isobase of Dr. Wilson's peat locality in the Apostle Islands.

In the Lake Huron basin the isobase of the peat locality produced from Lake Superior passes roughly 40 miles north of the zero or hinge-line of the northern uplift. At and south of this line there appears to have been little or no uplifting of the land since the beginning of the Nipissing Great Lakes, so that in this interval, or more probably in the southern part of it, the uplift died out, and the plane of the original Nipissing beach meets the subaqueous slope or, if the depth of the basin permits, becomes horizontal at the hinge line and continues southward in that attitude. The depth of the submerged horizontal stretch is not now known, but seems likely to be near 40 or 45 feet.

In the Professional Paper referred to above (pages 71–2), Dr. Leverett refers to G. R. Stuntz's finding of submerged tree stumps in place at the mouth of St. Louis River west of Duluth. In the area southwest of the Washburn isobase, the plane of the beach of the two-outlet stage passes below present lake level. The drowning is probably 12 to 15 feet at the river's mouth. Since the slow uplift turned the narrow strait at Sault Ste. Marie into a river, the level of Lake Superior has been controlled by that barrier. Its isobase, parallel with that of the North Bay outlet, strikes the north shore near Grand Portage Bay, Minnesota. In the whole area south of this line the shores of the lake are now undergoing progressive drowning. If the submerged peat west of Sand Island lies close to the level of the original Nipissing beach this fact affords a more accurate basis for the study of many interesting problems relating to the history of the Nipissing Great Lakes. The occurrence of the submerged peat in the Apostle Islands is decidedly in accord with our present knowledge of the post-glacial history of the region.

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NORTH AMERICAN PHYLLOPODS

IN SCIENCE, February 27, 1931, Mr. C. H. Behre, Jr., has presented some interesting questions concerning the zoogeography, ecology, and natural history of *Branchinecta*. His paper has prompted the following notes and discussion.

The occurrence of *Branchinecta coloradensis* at high altitudes is not necessarily an index of relationship. If the species in question had resulted from isolation since the glacial epoch, it should be related morphologically to the species *B. paludosa* of the arctic. The genus *Branchinecta* has representative members in Brazil, Patagonia, Russia, Hungary, Australia, Asia Minor, Mongolia, Tibet, United States and the circumpolar regions of the north and south. In all, about thirteen species are now known, five of which occur in North America. The relationships of the various species have not been adequately considered. However, there is no more reason to believe *B. coloradensis* morphologically related to *B. paludosa* of the arctic than *B. granulosa* from Patagonia, *B. packardi* from Colorado, or *B. ferox* of Russia, Hungary and Asia Minor.

In a recent paper[1] I have shown the distribution of the two continental species of *Streptocephalus*. Since that time I have collected *S. sealii* in small pools in the jungle between Jalapa and Vera Cruz in the state of Vera Cruz, Mexico. *S. sealii* is now known northward as far as Medicine Hat, Alberta and southward to the *tierra caliente* of Vera Cruz, Mexico. The ranges of the two continental species overlap on the central plateau, but the remarkable thing ecologically is, that, as yet, the two species have not been taken together in the same pool.

Thamnocephalus platyurus, Streptocephalus texanus, and *Apus aequalis,* were taken near Cerritos, San Luis Potosi, Mexico, in a roadside pond on June 2, 1930. *Leptestheria compleximanus* was obtained on May 14, 1930, in pools of the Lago de Texoco in the Federal District, Mexico. A species of *Apus* found in the same region is, according to the peons, used as food during the occurrence of the phyllopod in the winter months.

Concerning the question raised by Mr. Behre of the method of establishment of a phyllopod fauna, it should be noted that probably all phyllopod eggs can withstand desiccation. Many possibilities exist for transportation of eggs. Wading birds, turtles, mammals including man, are possible transporters. We do not know, as yet, whether or not the eggs of phyllopods are viable after passing through the intestinal tract of vertebrate animals Many species of entomostraca have been reared from mud obtained by travelers in foreign lands. G. O. Sars has written several papers on entomostraca obtained in this manner.[2] This suggests the means by which ponds may become stocked with fairy shrimp and other entomostraca.

My observations with *Eubranchipus vernalis* lead me to believe that death normally occurs shortly after breeding. The males die first, and this is the probable explanation of the statement so often found in the literature on various species of Phyllopoda: the male of this species is unknown. A resting period of unknown length is necessary before the eggs can hatch. Thereafter the appearance of the fairy shrimps is

[1] E. P. Creaser, Occ. Pap. Mus. Zool. Univ. Mich., No. 217, 1930.

