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BRITISH COLONIAL GEOLOGICAL SURVEYS

PLANNED co-operation in the development of backward areas may well serve modern needs better than unrestricted and often wasteful competition; and this applies particularly in connexion with the general development of vast, virtually unexplored regions such as are presented by the continent of Africa. The recent proposal to supplement various Colonial Surveys, particularly in Africa, by American geologists, therefore, deserves careful consideration. In commercial work there has at times been considerable collaboration between geologists of all English-speaking countries, as evidenced during the copper development period in Northern Rhodesia, when millions of subscribed capital were spent on exploration by the companies concerned. The results that they obtained were not, however, generally made public; there is no published map of the special areas which were explored in that large territory.

The present proposal takes for granted that there is, and will be for some time, a serious shortage of geologists in Great Britain and the Dominions. As to the competence of the geologists of the British Commonwealth there can be no doubt; the Dominions and Colonies have been well served indeed by their official Surveys, wherever these exist and where they have been adequately supported. The tempo is now to increase; the support to be given them will be greater.

Many of the problems of geological survey, especially in Africa, are not such as would confront a commercial company. Their study may not lead to immediate results. The work of a geological survey is never finished. There is not merely the question of an intensive search for economic minerals. There are problems of soil erosion, water supply, irrigation, structures, structural materials and hydro-electric problems, the location of land for agricultural needs, and the supply of essential mineral fertilizers. Where minerals are concerned, one is not necessarily considering the immediate exploitation of an economic asset. It is the function of a State Geological Survey to study what may be called 'strategic reserves' of minerals which may not be capable of being put to economic use for some time, or which, for reasons of national policy, it may not be desirable to disperse or even to discuss publicly. This has not infrequently led to conflict of opinion between big business interests, which generally have a relatively narrow outlook, and Government officers, whose duty it is to take a longer and more impartial view.

There are therefore some very practical questions to be answered before embarking on the wholesale recruitment of geologists from the United States for work on Colonial Surveys. Such survey work is a long-term operation for Governments, not short-period research for a company. Will American colleagues working with a Colonial Survey in, say Africa, be content to abide by the rules of an alien service? Will they be ready to lease or lend their national

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loyalty? Will they be content to spend long periods of their lives away from their own land, where opportunity and prosperity are still within reach of many? If not, what is to compensate for breaks in continuity of their work? Africa is not to be learned in a day.

Remuneration for such services in the United States is on a much higher scale than is customary in British Colonial or Dominion Geological Surveys. If, in the latter, it had been more generous in the past, there would no doubt be a less obvious shortage of British geologists now. Is it intended to scale up the rate of pay in these services, or are American geologists to receive an additional subsidy from their own or other Government concerned? The position may perhaps be summarized in the reply of at least one Geological Survey to a question regarding aid from the Office of European Economic Co-operation, in which the services of American experts were offered. In effect, it said that the needs and proper programme of that Survey had been painfully apparent for many years; what was required was money to carry them out.

Given adequate funds and sympathetic support, it should not take too long to attract and train men from the Commonwealth and Great Britain to their own geological services. For long-term work, as opposed to an immediate need, this is what is required; and the United States could render great service by helping in the part-training of such men in their own institutions and methods. It would be better to benefit by American generosity in this way than to subsidize American geologists to spend short periods under British administration, perhaps in competition with their fellow-professionals. True co-operation should not, in Kipling's telling phrase, become involved in "the business end of the American invasion".

Industrial competition within the United States has caused, and is still causing, an excessive waste and dispersal of irrecoverable raw materials. Any new discoveries of minerals in other lands should not be drawn into the mill of American productivity before a reasonable brake and limit has been set on the expenditure of such materials. This can only, and must ultimately, be attained by international agreement.

The development of backward areas through the collaboration of American personnel must needs bring with it some preference for American machinery and equipment, and some priority in the allocation to the United States of the raw materials produced. The law "to him that hath shall be given" has a sound philosophical basis, just as the problems of the concentration and dispersal of matter have their counterpart in the second law of thermodynamics. The need of the world to-day is that there should not be too much concentration of any one thing in one particular area, while providing for an adequate supply everywhere. If collaboration has this end in view, it is to be welcomed. Is it invidious to suggest that, concurrently with the development of backward areas, and the relieving of distressed ones, a modest form of rationing of some raw materials should be accepted in the New World?

THE NURTURE OF RESEARCH

The Genius of Industrial Research

By D. H. Killeffer. Pp. ix+263. (New York: Reinhold Publishing Corporation; London: Chapman and Hall, Ltd., 1948.) 27s. net.

IN the ever-growing literature dealing with industrial research, comparatively little attention has been given to the mental characteristics needed for research work and whether the training given at universities and technical colleges tends to develop adequately these qualities. In "Glances at Industrial Research", E. R. Weidlein and W. A. Hamor look beyond the walls of the Mellon Institute to the broader professional aspects of industrial research. These problems are briefly considered by Dr. D. W. Hill in "Co-operative Industrial Research"; but were virtually ignored by Sir Frank Heath and A. L. Hetherington in "Industrial Research and Development". A more adequate discussion is to be found in "The Future of Industrial Research", issued four years ago by the Standard Oil Development Co.; but apart from highly suggestive passages in Col. L. E. Simon's "German Research in World War II", it is to the scientific and technical periodicals that we must look for the more penetrating discussions of the qualities required in industrial research and the methods by which they are best fostered. Some of the post-war reports, like Dr. Vannevar Bush's "Science—the Endless Frontier" and that of the Barlow Committee on Scientific Staff, or statements from Nuffield College, have made some contribution; but by and large the most useful and fundamental contributions are widely scattered and probably not easily assembled.

Clearly the subject is one that demands some consideration at the present time, when the relative contribution of the technical colleges and of the universities is in debate, and Sir Lawrence Bragg's address on "The Standards of Advanced Studies and Research in Science and Technology", recently published in the *Universities' Quarterly*, will doubtless provoke some discussion on the issues which he clarifies. In the present volume, Mr. Killeffer's treatment is too superficial to make any real contribution to elucidating the qualities which are essential to success in industrial research or the way in which they are best fostered. His book is a treatise on the technique of research and some factors that determine success in industrial research, rather than a discussion of the genius or real nature of research; it indicates to the undergraduate the range of experience he may encounter and some of the techniques he should develop if he enters on a career in industrial research, rather than suggests to a teacher the way in which the inherent abilities of a student may best be nurtured for success in that field.

Mr. Killeffer's diffidence over the term 'genius' indicates that he is half aware that his title is ill-chosen. He does not distinguish very clearly between fundamental, or academic, research and industrial research, and some of his categories of the latter add nothing to his argument. This would be less important if Mr. Killeffer recognized that the creative minds, which are always rare, are required in both academic and industrial research. It is from them that the real advances come, nor are such men and women always the eccentrics that Mr. Killeffer implies. Often they take their place in a team, whether as units or as leaders, quite as harmoniously as their less talented colleagues.