Tea Leaves in Maintenance Rations

In a third experiment the object aimed at was to ascertain the extent to which this substitute food-stuff could be utilized in winter maintenance rations when other feeding-stuffs were in short supply. After a preliminary feeding period of two lunar months thirty adults, of average weight 7 lb. 7.6 oz., were divided into three comparable groups. Lot (7), the control group, was given a daily allowance per head of green food 7-11 oz., coarse hay 1.7 oz. and concentrates 3.6-2 oz., varied according to their condition and appetites; lots (8) and (9) were similarly fed except that 10 and 20 per cent, respectively, of the concentrates were replaced by tea leaves (on the 4:1 basis) supplemented by 6 per cent of fish meal. The concentrates were fed generously in the early periods, when practically all stock was heavy in the moult, and were later reduced, more greenstuff or roots then being fed. The average daily food consumption in each lunar month is shown in Table 1. Owing to shortage in the supply of tea leaves during the College vacation, there was a break of three weeks in the feeding between the second and third months.

TABLE 2. AVERAGE LIVE WEIGHTS

	Control		Concentrates replaced by tea leaves	
	lb.	oz.	10 per cent lb.	20 per cent lb.
Initial live weight	7	7.60	7	7.50
1st month ..	7	8.20	7	8.60
2nd ,, ..	8	0.50	7	9.00
Resumed weights	8	2.20	7	10.30
3rd month ..	8	6.50	7	13.50
4th ,, ..	8	2.90	7	10.50
5th ,, ..	8	1.20	7	12.00
6th ,, ..	8	8.70	8	0.00
7th ,, ..	8	11.20	8	2.40
Actual aver. gain	1	1.90	9.60	6.70

From the live weight data summarized in Table 2 it will be seen that during the first two months the average gains in live weight per head in the three groups were 8.9, 1.5 and 1.7 oz. respectively, which suggests that the control ration was more than adequate for maintenance and produced a certain amount of fattening, while the two tea-leaves groups seemed little more than bare maintenance. After the experimental feeding was resumed at the beginning of the third month the differences over the remaining five months were much less (9.0, 8.1, 5.0 oz.), there being in fact little difference between the control group and the 10 per cent tea-leaves group, although the 20 per cent group was still substantially behind the others. Over the whole experiment the average weight gains of the groups with concentrates replaced by tea leaves were 53-63 and 37-43 per cent respectively of that of the control group.

The condition of the groups was mainly good to very good. The fur underwent great change, from heavy moult in all groups at the start, to a good, even, glossy fur in each group by 3-4 months later without any noticeable difference between different rations. The full winter bloom later faded as the breeding season came round. In the last month the does were mated and the feeding of tea leaves ended before the birth of the young. The numbers of fertile does in each group in this round of matings were eight, seven and nine respectively, so that the

tea leaves would not seem to have exercised any specific effect, either good or bad, on fertility. There were strong indications that the infertile does in all groups were associated more with strain than feeding.

As was to be expected, a much higher proportion of water was drunk by the control animals, with their somewhat larger quantity of dry food, than by those eating fresh moist tea leaves. The average daily amounts of water taken were 5.19, 3.26 and 3.26 oz. respectively. The water intake was also influenced by the quantity of roots and greenstuff which was fed. The animals on the tea leaves had damper floors, especially on the 20 per cent replacement, and required more hutch cleaning and caused some coat stain on the lower part of the body fur.

Briefly summarized, this experiment indicated that adult rabbits could be maintained in body condition on a ration in which 10-20 per cent of the concentrates were replaced by spent tea leaves (on the 4:1 basis). There was an increase of live weight in all groups, being greatest on the control diet, and lowest on 20 per cent replacement of concentrates by the tea leaves mixture. In neither case was there any adverse effect on subsequent fertility.

Acknowledgment is made of the helpful advice received from Dr. Charles Crowther in connexion with these experiments.

¹ Aruch, E., *L'Italia Agricola*, 57, 17 (1920).

