It should be pointed out that these ratios are in the nature of minimum values and that the true effect of pressure on the permanent magnetization is really greater. The reason is that the specimen was short, with a large demagnetizing factor which interfered with the full development of the pressure effect. It should also be stated that the effect of pressure on the temporary magnetization should be relatively greater since it is known from our work on artificial magnetite[4] that strains of the compression type decrease the remanence.

The bearing of the present results on the general problem of ferro-magnetism is not clear. It is in their relations to other questions that they are of interest. First is the question of the origin of lodestone. It is manifestly impossible to imagine any magnetizing field of natural origin sufficiently large to give to lodestone its marked magnetic moment.[5] Unless one assumes some entirely unfamiliar process of magnetization one is forced to admit that the magnetic characteristics of magnetite are enormously magnified under pressure and, perhaps, temperature conditions such as found at great depths. The results herein described scarcely do more than show that the pressure effect is of the required sign. They represent a mere beginning in the attainment of the desired result, as is shown by the fact that the original natural moment of the specimen employed was 130 times the moment observed after magnetizing with a field of 39.1 gausses at 1,200 atmospheres pressure.

The other question is that of the contribution of the earth's material to its magnetic field. Much of the earth's crust is iron oxide. More specifically,[6] six per cent. of the outer ten miles is made up of the oxides of iron in their various forms. It is evident, if this material plays any part whatever in the earth's magnetic phenomena, that the contribution is larger than one would suppose from a study of magnetite under ordinary conditions. In any event, local magnetic anomalies which are known to be due to deposits of iron ore appear in an exaggerated form.

Several lines of research suggest themselves here. It would be interesting to see if the pressure effect is itself a function of the temperature. It would be of particular importance to learn if the critical temperature of magnetization is increased by pressure, not only in magnetite but in iron and nickel as well. It is strange, indeed, often as the suggestion has been made in the literature of the earth's magnetism, that no experiments in this direction have yet been made. Perhaps the difficulty of the large demagnetizing factor for a spherical body like the earth is considered to be so decisive and so insurmountable that a study of earth materials, under pressures and temperatures approaching as far as possible those existing in the earth, would be of no value to our knowledge of terrestrial magnetism.

Finally, it may be suggested that the property of magnetite herein described might be used, in principle at least, as a high pressure gauge.

LARS A. WELO

THE ROCKEFELLER INSTITUTE
FOR MEDICAL RESEARCH,
NEW YORK CITY
September 27, 1926

[4] *Phil. Mag.*, in press.

[5] Since writing this article it has occurred to me that such a field would exist in the neighborhood of a lightning flash. On looking through the literature I find that Pockels made use of this fact to measure the maximum current during the discharge. See *Phys. Zeit.*, 1901, II, 306 and III, 22.

[6] Proc. Nat. Acad. Sci., 1920, vi, 592.

PRELIMINARY NOTE ON THE EGG AND LARVA OF THE AMERICAN EEL (ANGUILLA ROSTRATA)

FOUR eggs provisionally identified as those of the American eel, *Anguilla rostrata*, were taken while on the *Arcturus* Oceanographical Expedition on July 16, 1925. The catch was made on the edge of the Challenger Bank, a shoal about ten miles southwest of Bermuda (Lat. 32°02′N, Long. 65°00′W), in a Petersen trawl towed at five hundred fathoms below the surface. The depth increases very rapidly from the banks, a sounding made just before the trawl giving 505.7 fathoms, and one not long after 2,116 fathoms.

The eggs closely resembled those of the few species of eels and eel-like fishes which are known. They were highly transparent, colorless except for a slight yellowish tinge of the yolk, and measured 3.3 mm in outside diameter. No oil globules were present. They were further characterized by a very wide perivitelline space, the diameter of the yolk measuring 1.7 mm. A very early stage of development had been reached, for the germinal disc was defined without evidence of cleavage. As development progressed the posterior extension of the vesicular yolk into a narrow stalk below the intestine nearly to the region of the vent was typical of a murænoid embryo.

