Marine Bed is known in practically every coalfield from Scotland to South Wales and Somerset) proves that occasionally very wide areas were submerged; the remarkable frequency with which thick coals occur at comparable horizons in different coalfields (as at the base of the *Similis-Pulchra* Zone) also suggests a comparative uniformity of conditions at certain stages in Coal Measure times. For some years, there had been a tendency to assume that the basins in which the Coal Measures were deposited were restricted in extent and more or less coincident with the existing coalfields: it was thus thought that the freshwater shells could not be used for correlation since they were only of local occurrence. Their wide distribution and the similarity of their sequences in different countries indicate at least a free communication between the areas.

Work on the spores of the coals has likewise tended to reveal the wide lateral extent of characteristic features. The classic investigation by Dr. L. Slater and others of the distribution of megaspores in the Silkstone and Better Bed coals of Yorkshire and the Arley of Lancashire, which confirmed the correlation of the Better Bed with the Arley, already put forward by Dr. D. A. Wray on stratigraphical grounds, clearly showed the value of these methods, and lent further support to the view that the main coals of these two coalfields were formerly continuous.

More recently, Dr. A. Raistrick has developed with remarkable success a technique for the examination of the microspore content of seams. He has applied this method to the coals of Northumberland and Durham, many of which appear to have a characteristic microspore content which persists over wide areas. He has recently been investigating the difficulties which are introduced by changes in the structure of the seams and in the chemical and physical properties of the coals. The various methods of using spores (both megaspores and microspores) in correlation, and the problems which arise in that work, are also being explored by the Government Department responsible for fuel research (Mr. J. J. Walker and Dr. J. O'N. Millott gave an account of this work).

There can be little doubt that these methods will be of immense importance in the identification of seams, especially in the Lower and Middle Coal Measures, where the floral changes are most pronounced. In the highest Coal Measures, as Mr. G. A. Kellaway showed, the microspore content of successive seams is much less varied, and these methods of correlation present greater difficulties. They are likely, however, to be of great use in the parts of the Coal Measures which are most worked. They will probably supplement rather than replace the use of the plants and shells, from which conclusions can generally be reached so much more rapidly. A. E. TRUEMAN.

Bracken as a Weed

THE Brake Fern or Bracken (*Pteridium aquilinum*) is an ancient plant of world-wide distribution in temperate and even tropical parts. Although a plant favouring the less dense woodlands and deeper soils, it may invade and dominate grass or heather even on shallow soils where the winters are not too severe or the summers too dry. This characteristic has made it a serious agricultural pest not only in Britain but also in Australia and New Zealand.

During the past forty or fifty years, the spread of bracken, especially in Scotland and Wales, has been so excessive that in many cases the available grazing land has been reduced by one half or more. This is not the only loss, however, for sheep which have been struck by the maggot fly (*Lucilia sericata*) take cover in dense bracken (which they normally avoid) and die there, although many could have been saved if treated in time. These carcasses are the breeding ground for more maggots. From the farmer's point of view, bracken (i) reduces the total grazing available and the number of sheep the ground should carry, (ii) leads to loss of sheep each of a value of 20*s*.–30*s*. or more, and (iii) adds to the costs of management, as in the absence of bracken a shepherd and his dogs can work a greater area of sheep-run.

The spread of bracken is due to many causes: (*a*) mild winters, (*b*) discontinuance of its use for thatching, litter, and as a source of potash for soap and manure, etc., (*c*) spore distribution, (*d*) depopulation of rural areas, and (*e*) reduction of cattle and horse grazing. Horses and cattle do not eat bracken extensively—it possesses a cumulative poison in their case—but heavy animals tramping and grazing amidst the fronds damage it and encourage grass. Pigs are the only animals which eat it; they dig up the subterranean stems or rhizomes.

