

pressure were not applied. In one case a cylindrical piece of steel, 1" long and $\frac{3}{8}$ " in diameter, was bored through two-thirds of its length by a hole $\frac{1}{16}$ " in diameter, in which a thermal junction was placed. The mass was heated to 1000° C., and it was found that without the application of pressure recalcence occurred at 650° C., but when a load of 9 tons per square inch was applied, recalcence occurred at 620° C., and was comparatively feeble. The experiment, it need hardly be said, is one very difficult to make, and could only be done by those having command of special apparatus. Other experiments were carried out, the result showing that the recalcence point is lowered by pressure, but it was found that the lowering was not affected, unless the load was applied at a temperature well above that at which recalcence takes place. Experiments were made with Newton's alloy of bismuth, lead, and tin, the full results of which will be published at some future time. In considering the whole scope of the report, the author said that it might be asked what evidence had been gathered as to the mode of action of added elements, and whether it appeared that the atomic volume of the added element had a dominating influence on the mechanical properties of the mass in which it is hidden? The true action of an added element, the author pointed out, may readily be masked by its action as a deoxidiser. Notwithstanding these difficulties, it is undoubtedly proved that bismuth, potassium, and tellurium, all of which have atomic volumes, greatly lower the tenacity of copper. Arsenic, which has a larger atomic value (13.2) than copper (7.1) confers strength on copper, but it is very certain that the limit of elasticity, and the ductility of a metal are greatly influenced by the presence of an element with large atomic volumes. This fact may be of more molecular significance than the diminution of tenacity, to which, for the sake of simplicity, attention was mainly directed, when the early experiments on gold were made.

In the discussion which followed the reading of the paper a number of speakers took part. The most important contribution was that of Dr. Watson, of the Broughton Copper Company, who brought forward some practical experience to reinforce the deductions of the author. Mr. Arnold, of the Technical Schools, Cambridge, read a very long manuscript, which it would be rash on our part to attempt to abstract, and which we cannot afford the space to give in full. Mr. Hadfield, of Sheffield, questioned the accuracy of the beta form of iron theory promulgated by Osmond and adopted by the author. The point is one of considerable importance, but requires a wide field for its discussion.

On the whole it cannot be doubted that the report is a most valuable contribution to the scientific knowledge at the command of the engineer, and were the attention called to the action of bismuth on copper its sole result, the labours of the committee would not be without warrant.

The summer meeting of the institution will be held this year at Middlesbrough on August 1 and three following days.

CONIFERS.¹

THIS is a bulky volume of nearly 600 pages, and contains a vast amount of information. If the Royal Horticultural Society had published nothing but this since 1891 they would have amply satisfied those who are interested in conifers, and have keenly felt the want of such a book of reference as the one now under notice. Some of the papers published in the report could have been omitted without loss, but on the whole the editors have done their work well. In the preface they say, in sending out this memorial of the Conifer Conference, 1891, "we would draw attention to the fact that it contains far more than a mere verbal report of the conference, Dr. Maxwell T. Masters, F.R.S., and Prof. Carl Hansen, of Copenhagen, having promised at the time to recast their notes more fully. This they have done most kindly, and with infinite labour and research, but not without some little expenditure of time, the final sheets of M.S. having only come into our hands in July, and the corrections extending up to September 29.

"The names adopted by Dr. Masters and Prof. Hansen may, of course, be relied upon as representing the latest decisions of botanical science in England and on the continent of Europe respectively, though future research may necessitate some still further slight alterations. However, the hitherto inextricably confused nomenclature of conifers may safely be described as settling down upon the lines adopted in this volume by these

two eminent authorities, who, although not yet in absolute agreement, will be found to approach very nearly."

The list of conifers and taxads, by Dr. Masters, is by far the most important contribution to the nomenclature and synonymy of conifers which has appeared since the publication of Parlatore's monograph in De Candolle's "Prodromus" in 1868; it is much more complete than Beissner's "Handbuch der Coniferen-Benennung," and the more recent "Handbuch der Nadelholzkunde," of the same author. There seems no reason to doubt that Dr. Masters's list will be used and followed by English systematists generally. Dr. Masters, in drawing up the list of genera, follows Bentham and Hooker's "Genera Plantarum" as the standard authority. A few deviations from it have, however, been made in accordance with more recently obtained knowledge. *Pseudolarix* is accorded generic rank (and not united with *Larix*, as in the "Genera Plantarum," whose authors had not seen male flowers); *Keteleeria* too, after a careful study of living material, has been separated from *Abies* and reinstated as a genus—Dr. Masters's studies having on these points proved the justice and accuracy of Carrière's views. The Chilean *Prumnopitys* is restored to generic rank, and separated from *Podocarpus*, with which it was united by Bentham and Hooker.