² King Wilson, W., *Fur and Feather*, 103, 759 (1940).

BRITISH ASSOCIATION CONFERENCE ON MINERAL RESOURCES*

THE second day of the Conference convened by the British Association Division for the Social and Industrial Relations of Science on July 24-25 was marked by the presence of Sir Stafford Cripps as chairman of the afternoon session. In his opening remarks Sir Stafford alluded to his own experience of chemical research under Sir William Ramsay and to his contacts with scientific problems in the course of legal practice. It had been said that technical invention had outstripped social and political invention and means had still to be found by which the knowledge of the technical experts could be fully utilized in a democratic organization. It was not desirable that Parliament should be composed of specialists, the 'common jury' mind, capable of forming a general judgment on wide problems, being of great value, but that judgment had often to be formed on a basis of scientific evidence or technical knowledge. The Atlantic Charter was an attempt to express in easily understood terms the direction in which the political leaders of the democracies were looking for progress after the War had been won. It was clear that in its application a multitude of questions would be raised, requiring the best brains for their solution.

However perfect the planning of the future by experts might be, it would be of no avail without the determination of the peoples of all nations that it should succeed. It could be destroyed by a return to the old competitive struggle between nations or corporations in an attempt to win monopolies, and it would be necessary for the United Nations to undertake international regulation of the production and

* Continued from p. 173.

distribution of raw materials, in the interest of the devastated countries as well as with the object of attaining a rising standard of living throughout the world. The proposed international organization for the mobilization of all available knowledge of natural resources would be a valuable factor. The pooling of knowledge, already long customary in the field of research, must now be translated into co-operative action. The co-ordinated and planned action which had been essential during the War would be no less so after it, and the step from economic warfare to economic welfare would have to be taken. Science had shown the way to an economy of plenty, and its possibility had been made clearer by the events of the War.

At the morning session the chairman Dr. C. H. Desch, spoke of new metals and new methods. The importance of the influence of small additions of special elements to metals on their properties was illustrated, not only by the example of the alloy steels but also by such applications as the hardening of copper by beryllium and the strengthening of lead by so little as 0.05 per cent of tellurium. Novel combinations of metals led to such remarkable products as the newer permanent magnet steels, containing nickel, aluminium, cobalt and copper, giving such a high concentration of magnetic energy that a bar could be made to float in air in consequence of repulsion by another magnet, and revolutionizing the design of loud-speakers and measuring-instruments. The growing importance of metals of high melting-point, especially tungsten, had led to new techniques, such as 'powder metallurgy', and to the development of the high-frequency induction furnace and of refractory materials far superior to those in general use. Vacuum melting and also the use of exceedingly high pressures would become progressively more important, and called for new materials and new methods of construction.

The substitution of one metal for another, as of a light alloy for steel in the building of ships or bridges, usually involved new problems of design on account of differences in elastic and other properties. Chile saltpetre had been replaced by synthetic nitrogen compounds, and the rapid development of the plastics industry had made possible the replacement of metals for a number of purposes, but such substitutions did not necessarily lessen our dependence on mineral resources. Electric power for nitrate synthesis might be obtained from water, but in some highly industrialized countries had to come from coal, while many of the plastics were derived from coal or petroleum, although, being organic substances, there was always the possibility of preparing them from vegetable sources, for example, through alcohol.

Two papers dealt with sea-water as a source of minerals. Dr. E. F. Armstrong reviewed the problem generally. Salt had long been prepared by the evaporation of sea-water, but more recently the demand for bromine for the manufacture of 'Ethyl' for addition to petrol had led to the recovery of that element, especially in America, where it was blown out of the sea-water by a current of air after displacement by chlorine. Magnesia was recovered in large quantities by precipitation by lime or by calcined dolomite, and the industry had assumed large proportions in Great Britain as well as in the United States. Magnesium, although very abundant in the earth's crust, had only lately assumed great economic importance. It was extracted either by electrolysis of the anhydrous chloride or by thermal reduction of magnesia by calcium carbide, ferro-

silicon, or carbon, the last of these presenting special difficulties on account of the high temperature required and the reversibility of the reaction with carbon monoxide.

