruption occurred in the island of Tanna, the well-known and very active volcanic island in the archipelago of the New Hebrides. On January 10, at 10 a.m., between the so-called Sulphur Bay and the old crater, a new eruption cone formed; the outbreak was accompanied by a mighty tidal wave which inundated a great part of the island. In spite of its violence the eruption lasted only a short time, but on February 4, a second outbreak followed which also did great damage.

Simultaneously yet another eruption happened. Its seat was the large island of Birara, in the group of New Britain. The northern part of the island was completely devastated, and its coasts rendered inaccessible through enormous masses of pumice stone, which covered the sea for many miles. Formerly, no volcano had been known there. We have repeatedly referred to the masses of floating pumice stone in the vicinity of the Solomon Islands, through which, as Captain Harrington reported, ships had to force their way for two or three days. It is very probable that this pumice stone originated from the eruption on Birara, and not from some submarine eruption, as was generally supposed at the time of the occurrence. It is true that there are two volcanoes in the Solomon Islands, the Semoya and the

Lamat upon the island of Guadalcanar, but from neither were any eruptions reported during 1878.

The third eruption of February, took place from the volcano Isluga in South America (lat. $19^{\circ} 10'$, S), which mountain had been inactive since 1869. The outbreak was accompanied by a fearful earthquake, and so great were the masses of lava ejected that the villages of Cariquima, Carima, Sotoca, and Chiapa, all situated at more than five leagues' distance from the volcano, were completely destroyed by the incandescent streams.

Smaller volcanic eruptions occurred from Mount Hecla (from February 27, to the end of March), from the Asamayama in Japan, from the Cotopaxi near Quito (in October), from the Tepaco, the Sitna, and the Isalco in San Salvador. The eruptions in the Aleutian and Society Islands were of greater importance. In the volcanic series of the Aleutian islands, the volcanoes on Amukta, Tscheguluk, and the Vsevidok volcano (almost 2,800 metres high) on Umnak were in eruption. In the Society Islands, according to the report of Captain Evers, the islands of Raiatea, and Borabora were completely devastated by the action of volcanoes.

At the end of the list of lava-eruptions Dr. Fuchs records the great mud-eruption of one of the well-known mud-volcanoes near Paternò in Sicily. After repeated shocks of earthquake in the province of Catania spreading over two months, this eruption began on December 10, numerous craters ejecting streams of mud with great noise. Several of these craters were continuously active, as the mud was of little consistency, and freely permitted the ascending gases to escape. The others had explosions from time to time, as the crater basin was filled with much thicker mud, which prevented the gases from passing upwards until their tension was sufficiently high, and they ejected the mud in high rays. At the end of the year this mud-eruption was still progressing with unabated force.

The number of earthquakes reported during 1878 amounts to 103. But amongst these there are many complete earthquake-periods during which shocks and oscillations lasted with short intervals for hours, days, and even for several weeks in the same locality. If we would or could count all the separate shocks which occurred, a very high total would be reached. Thus in the comparatively unimportant earthquake of Zengg twenty shocks were counted, and in the great earthquake of Terapaca in the night of January 23 no less than forty shocks, while the oscillations lasted here almost without interruption until April 12. An earthquake on the island of Tanna (New Hebrides) lasted for four weeks, and in the province of Catania the oscillations succeeded each other almost without interruption from October 4 to November 19.

The earthquakes were most frequent in winter and autumn, thirty-nine occurring in winter, twenty-six in autumn, and nineteen each in summer and spring.

The most violent and most destructive of all these phenomena happened on January 23 in that district of Peru and Bolivia in which the terrible earthquake of 1868 took place. The province of Terapaca suffered more than any other. Here, with the earthquake of May 9, 1877, which in violence was hardly surpassed by that of 1868, a great and considerably extended period of frequently-recurring oscillations had begun, amongst which the earthquake of January 23, 1878, was prominent by its particular force. At Iquique it began at 7.55 P.M., and the shocks continued during the whole night. As usual, the subsequent tidal-wave did still greater damage than the earthquake itself, and this was particularly the case at Arequipa, Pica, Mantilla, Pisuqua, Arica, and Terapaca.

The earthquake on October 2, in the southern part of the republic of San Salvador, was also very violent. In the town of Incupa almost all the houses were destroyed, and many of the inhabitants perished. In the vicinity a number of villages disappeared entirely. The motion of the soil was first undulatory and ended with a terrible shock.

Of European earthquakes the following must be mentioned specially:—

On January 28, about noon, an earthquake shook the north-western part of France and the south of England. It was particularly distinct in Normandy, at Rouen, Havre, and Dieppe. Even in Paris the shock was so considerable that several houses were endangered. In England it occurred between 11.45 and 11.50 A.M., and was observed at Greenwich, London, Brighton, Southampton, Cowes, and several other places.

Repeatedly shocks were felt in north-western Switzerland and at the south-west corner of the Black Forest. The first and more marked phenomenon happened on January 16, and con-