NOTICES OF MEMOIRS.

I.—British Association for the Advancement of Science. London, July 6, 1917.

Address to the Conference of Delegates. By John Hopkinson, F.L.S., F.G.S., F.Z.S., Assoc. Inst. C.E., President.

The Work and Aims of our Corresponding Societies.

IT is nearly forty years since I suggested that the Delegates from provincial societies should hold a Conference at each meeting of the British Association, subsequently arranging for the first Conference to be held at Swansea in 1880. Although sanctioned by the Council of the Association it was not an official Conference, being the first of five managed and supported financially by the Delegates only. Having then been in the chair I accept with the greater satisfaction after so many years the honour conferred upon me to preside at the present Conference.

At the Conference held at Swansea in 1880 the following resolution was passed: "That this Conference recommends that at future meetings of the British Association the delegates from the various scientific societies should meet with the view of promoting the best interests of the Association and of the several societies represented." With this end in view it seems to me that Mr. Symons' address was particularly appropriate, for it is surely in the best interests of the Association as well as of its Corresponding Societies that concerted systematic work should be done.

The main object of our Societies is, or should be, to undertake local scientific investigation, and we are here assembled chiefly to discuss the best means of doing so and of obtaining the most valuable results. While all should work to the same end, that end, whatever it may be, can best be achieved by all working in the same manner, or at least on some definite plan, so that the results may be comparable.

It is not, however, to stimulate and direct scientific investigation only that this Conference should aim; there is also for it the wider field of influencing public opinion on the importance of far greater attention than at present being given to scientific education and to many problems concerned with the future welfare of our nation in which science may lend a fostering hand. There is no other country in the world which has nearly so many scientific societies as we have. There are on our list 120 Corresponding Societies (ninety Affiliated and thirty Associated) with an aggregate membership exceeding 46,000, subject to a slight reduction, as some of these societies are represented individually as well as by the Union to which they belong, and some have members who are also members of other societies on our list, but we may, I think, estimate the number of individual members represented as not less than 45,000, while Principal Griffiths, in his address at our Cambridge Conference, in 1904, estimated the total number of scientific societies in the kingdom as about 500 with a membership approaching 100,000. If we could all agree upon some beneficial project what an immense influence we might have! . . .

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For Section C, Geology, much good work has been done by the Corresponding Societies, especially for the Committee on Geological Photographs, which was formed by the joint action of the Section and the Conference of Delegates at the Bath meeting in 1888. The photographs (a very large number) are deposited in the Geological Museum in Jermyn Street, where they may be seen; also numerous lantern slides which are lent for lectures. The Committee is still in existence and photographs are acceptable.

Other important geological subjects which have been brought before our Conference are earth-tremors, underground water, and coast-erosion, in the investigation of one or other of which all our Corresponding Societies may help.

The subjects embraced in Section D, Zoology, are by far the most attractive to members of our natural history societies, to whom we owe nearly all our knowledge of the distribution of animal life in the British Isles, far more perhaps of that of the Invertebrata than that of the Vertebrata, about which much was known in very early days. It should be the aim of all such societies to compile and publish lists of the animals inhabiting their areas, recording their localities, carefully noting their habitats, and studying their habits and life-histories. Increasing attention is being paid to our Invertebrate fauna, but there is still very much to be done, especially in the collection and study of the microscopic forms of life in our rivers, lakes, ponds, and ditches, on our stately trees and humble mosses, and even in our soils. Almost every tuft of moist moss teems with animal life which will well repay microscopic examination.