Since the products of the disintegration of all rocks ultimately reached the sea, most elements must occur in sea-water, although in a state of high dilution. Phosphates, the deposits of which were limited in amount and likely to become exhausted, were wasted in present methods of sewage disposal, Great Britain alone discarding the equivalent of 150,000 tons of rock phosphate a year. Some means might be found of recovering a part of this. Selective absorption of specific elements was now utilized in the various processes depending on base exchange, and a method of recovery of phosphates might possibly be based upon that principle.

Dr. Ernst Bergmann spoke of the Dead Sea, in which the concentration of salts was much higher than in oceanic waters, while the relative proportions of the several elements were very different. The concentration increased from the surface downwards, and for industrial purposes water was taken from the lower levels. At present only potassium chloride and bromine were extracted, Palestine being now the largest producer of bromine, but the high concentration of magnesium salts suggested the use of this source for the production of the metal, provided that electric power were made available. Deposits of phosphates were found on the Transjordanian shore of the Dead Sea.

Means of economizing in the rarer metals used in alloy steels were discussed by Dr. W. H. Hatfield. Since the principal steel-making countries were dependent on imported ores for such metals as tungsten, molybdenum, nickel and vanadium, the conditions of restricted supply in war-time made measures of economy necessary. From May 1940 onwards this problem had been dealt with by a Technical Advisory Committee, and the alloy steels covered by between two and three thousand specifications had been reduced to eighty-five categories, greatly simplifying the choice of steels. It was not always necessary to use the more highly alloyed steels, which could usually be restricted to the heavier masses, for which they were essential to complete hardening.

Another aspect of economy was dealt with by Sir Harold Hartley in a paper on the recovery of metals from scrap. While process scrap, re-used in the plants in which it originated, presented no difficulty, old scrap, from disused or worn-out material, was of a mixed character, and offered many problems of collection and classification. Changes in methods of manufacture and use, such as the repair of parts by welding and improved protection against corrosion, affected the quantities of scrap returning to the furnaces, and the importance of the careful segregation of scrap from alloys containing valuable elements was stressed, as it was by the previous speaker. The great difficulty of securing statistics of scrap and secondary metal was emphasized, the present statistical knowledge of this important question being very unsatisfactory.

The session concluded with a paper by Dr. David Williams on the mineral resources of the Soviet Union. The detailed survey, illustrated by a remarkable series of maps, does not lend itself to abstracting, but both the bulk of the estimated reserves and their wide distribution must have surprised many hearers. Potash salts and phosphates, besides the metallic minerals, were present in very large deposits.

The development of these resources within the last fifteen years had been exceptionally rapid, and although doubt might be expressed as to the validity of some of the Russian estimates of reserves, it should be recalled that there were still vast areas awaiting investigation. Tin and tungsten were deficient, but it seemed likely that the U.S.S.R. would become self-supporting in and even able to export large quantities of coal, iron, petroleum, manganese, platinum, magnesite, phosphates, asbestos, potash and sulphur.

The afternoon session was devoted to economic questions. After the opening address by Sir Stafford Cripps, Prof. J. G. Smith, speaking of international trade in raw materials, said that the arrangement by which certain countries only manufactured goods and exchanged them with other countries producing only raw materials had sometimes been regarded as permanent, but had shown signs of breaking down as old capitalist countries found themselves obliged to extend their agricultural basis, while countries rich in raw materials exported less and worked up more of those materials at home. It was argued that the tendency was for industries to become less dependent on the localization of raw materials, thus admitting considerations other than purely economic ones in the choice of a country's economic policy. The factors were, however, very complex.