The *Pinetum Danicum* of Prof. Carl Hansen is unsatisfactory, and its omission from the report would have been desirable. It is a somewhat ambitious performance, but in bulk is very largely made up of extracts from books and periodicals. Many of the records are certainly useless; for instance, under *Pinus longifolia*, it is stated: "one plant, however, exposed out of doors does not appear to have suffered"; this Indian species is tropical in its requirements, and as it will not grow out of doors even in the south of England, it is in the highest degree improbable that it would, even under the most favourable conditions, exist in the open air in Denmark. A curious mistake occurs on p. 372, where the Viennese botanist, Prof. Günther Beck, Ritter von Mannagetta, figures as Prof. Günther, Knight of Beek von Managetta. On p. 330 Prof. Hansen remarks under *Prumnopitys* that its wood is much valued by "ebonists." He probably means cabinetmakers (*ébénistes*). *Tsuga hookeriana* and *T. pattoniana* are kept up as distinct species by Hansen; but Prof. C. S. Sargent, who is familiar with the two forms in their native habitats, has no hesitation in regarding them as specifically identical. Hansen accords generic rank to *Biota*, *Thuopsis*, and *Chamæcyparis*, the first and second being merged into *Thuja*, and the third into *Cupressus* by Dr. Masters. It is rather annoying to find the obsolete geographical expression "New Holland" constantly used by Hansen. New Holland and South-east Victoria are given as the native countries of one species.

The coniferæ of Japan, by H. J. Veitch, is a valuable paper. From it we learn the somewhat startling fact that, in proportion to the area of the country, the flora of Japan contains more coniferous species than that of any other country in the world. Japan boasts of forty-one species and thirteen genera, whereas in the whole of Europe there are but eighteen species and seven genera.

A. D. Webster, "Conifers for Economic Planting." Mr. Webster is a practical forester of wide experience, and he considers that out of all the conifers cultivated in Britain only sixteen can be utilised in an economic sense, or for truly profitable planting. These are the larch, silver fir, Corsican pine, Douglas fir, *Pinus Strobus*, Scotch fir, *Thuja gigantea*, Spruce fir, Austrian pine, *Pinus Pinaster*, *Abies nordmanniana*, *Sequoia sempervirens*, *Cupressus macrocarpa* (or, as Mr. Webster calls it, *C. lambertiana*), *Cedrus atlantica*, *Pinus rigida*, and *Cupressus lawsoniana*. The order in which these names are given represents the relative value of the trees as timber producers. Under each heading Mr. Webster gives valuable data as to rates of growth under different conditions as regards soil, elevation, &c.

In a compact paper of thirteen pages Mr. W. Somerville gives a very good *résumé* of the present state of our knowledge of the quality of coniferous timber as affected by silvicultural treatment. Mr. Somerville's remarks are sure to be perused with profit by landowners and foresters.

Mr. D. F. Mackenzie, on the timber of exotic conifers: uses and comparative value, contributes much valuable information. Taking the value of Scotch fir timber at 100, the author calculates that of *Cupressus macrocarpa* at 190 and that of *C. lambertiana* at 283; as these two names represent one and

¹ Report of the Conifer Conference, 1891 (issued November, 1892).

the same species, the widely different results are probably due to the trees furnishing the timber having been grown under different conditions. Mr. Mackenzie mentions a curious fact "observed in the working of the various pine timbers I have named. It was found that the wood of pines having three leaves in a sheath was, as a rule, much harder than those having only two, whilst all those having five leaves in a sheath were uniformly soft, and when dressed had a silky appearance. So general is this characteristic that one could almost at once tell to what class a certain plank of pine timber belonged." These observations we do not remember to have seen previously recorded.

"The Diseases of Conifers." Although in German there is a literature of considerable extent on this subject, the publications in English are few. Prof. Marshall Ward is a very careful and competent observer, and his contribution to the report is of great value both to the man of science and to the practical forester.

Mr. W. F. H. Blandford's insects injurious to conifers is an excellent *résumé* of all that is known up to date of the life-history of the various insect pests, which have been noted as injurious to conifers. How important this subject is may be judged by the destruction wrought by the larvæ of *Liparus monacha* between 1853 and 1868 in East Prussia, Poland, and Russia, where the spruce was killed over an area of 7000 square German miles. A similar instance is that afforded in 1890 in the Bavarian forests by the same destructive insect, the loss caused by this to the revenue being estimated at £40,000. Those, however, who, like the writer of these notes, travelled over the districts affected during the ravages of the larvæ, would realise much more vividly the gravity of the attack than others could from a mere perusal of statistics.

Not the least valuable portions of the report are the statistics of conifers in the British Islands, and the value in the British Islands of introduced conifers, by Mr. Malcolm Dunn. These statistics represent an enormous amount of energy and perseverance on the part of the compiler. The tabulated forms give particulars from a large number of places in the British Islands, and deal with the soil, altitude, age of trees, their height, girth, &c. The list of conifers and largest specimens, also by Mr. Dunn, gives the dimensions of the largest specimens taken from the above-mentioned tables and also the number of returns respecting each species. G. N.

THE EARTHQUAKES IN ZANTE.