There is another aspect of the subject which has frequently been brought before us, that is the preservation of our native fauna. In endeavouring to prevent the destruction of rare animals or of those approaching extinction all may help. We cannot well make sure of the presence of a rare moth or butterfly without capturing it, but there is never need to take a large series, as is the practice of some entomologists. With birds and mammals it is different; they can mostly be identified by the practised naturalist without shooting them. There are birds, such as the rook and the wood-pigeon, which should be reduced in number, as they are so destructive to our field and garden crops, but such birds as hawks and owls, which are persecuted by gamekeepers, are our farmers' best friends, and their extermination ought not to be allowed. The same may be said of all insectivorous birds. Hawks may occasionally kill a partridge or even a pheasant, the beautiful kingfisher may take a few fish, but the food of the owls, with the exception of a few rare species such as the eagle owl and the snowy owl, consist almost entirely of small rodents.[1] With regard to the species which should be protected, the ornithologists in a natural history society can render County Councils valuable help. An order for the protection of certain birds was

[1] Taken out of a barn-owl's tree at Keswick in Norfolk in April, 1911, were 114 "pellets" containing the skulls of 19 very small rats, 126 long- and short-tailed field-mice, 69 shrews, and 3 small birds (perhaps greenfinches), but no game.

issued by the Hertfordshire County Council in 1895 on the representation of the Hertfordshire Natural History Society, the schedule being drawn up by ornithological members of the Society and accepted by the County Council. . . .

The subject of Museums comes, I think, most appropriately under this Section, for they are of very great educational value. One of the most important committees of the Association was that appointed in 1886, by the co-operation of Sections C and D and the Conference of Delegates, for the purpose of preparing a report on the provincial museums of the United Kingdom. The Committee was very expeditious, thanks to the energy of its Secretary, Mr. F. T. Mott, presenting in the following year a valuable report which appeared in the Report of the Association for 1887 (pp. 97–130) and a further report the next year (Report for 1888, pp. 124–32). In the first report there are tables (I) giving particulars of 211 provincial museums under headings extending across two pages, (II) an approximate estimate of the number of specimens contained in these museums, and (III) a list of collections of special interest indicating the museums in which they are preserved. A large portion of this report is occupied with "Discussion of Details" under thirty-six heads. The second report considers "the ideal to which provincial museums should endeavour to attain", and suggests "practical methods for approaching that ideal". It is not too much to say that these reports are invaluable, not only to those who have the management of museums, but also to all scientific workers who wish to know where, apart from our national museums, the materials for study in their own branch of science are to be found.

The Hertfordshire County Museum at St. Albans—the only one with which I am connected—was not then founded, but I may mention that it is visited largely by children from the Board Schools in the neighbourhood, who take an intelligent interest in the exhibits, quickly find out accessions, and collect and bring to the Curator objects they wish to know the names of, presenting to the Museum any worthy of acceptance. To young children there is one drawback in a museum, which has been felt at St. Albans: they wish to handle the specimens, rightly judging that by so doing they can learn more about them than by merely looking at them. Every museum should, if possible, have duplicates of the commoner objects, accurately named, to lend to schools. . . .

In walking over the Welsh hills I have repeatedly come across roots and stumps of trees in the peat-mosses which frequently cover them; they are evidences of former forests. The land is worthless except for the value of the peat, the removal of which would, for its valuable products, not only as a fuel, well repay the expense, and the ground would be rendered suitable for planting coniferous trees. It is true that most of our peat-covered mountain-land is above the elevation at which it is generally considered that trees will flourish (1,500 feet), but if they did so in the past there seems no reason why they should not do so in the future, for it is far more likely that our climate has become warmer since trees grew on that land than it is that it has become colder. We have also large areas of waste land at lower elevations, extensive slopes which are too steep for ordinary cultivation between, and on sheep-farms much very poor grazing-land which would be more profitably used in growing timber. As to the best trees to be planted at different elevations and on different soils, at least by private landowners, no doubt there are many botanists in our societies who could greatly help with their advice. In the last half-century we have doubled our imports of timber and now do not produce more than a tenth part of our requirements, although our climate is admirably suited to the production of nearly the whole.

We are far behind most European countries in the relative area of our timbered land. For instance, nearly half the area of Russia and of the Scandinavian countries is wooded, about 26 per cent of the area of Germany, about 17 per cent of that of France, and the same of Belgium, the most densely populated country in Europe until its devastation and depopulation by the Germans, but only about 4 per cent of the area of the United Kingdom, which will probably be reduced owing to the requirements of our war to not more than 2 or 3 per cent.

