proposed, for recreational uses, not only by the inhabitants of the larger cities of the State, but also by the country people and the inhabitants of the smaller towns whose home surroundings are often oppressively monotonous; (*b*) to consider the uses of forests as preserves of the primitive life of the State, of great interest and value to the student of science and his teacher and to the lovers of wild life; (*c*) to co-ordinate the forest policy of the State with the movement for the establishment of a system of State parks.

A study of this manual and the appendices may be recommended to all interested in the progress of afforestation in Britain and in the development of a forest policy on sound lines.

Mountain-Building Movements and the Genesis of Petroleum.

By HENRY B. MILNER.

THE influence of mountain-building movements on oil migration and accumulation has long been recognised, and is so plainly manifest in different petroliferous provinces all over the world, that it has become one of the least controverted theories in the general hypothesis of oil occurrence. In the past decade, the teachings of the Alpine school in Europe have especially helped to clarify this relationship, and developments in the oilfields of Galicia, Rumania, Iraq, Persia, Burma (to cite only a few) are constantly impressing us with its significance.

An unorthodox, and to some extent novel, aspect of the matter is viewed by Mr. John L. Rich in a paper entitled "Generation of Oil by Geologic Distillation during Mountain-Building,"[1] in which he follows more or less similar ideas put forward by Bailey Willis some years ago. He starts off with the fact that in regions of intense mountain-building movements, carbonaceous shales are seen to have lost their 'kerogen' or oil mother-substance, such hydrocarbon, however, being present in equivalent rocks without the metamorphic zone. The destiny of this 'lost' petroleum is traced in accordance with the latest theories of orogenesis, though not entirely by stages usually recognised in this particular natural history.

Rich defines at the outset his geosyncline, with its accumulation of thick series of bituminous sediments under deposition (conventionally) in a sinking basin. The next phase is mainly orogenic, concerned with the piling up of thrust-sheets *over* (the italics are mine) the geosynclinal sediments, this accompanied by a kind of synclinorial folding of the sediments beneath the nappes, further by the inevitable isostatic sinking. During this stage oil is generated by heat and dynamic movements, apparently beneath the nappe zones, the environment simulating that of a "giant high-pressure cracking still." There follow successively peneplanation and further unwarping of a regional character, and finally the delineation of three distinct zones. Zone 1 is the zone of distillation, *i.e.* intense dynamic metamorphism, where the bituminous rocks have suffered devolatilisation, carbon ratios are high, and possibly only small quantities of gas remain. Zone 2 is the zone of partial distillation, and what Mr. Rich calls *in situ* accumulation. In this zone the rocks are partly devolatilised, carbon ratios are medium, and oil is plentiful. In Zone 3 the unaltered rocks occur, and the influence of active dynamic distillation has not been felt; consequently carbon ratios are low, oil is scarce, and what there is of it has probably migrated either during orogenic movement or afterwards in response to hydraulic factors.

Thus it will be gathered that the author arrives at the explanation of this type of oil-pool in a somewhat different manner from that often given; also, he ascribes considerable importance to the upwarp phase, when rocks formerly subjected to distillation are exposed to inflow and artesian circulation of meteoric waters, causing extensive secondary migration of the oil. This putting of 'the cart before the horse' is probably the most contentious part of the theory. On the other hand, if there is anything in the hypothesis, then contiguous deposits to areas of carbonaceous shale occurrences, given the requisite evidence of earth-movement on a large scale, should be worth inspection for oil, undoubtedly an invigorating prospect. The author cites the Oklahoma-Kansas-Missouri-Iowa region as his example; possibly the reader may call to mind another.

[1] *Bull. Amer. Assoc. Petroleum Geologists*, vol. 4, pp. 1139-1149; 1927.

Herring Food.

DR. P. JESPERSEN, in an important memoir, gives a detailed account of the food of the herring in Danish waters ("Investigations of the food of the Herring in Danish Waters," *Meddelelser fra Kommissionen for Havundersøgelser*. Serie: Planton. Bind 2, No. 2, 1928. Copenhagen). This was undertaken at the instigation of the International Council for the Investigation of the Sea, and is part of a general scheme for working out the biology of the herring in different countries of Northern Europe.

The research is based on the examination of the stomach and intestine contents of a large number of fishes at different stages of development, with special reference to the diet during growth from larva to adult, noting variations in the nature and quantity of the food in different waters and at different seasons. More than 7000 fishes were examined, nearly 3000 of which were young stages between 4 mm. and 50 mm. in length, the remainder being adolescent and adult.

The results of the examination of the larval and young stages agree with former observers. It is found that those retaining the yolk are able to feed, although there is less food (chiefly green remains) inside them, in proportion to their size, than in the post-larvæ. After the absorption of the yolk sac much more food is taken, the size and amount of food increasing with the size of the fish. Phytoplankton and very small zooplankton is found in the smallest fishes, larger copepods and other small planktonic animals in those of larger size. Copepods predominate, especially *Temora longicornis* and, next in importance, *Pseudocalanus* and *Paracalanus*. The young herring 6-17 cm. in length, feed largely at all seasons, chiefly on copepods, but also at times on cladocerans, polychætes, *Sagitta*, and appendicularians. The adult herring 17-30 cm. in length, feeds mainly on Crustacea, but there is a considerable variation in its food according to season and locality. In the breeding season herring eggs are often eaten. In most localities, as has been shown by previous workers, spawning herring as a rule do not eat, although occasionally one finds full herring and those actually spawning with a large amount of food inside. Here they have been found to contain a considerable quantity of food,