LAST week we noted the fact that another disastrous earthquake had occurred in Zante on Monday, April 17, and that it had been followed by various slighter shocks. According to a special correspondent of the *Times* at the town of Zante, the centre of the disturbance seems to have been under the sea about two miles from land. Before the great shock the inhabitants of the district of Vasilikos, near this centre, heard submarine rumblings, which increased in loudness till the earthquake occurred. Two huge boulders were detached from the neighbouring mountain and rolled into the valley beneath. The same correspondent records that on the afternoon of April 21 there were several violent shocks.

The conditions under which this series of earthquakes has occurred will no doubt be carefully studied. Meanwhile we may call attention to a good article contributed to the *Mediterranean Naturalist* for April by Mr. W. G. Forster, seismologist, manager, and electrician, Eastern Telegraph, Zante, on the earthquakes which did so much damage in January. From this paper we reprint the following historic statement:—

"From the traditions of the place it has always been considered pretty certain that Zante must invariably expect a more or less severe earthquake about every thirty years. I find, however, that this cycle of seismic disturbances is common to all earthquake districts in south-eastern Europe and Asia Minor, and that there exists also a fairly proven and established law which governs these periods of visitation, for instance, whenever any long time has elapsed without the slight shocks—which average one or more a week in earthquake districts of non-volcanic regions—and when to these periods of comparative quiescence succeeds one of constant earth tremors, then a disastrous shock is nearly certain to take place. This is a very important point, and cannot be neglected when the question as to the origin of the shocks is under consideration.

"The last strong local earthquake previous to the present series of shocks occurred on October 26, 1873, and although it

was far less severe, it originated within a mile or so of the present one's centrum, as proven by a knot of submarine cable having been then lost, buried under the immense mass which fell into it, at the bottom of the sea; and by the measurements taken at the time.

"This earthquake had precisely the same characteristics as the present one, both previously and subsequently to its occurrence, and although very many severe and slight shocks have been felt since 1873, in no case were they of so pronounced a local nature as those just recently experienced. When the great earthquake of August 27, 1886, occurred, which destroyed Filiatra on the mainland to the south-east of Zante, this island was fortunately outside the direct vibrative waves of seismic forces radiating from the centrum of that shock; which covered up six knots of submarine cable in latitude $37^{\circ}25'$, longitude $21^{\circ}11'$ east of Greenwich; but still it did considerable damage, and its force was severe enough to cause the greatest alarm even in so distant a place as Malta.

"From that year until the spring of 1890 there were numbers of small shocks, but after then and up to August, 1892, only a very few tremors were recorded. On August 16 last year about twelve small shocks suddenly occurred during the day, purely local, and all from east to west. After three days of absolute tranquillity they began again, and although merely pulsations they were of a very pronounced character.

"At midnight on August 27 the shock was strong, and from then until the still smarter shocks of September 3 and 5 the earth seemed always shaking. Another few days of quiescence were followed by a renewal of shocks. This state of things continued until the middle of January last—and was again succeeded by a fortnight of perfect tranquillity. At 9 p.m. on January 30 a very distinct rumbling occurred, which was followed by a short, sharp shock, as if from some falling mass, and then all was still again. I noticed after the shock a series of small ripples on the sea, which was previously and subsequently quite calm. The night passed very quietly until 5.34 a.m., local time, when the whole island began to sway terrifically from east to west, with a purely undulating motion, finishing up by a movement which I can only describe as being similar to that of some mighty force wrenching out the bowels of the earth. This shock lasted twelve seconds, and its centre was undoubtedly in the sea very close to the town, and due east of the same. From its apex of origin its range of destruction, on the frontage of the town, was not wider than two miles, spreading out to about fifteen when it reached the villages at the base of the range of hills, six miles off.

"The destructive force had a tendency to incline from due east to the north-west of the island, which is about 27 miles in length by an average breadth of eight, a subsequent shock taking a much lower range. During the whole day shocks were alarmingly frequent and numbered some hundreds between the first and nightfall when everybody went to the open ground in a most panic-stricken condition. At 1.56 a.m. on February 1 another terrific shock took place—not so severe as the first, but with a range towards the south-west and of increasing destructive force. This shock lasted 20 seconds and was also succeeded by numberless others. After 23 hours a third severe shock occurred and periodically during the whole week others of decreasing intensity took place. Since the first shock until the present date, at least one thousand (including pulsations and tremors) have been felt.

"Of course the direct and indirect damage has been very great owing to the extensive zone of destruction, the scattered nature of the villages and to the bad construction of the houses in general and to their dilapidated condition owing to extreme poverty of the island. At least half a million sterling is required to rebuild the place, and as this amount can never be realised many of the ruins are likely to remain untouched and most of the population will have to emigrate."

SCIENTIFIC SERIALS.

American Journal of Mathematics, vol. xv. 1 (Baltimore: Johns Hopkins Press, January, 1893).—The pièce de résistance of this number is a memoir by Prof. Cayley on symmetric functions and seminvariants (pp. 1-74), in which the author further develops the theory of seminvariants, and in connection therewith is led to some investigations on symmetric functions. The subject is treated with characteristic ability and affords ample evidence of the writer's recovery from his recent serious