

takes occasion to discuss the bearing of the work of a research station upon the development of agriculture. He maintains that its function is to obtain knowledge that the corps of teachers and experts now in the country can utilise. "Before the expert adviser and the teacher can do their work satisfactorily it is evident that definite systematic knowledge must be obtained of the subject with which they have to deal. Until this has been done much of their teaching must be purely conjectural, and may even be unsound—the history of the subject is full of illustrations in point. The only safe foundation on which their work can be built up is sound accurate knowledge gained by systematic investigation."

This appears to us very necessary doctrine; the State has now endowed Rothamsted so that it becomes subject to official criticism as to whether it is returning value for its money, and official criticism always likes to take its cue from the practical man. Yet much of the best work of Rothamsted must remain not merely unappreciated by, but unintelligible to, the practical man; the real test of its value must be whether it is moulding the opinion and rendering more accurate the advice of the teacher who is dealing directly with the farmer. To take a case in point: one of the commonest questions addressed to the scientific man by the farmer is whether he should lime his land, how much should be put on, and whether quicklime or carbonate. The first part of the question admitted of some sort of answer from analysis, though the chemist who began by determining the amount of calcium dissolved out of the soil by acid (a practice by no means extinct) arrived at most misleading results. Later the chemist began to determine the carbonate in the soil as a measure of the necessary base to supply which is the function of quicklime or carbonate, and latterly refined methods of analysis were devised to pick up the trace of carbonate which in many soils makes all the difference between fertility and poverty. Still, there were many dubious cases left; nor were they quite cleared up by attempts by means of litmus, etc., to determine whether the soil was neutral or acid.

In a set of papers abstracted in this report Hutchinson and MacLennan have practically cleared up the difficulties by attacking the problem from the chemical and biological side simultaneously. As an outcome they have devised an analytical process which proved sufficiently critical to indicate differences in the soil corresponding to the varying natural flora of parts of Harpenden Common, a non-calcareous soil verging on acidity and in places overpassing the neutral limit. These authors further were able to discriminate between the action of quicklime and carbonate of lime, so as to arrive at a rational explanation of the very different action upon the soil they occasionally exhibit. The continuous work these three papers represent would appear to a practical man to be wasted; he "knows" that lime is the remedy for sour soils and requires no research to teach him that. The shoe does not happen to be pinching him, but the time comes when some other practical man begins to wonder if his soil is sour and if he wants lime or had better try chalk or ground limestone, points on which the general maxim of sour soils requiring lime has no particular bearing. So he turns to his scientific adviser, who is now, thanks to Hutchinson's and MacLennan's research, in a position to answer with some accuracy. We have laboured his point because it is typical; years and years of work of a research station, even if successful, may be required in order to modify a single sentence in a text-book, upon which, in its turn, depends the judgment of men whose function it is to advise the farmer.

To the practical man the work of a research station must always seem remote and in the air; fortunately the old field plots at Rothamsted have such an extraordinary fascination and raise such interest in the least scientific of farmers that the value of the unseen laboratory work has been also taken for granted; moreover, the new land available is being utilised for sundry temporary experiments of immediate interest to the working agriculturist.

PRESENTATION TO SIR PHILIP MAGNUS.

A DISTINGUISHED company assembled in Carpenters' Hall, London Wall, on Wednesday, June 2, on the occasion of the presentation to Sir Philip Magnus, M.P., of an address on his retirement from his position as superintendent of the technological examinations of the City and Guilds of London Institute, which he has held for the last thirty-five years, by the Association of Technical Institutions, a body representing more than ninety such institutions in the United Kingdom and in the colonies. The assembly was a fine testimony of the esteem in which he is held by all ranks of educationists for the eminent service he has rendered by speech and writings and by administrative work during a long and strenuous life. There were present, among many others, Sir Alfred Keogh, who presided, Sir Henry Miers, the Rt. Hon. Herbert Samuel, M.P., Mr. Pike Pease, M.P., the Rt. Hon. Sir Wm. Mather, Sir H. F. Hibbert, M.P., Sir Swire Smith, Sir George R. Kenrick, Sir Amherst Selby-Bigge, Sir John Struthers, Mr. Morton Latham, Prof. H. E. Armstrong, Dr. G. T. Beilby, and representatives of the Teachers' Registration Council, of the associations of directors and secretaries for education, of teachers in technical institutions, of the art masters, of Local Government officers, and of the College of Preceptors. The presentation of the illuminated address was made by Mr. J. H. Reynolds, and of the personal gifts to Sir Philip and Lady Magnus by Sir Wm. Mather. The address set forth the high appreciation of the association for the great services rendered by Sir Philip Magnus as a member of the Royal Commission on Technical Education of 1882, and for the important share which he has taken, not only in the development of technical education as a consequence thereof, but in the endeavour to place upon a sound footing the teaching of science in the secondary school and to introduce the principles and practice of manual training in all types of schools.

Reference was made in the course of the proceedings to the great value of the work accomplished by the institute under the guidance and inspiration of Sir Philip Magnus, to the help and encouragement given in the foundation of many technical institutions, to the establishment of a system of technological examinations which last year comprised seventy-three subjects attended by 56,000 students, and to the paramount necessity of more serious attention being given to the cultivation of science and to its application to industrial uses if the nation is to maintain successfully its industrial and commercial position in competition with other nations and especially with Germany. No attempts to "capture" German trade can have any possible chance of success unless they are founded on the sure basis of scientific research carried out by men thoroughly trained as scientific investigators, supported, as in Germany, by ample resources; and for this purpose it is necessary that there should be an entire change in the attitude of the English employer, from whom much more active encouragement and sympathy are needed. The course of the war has shown the enormous advantage which Germany enjoys as a result of her sedulous cultiva-

tion of science in its technical applications, and the peril in which some of our staple industries have been placed by reason of our lack of dyestuffs and other materials which are the product of her great chemical manufactories, and which could, if proper encouragement were given and suitable measures taken, be produced in this country.

