

Other recommendations were addressed to the attention of all the Research Councils. These are the need, first for further support for work leading to the development of more selective and safer products of limited persistence—a recommendation to which high priority is attached; secondly, for occasional meetings to correlate analytical findings, for passing on information on these detailed research needs to appropriate research departments, including those in universities; and thirdly, for toxicological and biological investigations in birds and wild-life generally. High priority is also recommended for the more extensive ecological investigations, the

improvement of methods for such investigations, the assessment of the present level of contamination of the environment by pest-control products, and of the toxicological significance to man and wild-life, as well as to more research on biological control methods. In sum, it amounts to considerable research effort, which, as the Committee recognizes, makes a demand for trained man-power in categories where the shortage often appears to be world-wide. To meet that demand, and to provide the necessary resources of equipment and finance is, however, the urgent and inescapable price now to be paid for shortsightedness in the past.

## GEOLOGY IN SCHOOLS

TWO recent presidential addresses, to the Geological Society of London and Geologists' Association, respectively, have laid stress on public enlightenment in Earth sciences and how this may be accomplished. One of the obvious, but long-term policies, in creating an enlightened lay public is to introduce the subject into schools at all levels, from primary to secondary. As a first step towards this, a course for actual and prospective teachers of geology was held at Queen Mary College during March 23–25. This was almost certainly the first course of its type to be held in Britain. Nearly forty people attended, drawn from a wide range of schools. For two days various aspects of the teaching of stratigraphy, palaeontology, petrology and mineralogy were discussed at length. Other subjects included teaching aids and the practical problems of the school geology teacher. The coverage of the relevant branches of the subject was completed by a demonstration field excursion to the south of London.

Several significant pointers for the future emerged from the discussions. One of these was that the advances made in the subject were such as to make a sound background in chemistry and mathematics essential for successful teaching, especially at advanced level of the General Certificate of Education (G.C.E.). As many teachers have, in fact, an arts background they may well be progressively winnowed out by modernization of

syllabi. This is clearly undesirable, especially in view of the fact that many present-day G.C.E. syllabi need drastic re-thinking. Hence, if geology is to maintain and strengthen its place in British schools more provision must be made for revision courses by university departments. Otherwise, the only alternatives for many experienced teachers will be to teach the subject to a lower standard (O-level or Certificate of Secondary Education) or cease to teach it at all.

Despite the fact that examination syllabi fragment the science and fragment its teaching, emphasis in the course was laid on unifying the various branches as frequently as possible. This is most readily accomplished in natural history subjects by field studies, and some education authorities are now becoming aware of the need to budget for school field activities. As field classes become more commonplace, however, it follows that there must be more centres capable of accommodating school groups. Otherwise the expansion of geology in schools may be handicapped.

The liaison effected between the teachers, lecturers and examiners attending the course was undoubtedly beneficial and a healthy sign in the revitalization of a subject which tends to be underrated, culturally and academically, by most schools, public media of communication, and the lay public alike.

## ORES AND METALS

A RECENT report from the Ancient Mining and Metallurgy Committee of the Royal Anthropological Institute, *Ores and Metals*\*, consists of three sections: "A Note on Irish Copper Ores and Metals", by Mr. H. H. Coghlan; "Elements in Irish Copper Ores", by Dr. J. R. Butler; and finally, "A Metallurgical Study of Four Bronze-Age Implements", by Dr. George Parker. An enormous amount of data concerned with a restricted area, some previously published and some now, has been brought together dealing with the sources available and the metal (presumably) produced from them. The whole work is, as the main author says, "very much in the nature of a preliminary investigation" and as such is to be whole-heartedly welcomed. Dr. Butler's share has been the task of analysing some hundred samples of the ores and is a contribution of outstanding importance. Dr. Parker provides a detailed metallurgical examination of five specimens, including the rivets of a halberd, of Bronze Age implements. Such work is of fundamental importance and more is needed. One of the points of special interest in this report is that, again including the

rivets, only two are in bronzes, the remainder being copper. Such evidence that then, as now, different types of metal were in use at one and the same time is well worth bearing in mind.

The largest section, in which the results are considered, is directed to the hope that from a detailed investigation of the impurities in the metal and in the ore it will in the end be possible to relate the two and thus, wherever it be found, discover the place of origin of the metal. As is very properly pointed out, this can only be done for those times, if such in fact do exist, before scrap metals from different sources were melted together. To a metallurgist it would appear that the uncertainties involved in the ore-metal correlation have been underestimated. Among other things, for example, ores do vary, sometimes greatly, with depth both for geological reasons and as a result of weathering. It is stated in the report that "the prehistoric miner usually worked by open-cast, and but a few feet below the surface". Though doubtless true in the earliest days, evidence of mining by 'fire-setting' as early as the second millennium B.C. shows that even then unweathered ore was being won. The further implication that not until the Roman period was ore worked which might vary in composition from that of the weathered surface material is exceedingly difficult to accept when it is

\* *Ores and Metals: a Report of the Ancient Mining and Metallurgy Committee, Royal Anthropological Institute.* (Royal Anthropological Institute Occasional Paper, No. 17.) By H. H. Coghlan, J. R. Butler and George Parker. Pp. v+63. (London: Royal Anthropological Institute of Great Britain and Ireland, 1963.) 35s.



remembered, for example, that the deepest shafts at Laurion, some half a millenium earlier, were not all that short of some 400 ft.