Next to fostering agriculture let it be your aim, individually as well as collectively in your capacity as members of societies working in harmonious co-operation, to promote to the best of your ability the re-afforestation of our country. By encouraging these two industries you will help to secure its future safety and prosperity.

II.—Report on the Tungsten Deposits of Essexvale, Umzingwane District.[1] By A. E. V. Zealley, A.R.C.S., Geologist to the Southern Rhodesia Geological Survey.

There seems to be general opinion that the tungsten deposits at Essexvale consist only of so-called alluvial or rubble wolframite, and that reefs have not been found. This is not true. Some reefs have long been known, and the excavation of the rubble has led to the uncovering of others, which, so far as can be judged without actual sampling and development, offer good prospects for mining. But hitherto there has been a strange reluctance to undertake mining operations on the reefs, whilst the work on the rubble has been largely desultory.

Position.—The known tungsten reefs lie within an east and west rectangular block of country of about 9½ square miles area lying immediately to the north of Essexvale Siding and mainly west of the railway. The reefs extend from the neighbourhood of "The Ranche" (2¾ miles north-west of the Siding) to the Native Church (1½ miles north-east of the Siding). Sixteen distinct reefs are known, eleven of which have had a little work done on them from time to time.

History.—The deposits were first prospected in 1906. In the ensuing two years a fair amount of ore was produced, but in 1909 the production ceased. A little interest was again taken in the deposits in 1912–13, but there was no production in 1914–15. At

[1] Reprinted from the *Bulawayo Chronicle* of May 18, 1917.

the end of that period a local syndicate extensively sampled some thousands of tons of rubble and made trial crushings. The grade was found to be just too low for profitable working by the methods then employed. During 1916, however, determined efforts have been made by other workers to test the rubble of two restricted areas.

Altogether about 85 tons of concentrate valued at £7,165 has been marketed. The returns for 1916 are 2½ tons valued at £467. This was produced by one worker with a few natives in a five-foot rotary diamond washer, and by one man on another claim who hand-picked rubble and recovered 1,600 lb. of wolframite.

The prospecting done on a few reefs that have been opened has nowhere been for more than a few feet below the surface. This may be due chiefly to the fact that the deposit upon which serious prospecting work has been undertaken is from its nature the least likely to prove profitable.

Geology.—The known tungsten-bearing tract of country occupies the central portion of an irregularly oval mass of granite about 8 miles long and 5 miles across at the widest part. The long axis of the mass trends north-west to south-east. This granite body forms the floor of a wide depression which is traversed by two permanently flowing streams, one of which is known as Fern Spruit. The granite appears to pass beneath the surrounding rim of epidiorite and felsite hills. The soil is a pale-red sandy loam. There are very few exposures excepting in the streams and an occasional small but bold granite kopje. The granite almost wherever seen is coarse-textured and massive, that is, not schistose. It is a hornblende granite, and is thus different from the large granite masses of Rhodesia. Patches of epidiorite, probably inclusions of country rock, and dykes and other bodies of felsite are occasionally encountered, particularly near the eastern edge.

The Reefs.—The tungsten reefs consist of *greisen* composed chiefly of a soft greenish-yellow mica or of mica, fluorspar, topaz, and secondary felspar. This rock weathers soft and rusty brown. The greisen has arisen by the action of vapours on a porphyry or aplite (fine-textured white granite free from hornblende and mica). With the greisen of each reef is a variable amount of rather white glassy quartz forming strings or large lenses in the greisen, and evidently connected with the greisenization, that is, deposited at the same time and by the same agency as the mica, fluorspar, topaz, tourmaline, chlorite, wolframite, and scheelite of the greisen.

The constant presence of the quartz lenses as part of the greisen bodies is a great help in recognizing the presence of the greisen. Those parts of the greisen which contain little or no quartz very rarely crop out, and thus may easily escape discovery. No tungsten reefs have been found without the quartz, although it is quite conceivable that such exist.

The quartz strings expand into lenses exceeding 20 feet in width, and thus make low hillocks such as those at "The Ranche" homestead; again two-thirds of a mile to the south-east of this, and at the Native Church a mile and a half north-east of Essexvale Siding.