After an incubation of approximately seven days a ribbon-shaped, transparent prelarva emerged. It was 9 mm long, colorless except for ocular pigment, and provided with three pairs of very large teeth in the upper jaw, and four pairs in the lower. The anterior upper teeth were enormous fangs. When the eel was living there appeared to be a very few black chromatophores on the caudal portion of the

embryonic fin, but as this region was somewhat mutilated after death, their presence has not definitely been established. The embryonic fin enveloped the body without indication of finrays. Pectorals were prominent. No hypural elements had developed, the end of the notachord being quite straight. At twenty-four hours the prelarva had increased to 10 mm in length and four pairs of teeth could be seen in each jaw, longer and much slenderer than on the previous day.

Were it possible to obtain descriptions of the young of all living eels, one might with certainty attribute this leptocephalus to a particular species. Every expedition at sea, however, captures more new species, so that, although I feel reasonably sure that the proof in this case is quite conclusive, it is only provisionally that the eggs and young at hand are called *Anguilla rostrata*. The evidence for this identification may be summed up as follows:

(1) *Character of the eggs:* The eggs were definitely those of an eel or eel-like fish, evidenced by their large size, large perivitelline space, vesicular-stalked yolk, and slightly iridescent cell membrane, fine in texture and lacking pore canals, as well as by the leptocephalid character of the larvae hatching from them. They were different from any murænoid eggs previously observed.

(2) *Location of the collecting-ground:* The eggs were found within the area designated by Schmidt to encompass the breeding ground of the American and European eels. In the absence of closing net hauls it is impossible to state at what level they were taken. The nets rose to the surface open and consequently fished at various depths. At the time of the collection four surface nets, meter nets at three hundred and four hundred fathoms, and a meter net and Petersen trawl at five hundred fathoms were towing. The fact that but four eggs were taken in the trawl and none in the meter net at the same depth would indicate that the eggs were not abundant. If we were able to conclude, from the fact that the eggs were collected only by the deepest net, that they were taken while towing at five hundred fathoms and not during its passage from this depth to the surface, then the early stage of development attained would favor a previous theory of fertilization at considerable depths.

(3) *Comparison of this prelarva with an European eel 6 mm long:* Since the two species *Anguilla rostrata* and *Anguilla vulgaris* are so closely allied that distinction is based mostly upon the difference of only a few muscle segments, it is logical to suppose that the earliest larval stages will show like similarity. The present prelarva strikingly resembles the European eel prelarva in the general proportions of the body, the teeth and the probable presence of pigment on the caudal portion of the embryonic fin, but the pigmented eye and the absence of an oil globule, as well as the difference in myomere count, show them to be separate species.

(4) *Comparison of this prelarva with an American eel 10½ mm long:* The smallest American eel prelarva previously recorded was pictured by Schmidt (1916). It measured 10½ mm after preservation and was obviously in a later stage of development than my specimen. The dental formula $\frac{1+3}{1+3}$ was identical in the two prelarvae, but the teeth of Schmidt's specimen were more even, stronger and less tapering, like those of older leptocephali. The depth of the body of the latter was slightly greater, a change which is known to occur as development progresses. Pigmentation, as in the present specimen, was restricted to the eye and a few black stellate chromatophores on the embryonic fin near the tip of the tail (not on the tail itself). The number of myomeres was the same.

(5) *Myomere count:* A character which remains constant throughout all stages of development is the number of muscle segments and vertebrae. According to the principle adopted by most investigators interested in the eel question, "A species is regarded as new only when it differs from all known species in which the myomere count is known" (Lea). This leptocephalus has the same number of muscle segments as the American eel, and no other larva or adult species of an eel has this count. Of those species which have a number of muscle segments within twenty of the present specimen, there are other specific differences which allow their elimination.

Since the time of the early Greeks scientists have speculated upon the mysterious reproductive methods of the eel, and it was not until after 1904, when Johannes Schmidt began his intensive work upon this subject, that its breeding ground was definitely located. If my identification is indeed correct, the sea has given up the last secret concerning the life history of the American eel which it has jealously guarded for so many centuries.

A complete account and a number of illustrations of these eggs and the larva, together with a review of previous literature on the embryology of other eels and the life history of the common eel, has been submitted to the U. S. Bureau of Fisheries, and will be published by the New York Zoological Society in a forthcoming volume of *Zoologica*.

MARIE POLAND FISH

BUREAU OF FISHERIES

ACIDOSIS, TREMBLES AND MILKSICKNESS

DURING a biochemical study of the course of sickness in animals poisoned by richweed (*Eupatorium*