That the enormous amount of work done in making these analyses and in collecting the data together was

eminently worth while no one can possibly doubt, and all those interested in ancient metals must owe the authors most grateful thanks. But there is most clearly a long, and very difficult, row still to hoe—how difficult may, perhaps, not yet have been fully realized. F. C. THOMPSON

## SWEDISH FORESTRY

THE two well-known Swedish forestry publications, *Meddelanden från Statens skogsforskningsinstitut* and *Kungl. Skogshögskolans skrifter*, are continued in a new series, *Studia Forestalia Suecica*\*, which began in 1963. This series includes original papers and publication will take place at irregular intervals. Of the first nine numbers, one has an English summary, another gives a condensed version in English and the remaining seven are in English with Swedish summaries. The range of subjects is wide. There are two accounts of resistance-biology concerning Scots pine and the twisting rust and the snow blight fungus. The second is an interesting study of the relative susceptibility to this fungus of different provenances of Scots pine in Sweden. The result of the experiments is confirmation of observations first made in 1923 that the resistance of the northern provenances is far greater than that of the southern ones except that plants from seed collected from the Arctic Ocean coast show a greater degree of susceptibility than plants from the interior of Upper Norrland. Thus the conclusion is reached that southern provenances of Scots pine should not be planted farther north but northern provenances may be introduced towards the south. Two excellent coloured plates show the difference between infected and healthy seven-year-old Scots pine seedlings.

Another interesting mycological paper is an experimental study of the influence of temperature on the antagonistic effect of *Trichoderma viride* on that very important root fungus *Fomes annosus*. The significance of the results—not new but certainly confirmatory—is that *T. viride* is active at higher temperatures than *F. annosus* requires for growth. Thus there may be but a short period during the growing season when *T. viride* can have any appreciable effect on *F. annosus*.

Although it is known what are the relative amounts of water-soluble substances occurring in litter from various

\* Skogshögskolan, Stockholm. *Studia Forestalia Suecica*. Nr. 1: *Preparering av Virkesavlägg på Is*. By Av Bengt Ager. Pp. 227. 15 kr. Nr. 2: *Studies on the Germination in Seeds of Scots Pine (Pinus silvestris L.), with Special Reference to the Light Factor*. By Bengt Nyman. Pp. 164. 12 kr. Nr. 3: *Leaching and Decomposition of Water-Soluble Organic Substances from Different Types of Leaf and Needle Litter*. By Nils Nykvist. Pp. 31. 3 kr. Nr. 4: *The Influence of Temperature on the Antagonistic Effect of Trichoderma viride Fr. on Fomes annosus (Fr.) Oke*. By Arne Persson-Hüppel. Pp. 13. 2 kr. Nr. 5: *Resistance of Snow Blight (Phacidium infestans Karst.) in Different Provenances of Pinus silvestris L.* By Erik Björkman. Pp. 16 + 2 plates. 3 kr. Nr. 6: *Melampsora Pinitorqua (Braun) Rostr.—Pine Twisting Rust: Some Experiments in Resistance-biology*. By Allan Klingström. Pp. 23. 3 kr. Nr. 7: *Enzymatic Splitting of Sucrose by Some Strains of Valsa nivea Fr.* By Arne Persson-Hüppel. Pp. 29. 3 kr. Nr. 8: *Determination of Mechanical Damage on Scots Pine Seed with X-ray Contrast Method*. By S. K. Kamra. Pp. 20. (2 plates.) 2 kr. Nr. 9: *Om Kostrads/Inäktts-Analys Inom Skogliga Företag*. By Av Karl Viktor Algvere. Pp. 169. 15 kr. (Stockholm: Svenska Skogsvårdsforeningen, Box 16316, 1963.)

tree species, much less is known about the factors which influence the leaching of these substances. In a well-written paper, the author describes a comparison between seven different leaf and needle litters, and some very interesting results emerge. The total amount leached in a single day when expressed as a percentage of the dry weight of the litter ranges from 25 per cent in ash to 8 per cent in beech. Water-soluble substances are easily leached from leaf litter, especially alder, ash and birch, and slowly from pine and spruce litter. Temperature influences the rate of leaching in some species more than in others, and the amount of water-soluble substances is greater when leaching takes place under anaerobic rather than aerobic conditions. The author also describes the constituents of the water-soluble substances. This is a very useful contribution to an important subject.

In recent years, more and more attention has been directed to forest economics. Why this is so is described in a dissertation (No. 9) which considers managerial-economics (cost-revenue analysis), the objectives of the forest enterprise and its management planning. The present-day profitability of forestry is conditioned by progressive mechanization which is itself a result of the decrease in the supply of man-power and a rise in wages and, in some cases, to falling timber prices. Because some of the traditional methods of calculation in forest economics are based on out-dated theories, it is therefore essential that the subject must be reevaluated and adjusted to those principles which are adopted in general economics. In his final chapter "Management Planning of the Forest Enterprise" K. V. Algrere shows in a most able and succinct manner that, until now, management plans have been rather rigid and he suggests that they should be regarded primarily as an instrument for revenue planning and as a basis for cost planning. The author rightly considers that planning must include establishing the justifiable density of the road network and trying to set certain standards for it. In fact, what he calls "Budgeting as a means of forestry planning" is really a case of tracing the consequences of the different possible courses of action as a result of expressing the planned activities of the enterprise in terms of costs and revenues, which are expected to occur during the planning period. By this means budgeting deals with the enterprise as a whole and thus effects a proper co-ordination of the various components into a joint programme.

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## SPECTRA AND REACTIONS IN HYDROGEN—OXYGEN—NITROGEN FLAMES WITH ADDITION OF CYANOGEN AND NITRIC OXIDE

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IN the course of a programme of work on the combustion of small amounts of various substances under the controlled conditions of a premixed hydrogen-oxygen-

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nitrogen flame at atmospheric pressure we have observed the spectra produced by quantities of about 1 per cent of cyanogen, with and without a further about 1 per cent of nitric oxide in such a flame.

The characteristic emission spectra of the species CN, NO, NH, CH and OH were observed photographically