Dr. W. A. Lewis, in a striking paper on some aspects of mining finance, confined his remarks in the main to mining in Africa. The ordinary investor regarded mining ventures as highly speculative, owing to the uncertainty of the quantity of ore in a given mine, the fluctuations of price of most metals, and also to the prevalence of fraud. Greater legal control of company promotion would be of service in increasing confidence. The financing of mining had fallen mainly into the hands of large corporations, which could spread the risk and also provide the necessary technical guidance. This 'grouping' system, paralleled by the 'managing agency' system of the Eastern colonies, was good from the investor's point of view, but had the disadvantage that an entire colony might find itself in the hands of one or two corporations, dominated by one or two rich men, since the capital of such corporations came only in small part from the private investor, and mainly from banks and large finance organizations. The Governments of Southern Rhodesia and Tanganyika had set up special funds for financing small mines, which still had a future, and this policy might be extended.

The large corporations, by eliminating competition, were able to make excessive profits, from which the colony derived little benefit. In 1937 the Trinidad mines earned in profits three times what they paid to their native employees in wages, the Gold Coast mines two and a half times, and the Northern Rhodesian mines twenty times, and when dividends of 100 per cent were announced, colonial peoples asked why European capitalists should take out the principal wealth of the country and leave so little. Sooner or later awakening nationalism would compel the colonial peoples to assume control of their own resources, and in the meantime taxation might be increased, or experiments made with joint control, as in the Belgian Congo and Dutch East Indies, where the capital was provided in part by the Government and in part by private enterprise.

Mr. Arthur Notman, taking aluminium as his text, suggested that there was no more fruitful source of international friction than a system of tariffs, ex-

change controls, and other arbitrary restrictions on freedom of trade. The existence of a great internal free trade market had been an important factor in the prosperity of the United States. Aluminium would play a leading part in the future improvement of communications, and reference was made to a possible policing of the world by an international air force.

The general question of planning and the mineral industries was dealt with by Mr. O. W. Roskill, who concluded that there must be a central international authority which would correlate the plan for the mineral industries with the requirements of other industries, and could be built up out of existing bodies. All nations must be included. Planning of production was meaningless unless accompanied by planning of distribution and consumption. The determination of prices by the free interplay of supply and demand was incompatible with such planning, and it seemed likely that prices would be increasingly related to costs. If such stabilization occurred, producers and manufacturers would not need to protect themselves against fluctuations. Organizations for each group of commodities and manufactured goods would have to control both exports and imports.

The last communication was from Dr. L. Dudley Stamp, who spoke on the exploitation of minerals in relation to national and world planning. It was necessary to distinguish between those minerals which were in limited supply and were removed as completely as possible in mining, such as coal, oil and most metalliferous ores, and those which were so abundant that only parts of the available deposits were likely to be worked, such as limestone, clay, sand and gravel. In international planning it was the first which was important. There was in general a cycle in the development of such deposits—exploration, exploitation and exhaustion. In the early stages there might be a mining boom, with a very rapid development, great increase of population, and sometimes much extravagant building. The period of steady exploitation might be short, as with alluvial gold or tin, or might last a century or more as in a coal-field. Towns might be built and the fact that their prosperity depended on the exploitation of a deposit forgotten. The period of exhaustion could cause great maladjustments and much human suffering. The recognition of the right of the nations of the world to share its mineral resources carried with it an obligation to accept responsibility and to share the burden of such readjustments as might be needed. Examples taken from the British Isles included the decay of the Cornish tin mines, the destruction of vegetation and fisheries by lead mining and smelting, the formation of a stony desert in Northamptonshire after the removal of iron ore from good agricultural land, and the familiar instance of derelict coal-fields. It would appear that mineral exploitation inevitably resulted in a need for restoration, whether of land or of the social structure of the community; that this restoration should be obligatory on those who derived benefit from the working of minerals, and that as the stage of exhaustion was unprofitable, there should be some provision, comparable with an amortization assurance, made while the work was in the flourishing stage.

The Conference closed with the passing of the resolution proposed by Sir Richard Gregory and quoted in the first article (p. 171).

C. H. DESCH.