[2] G. O. Sars, *Skr. Vidensk. Christiania,* 95, 8, 1–56. *Arch. Naturv.,* 18, No. 2, 1–17. *Ibid,* No. 3, 1–81.

governed ecologically by factors such as temperature, rainfall, and the chemical constituents of the environment. In some instances drying of the eggs appears necessary.

It may be of interest to note that in the collections of the University of Michigan Museum of Zoology there are some specimens of *Branchinecta coloradensis* taken from a hollow in a boulder. These were obtained on Sept. 14, 1916, at Estes Park, Colorado, at an elevation of 8,000 feet.

It is quite apparent that the phyllopods are zoogeographically unruly. Ecologically they are profoundly interesting, and they certainly merit, as Mr. C. H. Behre, Jr., says, a detailed study of their life history.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A TECHNIQUE FOR FIXING AND REMOVING CHICK BLASTODISCS AND EMBRYOS FROM THE EGG SHELL

FOR some time I have been looking for a simple, rapid and effective method for removing blastodiscs and embryos from the egg shell which might be used both by the technician in making up quantities of whole mounts or serial sections, and one which can be readily acquired by students in the classroom who have had very little or no training in handling such delicate objects. The method outlined by Dr. M. F. Guyer in his "Animal Micrology" (p. 127) is very good, but in order to use it the worker must have had considerable experience. Because of this I have found it impracticable to use in the classroom when both time and material are limited.

The technique outlined by Dr. C. E. McClung in his "Handbook of Microscopic Technique" (p. 213) is the best I have so far been able to find, but in using the formal-nitric fixative recommended (three parts ten per cent. formalin to one part ten per cent nitric acid) I experienced difficulty in removing the vitelline membrane, and also in washing the blastodisc free from yolk. The length of time required by the McClung method for the fixative to act sufficiently to permit the removal of the blastodiscs or embryo was from fifteen to twenty minutes. During the past year and a half I have prepared several hundred whole mounts and serial sections of blastodiscs and embryos. By modifying the formal-nitric fixative suggested by Dr. McClung from three parts of 10 per cent. formalin and one part 10 per cent. nitric acid to four parts of 10 per cent. formalin and one part of 20 per cent. nitric acid, I have found that I can remove as many as sixty blastodiscs or embryos up to ninety-six hours' incubation within an hour and a half with the aid of an assistant, whereas the original method as outlined by Dr. McClung required from four to five hours to prepare the same number. Comparative studies of tissue fixed by the two different concentrations of the fixative did not reveal any differences in their effect upon cell structure.

The following is a summary of the procedure I followed:

(1) Incubate the egg to the desired stage.

(2) Remove the egg from the incubator to a finger-bowl filled with normal salt solution. (Seven to nine grams NaCl per liter of distilled water.)

(3) Using a pair of small forceps and curved scissors, remove the upper part of the egg shell to expose the blastodisc or embryo.

(4) Flood the blastodisc with several drops of the formal-nitric fixative. Remove the coagulated albumen and apply more of the fixative. Repeat this operation until the blastodisc is free from albumen. When all of the albumen is removed flood the blastodisc or embryo with the fixative and permit it to act for from one half to two minutes.

(5) Cut around blastodisc with curved scissors.

(6) By inserting a section lifter into the yolk under the blastodisc, lift the latter and transfer it to a Syracuse watch-glass filled with normal saline. Agitate the salt solution until the blastodisc is washed free from the yolk, and then transfer it to a watch-glass of fresh salt solution.

(7) Remove the vitelline membrane by grasping its free edge with forceps and move the membrane gently back and forth until it becomes free.

(8) Transfer the blastodisc, washed free from yolk and vitelline membrane, to a dish of Worchester's fluid.[1] (Nine parts ten per cent. formalin saturated with mercuric chloride to eleven parts glacial acetic acid.) It is desirable to place about a quarter of an inch of the fixative in a rather large flat-bottomed dish in order that the embryonic tissue being fixed will lay flat.

(9) Place the tissue in seventy per cent. alcohol containing iodine colored to that of port wine to remove the corrosive sublimate. (Three to ten hours.)

(10) Preserve in fresh seventy per cent. alcohol until ready for use.

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[1] Fixatives other than Worchester's may be used if desired, but for total mount work Worchester's is preferable since it has a tendency to leave the tissue tough rather than brittle as do many fixatives.