The reefs vary from 200 yards to about a mile long. The two most promising reefs exposed are respectively about a mile long and half a mile long so far as proved. These are the Rhoda reef in the north-eastern portion of Plot 27, and the reef running through the Lunar and Moon blocks near the common boundary of Plots 37 and 38.

With one exception the reefs examined strike east to west and dip north at angles varying between 30° and 55°. The reef on Plot 4 strikes north-west to south-east and dips north-east at 53°.

The width of the reefs is of course variable owing to the lenses of quartz. Apart from the quartz lenses, the width averages three feet, and is surprisingly constant.

In each instance the country is coarse massive hornblende granite without signs of shearing or faulting between the reef and the country. It appears, therefore, that the aplite was injected along master joint planes caused by the contraction of the granite on consolidating, and not in fissures caused by faulting. This may have an important bearing on the persistence of the greisen bodies below the surface. In a few instances the mica greisen has a slightly schistose appearance. In a few places greisenization of the country is suspected, but this is on a small scale only, and no tungsten ore has been discovered in it.

With the exception of the Union Jack reef in the north-west corner of Essexvale Reserve the aplite has been completely greisenized so far as can be judged by the small amount of reef exposed. At the Union Jack the intrusion exceeds six feet in width, but about a third of it consists of white aplite apparently ungreisenized.

Stockwork Deposit.—The block upon which most work has been done differs from the above blocks, which may be taken to be normal. The occurrence in question is situated on Tungsten Kopje, a prominent hill of massive hornblende granite with a low ridge extending about 300 yards to the east and a longer one to the west.

The fact that a large amount of float wolframite occurred immediately around the hill led to prospecting on the hill, with the result that a stockwork deposit was discovered extending along the eastern and western ridges and on the north flank of the hill.

Throughout the massive hornblende granite of this zone streaks and seams of aplite containing gashes of quartz are scattered rather sparsely and quite indiscriminately. These seams run in all directions and at all angles, many are nearly flat, but some are vertical; they make small saddles in several places, but pursue irregular courses, and expand and die out quite irregularly. They average a few inches wide and in no instance exceed a foot. None are traceable for more than a few yards. The greisen always carries streaks of quartz and occurs on one or both sides of the latter. The aplite varies in degree of greisenization. In some parts the greisen consists of sugary quartz and pyrite with very fine wolframite scattered through it but invisible to the naked eye. Such a rock weathers brown and strongly resembles sandstone. It is always present in the rotary concentrate. In other parts the greisen consists chiefly of a soft yellow mica.

At the south-west end of this deposit a body of greisen about 6 feet wide, striking north to south and dipping about 40° E., has been opened and afforded rich patches of wolframite.

Minerals of the Greisen.—The minerals detected in the greisens comprise quartz, soft yellow mica, felspar, dark-green chlorite in rosettes, black tourmaline, pyrite (altered to cubes of limonite at the surface), fluorspar (blue, mauve, green, white, and colourless), topaz (pale brown and colourless), galena (rather rarely), pyrrhotite, wolframite, and scheelite.

Small quantities of each of these occur in the quartz. Here and there a bunch or streak of any one of them, including the tungsten minerals, lies in the quartz. The distribution of the minerals in the quartz or in the altered aplite is in fact generally patchy, as is always the case in greisens. Coarse aggregates of any one mineral are occasionally noted; for example, single aggregates of very large wolframite crystals weighing 235 and 157 lb are said to have been found at the stockwork deposit, and similar groups of crystals have been obtained at the Lunar Block (the specimen in the Rhodesia Museum weighing 172 lb. came from here). Pieces of wolframite weighing up to 8 lb. are not uncommon, and groups of pale pinkish scheelite crystals measuring 3 or 4 inches are to be found. The two tungsten minerals are commonly intergrown; but in spite of this and of the fact that scheelite, containing as it frequently does several per cent more tungstic oxide than wolframite, may be worth several pounds sterling per ton more than the wolframite, it was found that the scheelite was neglected by the workers; in fact, considerable trouble was taken by them to separate it from the wolframite and reject it.

