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ORIGINAL ARTICLES.

I.—SOME SUGGESTIONS ON EXTINCTION.

By C. W. ANDREWS, D.Sc., F.G.S., British Museum (Natural History).

THE sudden disappearance of groups of animals, which have existed through long periods of time and have attained a high degree of specialization, is a phenomenon of which many instances will occur to every student of Palæozoology. For instance, to mention only two cases in illustration, we may refer to the disappearance of the Dinosaurs at the end of the Secondary period, and that of the North American Titanotheres in the Miocene. Of the proximate causes of this extinction little is known: they must have been either inherent in the organisms themselves, or have been connected with the relations of the organisms with their environment; probably in every case several factors co-operated to bring about the observed result. In a recent paper by Mr. C. B. Crampton (Proc. Roy. Phys. Soc. Edinburgh, vol. xiv, p. 461) a possible inherent cause of extinction is suggested. It is impossible to do justice to this interesting paper in a short note, but the gist of the argument seems to be as follows:—In the original unicellular organism the possibilities of variation are almost infinite, but as soon as evolution along any line begins, these possibilities are restricted, and become more and more so the more highly specialized the animal is; in short, the potential variation of an organism becomes less and less as specialization advances. Furthermore, under the influence of natural selection, in each generation the individuals which tend to vary in the same direction will survive, while at the same time, as already pointed out, their capacity for variation becomes more and more restricted. The consequence of this will be that the more highly specialized any stock becomes, the more the individuals composing it will come to resemble one another, until at length the same results as arise from close interbreeding, viz., weakening of the stock and, finally, extinction, may follow.

In a paper recently read before the Zoological Society, the present writer, in speaking of the evolution of the Proboscidea, took the

opportunity of pointing out another possible cause of extinction of some groups of animals. It will be observed that in many cases the evolution of a group of animals is accompanied by a simultaneous increase in the bulk of the individuals composing it. The Proboscidea themselves offer a fairly good instance of this tendency, but a better known case is that of the horses. An almost necessary corollary of this increase in bulk is the lengthening of the individual life, or at least what, for our argument, amounts to much the same thing, the lengthening of the time taken to attain sexual maturity. In many Ungulates this increased longevity is indicated by various modifications of the teeth, tending to give them a longer period of wear: generally this end is attained by the increasing hypselodonty of the cheek-teeth. A necessary consequence of the longer individual life will be that in a given period fewer generations will succeed one another, and the rate of evolution of the stock will therefore be lowered in the same proportion. If now the conditions of life undergo change, the question whether a given group of animals will survive or become extinct will depend upon whether it can undergo sufficiently rapid variation to enable it to avoid getting so far out of harmony with its surroundings that further existence becomes impossible. It seems to follow then that the smaller animals, in which the generations succeed one another rapidly, will have a better chance of surviving than the larger and more slowly breeding forms, which at the same time will be still further handicapped if, as is usually the case, they are more highly specialized than the smaller forms, and therefore have a more restricted range of possible variation.

Another result of the increased length of the individual life would be that, during the earlier history of a stock the modification undergone by its members would be more rapid than among the later forms, a phenomenon of which actual instances might be cited, e.g. in the Proboscidea. On the same principle it may perhaps also be explained why certain groups have remained comparatively unchanged through long periods of time. The Sirenia may be a case in point, though no doubt in this case, among other factors, the comparative stability of the conditions of life has had much to do with the conservative character of the group.

II.—WOODWARDIAN MUSEUM NOTES: ON SOME WENLOCK SPECIES OF *LICHAS*.

By F. R. COWPER REED, M.A., F.G.S.

(PLATE I.)

THE entire collection of Wenlock fossils made by T. W. Fletcher, Esq., which is now in the Woodwardian Museum, affords unsurpassed facilities for studying the material on which a large number of species of trilobites were founded. Particularly is this the case with those of the genus *Lichas*, and a recent examination of the types and other specimens which Fletcher used in writing his paper "Observations on Dudley Trilobites" (Q.J.G.S., 1850,