In a moderately dense patch of bracken there will be 40 tons of rhizome and about 10 tons of fronds to the acre. The huge amount of material built up each year is used for replenishing the depleted rhizomes, the formation of new buds for future rhizomes and fronds, for the production of spores and for the elongation of the perennating rhizome—its chief method of spreading. This may grow as much as a yard each year. In this way a 1/40 acre bracken plant could become an acre in extent in 34 years, or 24 such plants could invade 1,000 sq. yd. in a year.

Unfortunately, bracken possesses few natural insect and fungoid enemies, and none of these materially damages it when it is growing in congenial sites. The one effective measure of control is continuous destruction of the fronds, so that the rhizome is exhausted in forming new fronds. The best time is when the frond is almost completely unfolded (mid-June to early July). A second and even a third removal of the fronds may be necessary for the first two years; thereafter the plant is much weakened and a single cut per year for a further two to five years should exterminate it.

Until recently, fronds have been destroyed by the scythe or by the sickle at a rate of 0·5–3 acres per day, at a cost of 3*s*.–8*s*. per cut per acre, and this on land probably worth only a shilling or two per acre. Now various machines have been produced, and this year the Department of Agriculture for Scotland has granted half the purchase price of machines (spread over three years) for areas satisfactorily cut with the Collins' power bracken cutter or the Glaslyn bracken cutter. The former can cut more than an acre an hour and the latter about an acre an hour, thus reducing the cost to approximately 1*s*. 6*d*.–2*s*. 6*d*. per acre. This season other promising machines have been produced: (*a*) the Denny hand scythe, (*b*) for horses or tractors, the Crossley thistle cutter and the Holt bracken breaker, and (*c*) the Allan and the Gordon motor machines. Reports of a demonstration of these and the two former machines appeared in the *North British Agriturist* and the *Scottish Farmer* of September 3 and 5, 1936, respectively*, and results of their use over extensive areas will be awaited with interest.

The employment of chemical sprays and powders applied by autogiro, tractor, horse-sprayer or hand, has so far proved to be costly and clumsy compared with the cutting methods, and often the resulting growth of herbage is less satisfactory.

* *The North British Agriculturist*, **88**, No. 37, 855 (1936). *The Scottish Farmer*, **44**, No. 2277 (1936).

Developments in Electroplating

WITH the ever-growing demand for materials possessing new and more varied combinations of properties, it is seldom that any one of the commoner metals has all the properties desired for special applications. Suitable mechanical strength may be offset by susceptibility to corrosion, suitable density by insufficient hardness, amenability to mechanical processing by unsatisfactory appearance. The use of alloys of two or more metals affords one important method of escape from these limitations, especially since a small addition of an alloying element often produces profound alterations of properties. On the other hand, since it is frequently only the surface properties which particularly need modification, an alternative method is to cover the surface with a suitable coating. Thus, the metal may be coated with various enamels, paints, or lacquers; or with a thin layer of a different metal which may be applied by direct immersion in the molten metal—as in the production of tin-plate or galvanized iron—by electrodeposition from a solution of a salt of the metal, or by other means.

The two ways of using a metal to modify the properties of another—as an alloying element and as a coating—have both been extensively exploited, but their fields of application have seldom overlapped. Thus the range of utility of steel has been enormously extended by the use of coatings of tin, zinc and cadmium, but no alloys of these metals with steel have found application. Nickel has been used in both ways in relation to steel, but the applications of the respective products have been notably different. Indeed, chromium seems to be the only metal employed both for alloying with steel and as a coating on steel in order to produce the same type of result, namely, a tarnish-resisting surface.

These were among the matters discussed by Mr. D. J. Macnaughtan in introducing a symposium on electroplating before Section B (Chemistry) of the British Association at the recent meeting in Blackpool. The other papers presented were "The Development of Control in Electrodeposition Processes", by Mr. A. W. Hothersall; "Electrodeposited Coatings as Corrosion Preventives", by Dr. S. Wernick; "Non-tarnishable Finishes", by Mr. E. A. Ollard; "Advances in Industrial Electroplating", by Mr. C. F. J. Francis-Carter; and "The Future of Electrodeposition", by Dr. H. J. T. Ellingham. The whole group of papers afforded a survey of the development of electroplating