THE UNIVERSITIES AND INVESTIGATION.

MOST of us are perhaps a little tired of addresses by eminent people explaining that the extension rather than the propagation of knowledge should be the primary object of a university. But the most jaded appetite will find something stimulating in a founder's day address delivered at Clark University by Prof. Ralph S. Lillie (*Science*, April 16). Nowhere has the case been put more simply and directly, with greater force and less of the overstatement which is apt to defeat its own objects; nowhere has the defence of "useless knowledge" been conducted with greater cogency and sanity.

But Dr. Lillie's main object is not to establish principles to which everyone in these days pays at least lip-service, but to inquire how best they may be put into operation. What exactly should a university do to encourage research? Build laboratories, endow chairs, and try to attract the best men to fill them—such is the answer which would probably be given in this country. But American experience seems to show that something further is also needed. These things have been done on an unprecedented scale, and yet the production of work of the highest class is inconsiderable compared with that of several European countries far less lavishly equipped. Why? asks Dr. Lillie.

His answer is that the right spirit of research is lacking. He thinks that it has been too hastily assumed that the methods which have proved successful in the production of goods must be equally successful in the production of thought. The cult of the card-index, the typewriter, and the timekeeper has been carried too far; the heads of departments are overburdened with executive duties, and the demand for an appearance of strenuous activity leaves them and their subordinates no time to think.

And Dr. Lillie has a graver charge to bring. He accuses some American universities of being under the influence of a mistaken conception of democratic equality. He finds it necessary to protest against "a spirit of hostility to distinction." He quotes influential speakers to show that there is a tendency to under-rate the importance of the exceptional mind and to imagine that everything can be achieved by industry without genius. He does not doubt the value of organised collaboration in the development of an investigation, but he fears that the exaggerated importance attributed to "team-methods" is apt to smother the individual inspiration from which all investigation must spring. "A university should be the stronghold of individuality," he protests in a notable phrase.

How far the diagnosis is correct it is not for a foreigner to judge, but the questions he raises have an interest beyond any immediate application. Is it really possible to do anything actively to encourage research? Will not official attempts to encourage the highest form of scientific learning have the same deadening effect as official attempts to encourage art? Can we do anything to produce a genius except avoid crushing him when he appears, and is even this negative precaution necessary? A genius is one who

moulds and is not moulded by his circumstances, and, in spite of Dr. Lillie's fears, the men he wants will appear in the fulness of time when they are ready.

N. R. C.

ECONOMIC GEOLOGY OF NAVANAGAR.¹

MR. E. HOWARD ADYE, as Director of the Geological Survey of Navanagar, has written a memoir of 262 pages on the economic geology of the State. A coloured lithological map, on the scale of one inch to four miles, is bound up in sections with the volume, and numerous photographic plates of rock-sections and a few landscapes illustrate the text. The rock-slices have been selected with the care that might be expected from Mr. Adye's previous work (see *NATURE*, vol. lxxvii., p. 125), and a system of lettering indicates the various mineral constituents. The production of this handsome and well-bound memoir by the Government of a native State in India renders the portrait of the Maharaja, Jam Shri Ranjitsinhji, distinctly welcome as a frontispiece.

One of the most interesting features of the region is the wide development of a foraminiferal limestone, which was laid down apparently in post-Pliocene times, and which is now in places 1100 ft. above the sea. The name "Miliolite" has been unfortunately given to this stone, and is retained, with suitable explanations (pp. 133 and 135), by the author. The rock becomes hard and durable on exposure, and has been used with marked success for building. Great masses of "hypabyssal" acid rocks occur in the south of the State, giving rise to the bold features of the Alech and Bard Hills. Mr. Adye predicts a commercial future for the micropegmatitic and other fine-grained types (granophyres and felsites), which are capable of being highly polished, and are also serviceable as road-metal (p. 219). This series, with which a few rhyolites are associated, was intruded about the opening of the Eocene period into the widely-spread basalts of the Deccan trap. Pipe-amygdaloids (p. 56) and other types of the vesicular basic lavas are described. In dealing (p. 194) with the quality of toughness which characterises ophitic basalts, the nodular crystals of pyroxene in which the feldspars are embedded are styled "plates." This is a very common slip, due to the impression given by these objects in rock-slices; but it injures the explanation given of the resisting properties of the rock. Perhaps we must not grumble at the new names proposed for altered limestones, "pindáralite" (pp. 178 and 181) for a marine rock permeated by iron hydroxide, and "ramwaralite" (p. 183) for a similar rock in which dolomite has developed. Such terms will at any rate attract interest within the State, and will thus serve one of the main objects of the book.

Mr. Adye's style has become curiously assimilated to that of certain Indian writers of English. Apart from the irregular distribution of commas, there are phrases like "sacerdotal equipments" and "revenons à nos moutons," and the statement (p. 9) that a range of hills "has hitherto remained 'without a local habitation and a name,'" which would make a stranger doubt the author's nationality. How did a hill escape a local habitation? These things, however, probably show the influence of environment on a writer who is obviously throwing his energies into the development of the country which he serves.

G. A. J. C.

¹ "Memoir on the Economic Geology of Navanagar State in the Province of Káthiáwár, India." By E. H. Adye. (Bombay: Thacker and Co., 1914.)