Scheelite is a mineral very easily recognized, and the natives engaged in panning the concentrate should be taught to know it. Although it is not unlike quartz so far as colour is concerned—being white, pinkish, or yellowish—its characteristic greasy lustre, softness (it is easily scratched by the knife or by quartz), and heaviness are properties which differentiate it sufficiently from any of the minerals with which it is associated. If boiled in dilute hydrochloric acid it becomes coated with bright yellow powder soluble in alkali.

Among the dark minerals got in the concentrate, magnetite may be recognized (and separated) by the magnet, and limonite by being in brown cubes. Coarse and moderately fine wolframite is easily distinguished from the other black minerals by its greater specific gravity and chocolate-brown streak; it breaks into flat slabby pieces with lamellar structure owing to the presence of a single perfect cleavage; the flat surfaces are bright and shiny (submetallic to resinous lustre), whilst the cross fractures are dull. Ilmenite, which is rather abundant in very fine round grains in the concentrate of the rubble, is difficult to distinguish from fine wolframite by simple tests, and this fact had led to the rejection of the finest concentrate.

Mineralization.—In addition to the minerals common to greisen, the presence both in the stockwork and in the veins, of galena, pyrite, pyrrhotite, and presumably gold, together with the large amount and constant presence of a kind of quartz which is indistinguishable from the ordinary vein quartz of gold deposits, suggests that the Essexvale tungsten deposits are not normal greisens, but to some degree assume the characters of the gold-quartz vein type of deposit. In fact, they appear to form a connecting link between the two types. This theory is borne out by the character of the mineralization of the country rock alongside the greisen streaks in the stockwork deposit. The rock is pyritized (pyrite and pyrrhotite), and the felspars altered to sericitic aggregates.

The Rubble.—The richer patches of rubble lie within 100 yards of the greisens on the steeper ground and within about 25 yards on the flat ground.

Tests of this rubble indicate that the yield of wolframite (the scheelite as noted above being rejected) varies from 2 to 8 lb. per ton. In this estimate the occasional lumps of coarse wolframite are not included, and fine wolframite and scheelite in lumps of rock and free are also not included, since they are rejected.

In the instance of the western end of the Lunar Block reef it was stated that early in 1916, 1,600 lb. of wolframite was picked up from the surface by hand without any appliances, without even a prospecting pan, notwithstanding that the ground had been broken, turned over, and picked on at least one previous occasion.

Where the rubble is being more thoroughly tested, the ground, made up of angular quartz fragments, brown-weathered greisen, and sandstone-like aplite in a matrix of red loam, is hand-jigged on rocking-screens, the coarse wolframite being hand-picked from the screens. The fines are concentrated in a 5 ft. rotary diamond washer, which recovers the tungsten minerals and even the fine heavy minerals. The concentrate is then panned by hand. The coarse wolframite (pieces over half an inch) are picked by hand and the fines re-panned. Any coarse wolframite with adhering quartz is pestled and panned. The coarse and medium concentrate so obtained is remarkably clean wolframite. The finest concentrate consists of wolframite and scheelite, with a certain amount of quartz, felspar, epidote, hornblende, mica, zircon, and tourmaline, together with a trace of gold, and a fairly large quantity of ilmenite, limonite cubes, and magnetite. The finest concentrate is rejected under existing circumstances, but on a larger scale of operations concentrating tables and magnetite separators may be expected to give profitable results.

REVIEWS.

I.—A Pocket Handbook of Minerals. By G. Montague Butler. Second Edition. pp. x + 311, with 89 figures in the text. New York, John Wiley & Sons; London, Chapman & Hall, Ltd. No date. Price 11*s.* 6*d.* net.

THIS handy little treatise by the Professor of Mineralogy and Petrology in the University of Arizona has met with such a large demand that a second edition has been called for. The original scope and plan proved so satisfactory that no change as regards them was made, and the only difference in this edition is that additions have been made here and there to the original text where experience has suggested the need, and, of course, all typographical errors that have come to light have been corrected.