

of applied physics. Surely in a book of this kind the reader should be given some account of the uses of polarimetry? Dr. Lowe has unaccountably avoided this subject. Perhaps he will repair the omission in a later edition.

Many valuable numerical tables are included in the book, which is well printed and contains a good index.

Primitive Fossil Fishes

British Museum (Natural History). *The Cephalaspids of Great Britain*. By E. A. Stensio. Pp. xiv + 220 + 66 plates. (London: British Museum (Natural History), 1932.) 60s.

THE Cephalaspids are among the oldest fossil fishes which are known by nearly complete specimens. They are found in the Upper Silurian, Downtonian and Devonian fresh-water deposits of Europe and North America; and they seem to have lived on the bottom like certain modern Siluroid fishes, which they much resemble in outward shape. They are specially important because the fossils exhibit not only the external armour, but also enough of the internal skeleton of the head and branchial region to reveal the arrangement of many soft parts. They thus make it possible to discover some of the fundamental characters of fishes in their beginning.

The best-preserved heads of Cephalaspids hitherto known are from the Downtonian rocks of Spitsbergen, and have been described in astonishing detail by Dr. E. A. Stensio, of Stockholm. With these heads, however, there are rarely any fragments of the trunk. Dr. Stensio has therefore now undertaken a study of the Cephalaspids from the Downtonian and Lower Devonian formations of Great Britain, in which the trunk is often present and sometimes well preserved. The structure of the head could not have been satisfactorily discovered from the British specimens alone, because in these the internal parts are less well ossified and fossilised; but the dermal armour of the trunk and fins is almost completely displayed, and admits of detailed study and comparison.

Dr. Stensio's results are published by the British Museum in one of the most sumptuous volumes ever devoted to a group of fossils. They are illustrated by sixty-six plates of unusually clear photographs, which have been obtained by specially devised methods; they are also explained by numerous diagrammatic figures in the text.

In the chapter on anatomy, which extends to seventy pages, Dr. Stensio interprets the British fossil heads by reference to the specimens from Spitsbergen, but adds new observations on the irregular vascular canals in the middle layer of the shield, which he thinks are supplemented by an elaborate system of mucus-producing canals in a more superficial layer. He also considers that the appearance of separate polygonal plates in the head-shield is due to the impress of a coarse network of mucus canals, distinct from the ordinary sensory canals which sometimes leave simple linear impressions on the surface. At the same time, he points out that the "radiating vascular canals" and the "ring sinus" which mark the edge of the polygonal areas in the head-shield, are seen again at the lines of junction in the transverse rows of scales on the trunk. His interpretation of the polygonal areas may therefore be wrong.

All satisfactory observations, however, confirm the conclusion that the Cephalaspids belong to the same great primitive group as the modern lampreys and hag-fishes, which are merely degenerate survivors. It is thus interesting to note that along the trunk in *Cephalaspis* itself, and in some other genera, a pair of ridges supported by simple scales seem to represent continuous paired fin-folds, of which the scaly pectorals form the only enlarged and differentiated portion. At least, the scales supporting these ridges are very like those which obviously represent the anterior dorsal fin in some genera. The Cephalaspids, indeed, so far as known, are almost ideally archaic fishes.

The systematic descriptions occupy half of Dr. Stensio's volume, and he recognises many more species than have hitherto been admitted among the British Cephalaspids. He also adds two genera. He makes less allowance than previous authors have done for imperfections in the fossils due to crushing and fracture, and for possible changes during growth. Only experience in the naming of future discoveries can show whether his elaborate scheme of classification is justified. He has received valuable help from Mr. W. Wickham King in determining the geological distribution of the various forms.

Dr. Stensio and the British Museum are indeed to be congratulated on this imposing contribution to our knowledge of British fossils but one wonders what will be the extent of a palæontologist's library in the future if each little group is treated in a similar manner.

A. S. W.