Several scores of well-preserved, small, spherical spores have been found in the ground-mass of finely divided "black" debris. It is this spore content which arrests our attention.

The spores bear the typical triradiate scar characteristic of pteridophytes. The spores vary in diameter from 65 to 75 micra. Although the color of the boghead is dark brown to "black," bleaching with chlorine or oxygen readily restores a bright yellow resinous color.

Similar spores are abundant in Upper and Middle Paleozoic rocks. Perhaps the most celebrated are those of *Sporocarpon furcatum* Dawson (*Foerstia ohioensis* White and Stadnichenko). In this plant, beautifully preserved tetrads are present in practically all specimens which I have studied. White and Stadnichenko[3] and Kidston and Lang[4] have published excellent figures of the tetrads.

Sporocarpon furcatum is generally considered as an alga,[5] because the thalloid body so far as known consists of small, simple, terminal dichotomously forked branches, occasionally circinnately coiled. In answer to letters of inquiry, both Professor Pia, of Vienna, and Professor Kräusel, of Frankfort-am-Main, the leading investigators of Paleozoic algae, say that they have not seen specimens. Kidston and Lang suggest that the spores are "resistant" and cutinized, and thereby avoid a dogmatic interpretation of systematic position. However, the thallus-like terminal branches are lignitized, as can be readily demonstrated by their dissolution with nitric acid and strong alkali. No algae are known to bear cutinized or resistant spores with the tetrad triradiate scar.

Thus we reach the inevitable choice between two possibilities: either the Cambrian spores from Swedish oil shale are those of terrestrial plants which had attained the pteridophytic level of development or they represent algal-like plants which progressed far along the direction towards the production of resistant spores. It is in this latter light that Kidston and Lang have viewed *Sporocarpon.*

It is not possible that the Cambrian spores from Sweden are related to any of the several species of *Pachytheca*. *Pachytheca*[6] is a genus of Silurian and Devonian calcareous organisms presumably algal in nature. These fossils are megascopic in size and have, at times, been considered to be calcitized eggs of trilobites. There is present, in well-preserved specimens, a large central cavity surrounded by a zone of radiating tubes, some of which are branched. No spores of *Pachytheca* are known. Some investigators[7] have called attention to the possibility that *Pachytheca* itself may be the fructification of a *Nematophyton*-like plant.

The Cambrian spores, for which no name is here proposed, are quite different from any other known Paleozoic spores. They conform most closely to those of the Psilophytales in size, lack of ornamentation and the proportionately large triradiate scar.

The boghead coals are conventionally interpreted as algal sapropelic carbonaceous sediments. The celebrated Permian boghead from Autun in France is variously considered to be algal, spore or even sphaerulitic. A boghead is a sediment which has the physical characteristics of a cannel coal but with a high "kerosene" content. It can be ignited with the flame of a match and yield the familiar odors of burning petroleum. The evidences upon which the algal opinion is based are not convincing. Even Zalessky's figures of Kuckersite are not persuasive.

The Swedish Kolm has the general appearance of a Carboniferous cannel coal. True cannels are composed chiefly of cutinized spores of various pteridophytes. The Cambrian age of the Swedish oil shale is not disputed by geologists. It is found in the Upper Cambrian with a characteristic trilobite fauna.[8] The sediment is properly termed a boghead, although specimens shrink and crack only slightly upon exposure to air. The shrinkage usually observed in fresh specimens of bogheads is due to the evaporation of volatile ingredients.

The chief interest in these early plant structures centers in their remote geological age. They are, as far as I have been able to ascertain, not only the oldest recognized spores but also are intriguingly suggestive of the antiquity of the tendency toward the attainment of the land-habit.

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A LAWN MARVEL

THE slime-moulds are probably survivors of that period in the history of life on the planet when the distinction between animals and plants had not yet been established. (To be sure, it is not clear even now.) They have animal affinities—amoeboid movement—in the vegetative stage and plant affinities—spore formation—in the reproductive stage. They creep about in rich soil, under leaves and in the spaces in rotten wood in search of food, but when growth is

[3] *Econ. Geol.,* 18: 238–252, 1923.

[4] *Trans. Roy. Soc. Edinb.,* 53: 597–601, 1924.

[5] M. Hirmer, "Handbuch d. Palaobotanik," 1: 109, 1927.

[6] P. E. Raymond, *Bull. Mus. Comp. Zool.,* 55: 165–171, 1931.

[7] See D. H. Scott, "Paleobotany" in Encyclopedia Britannica, 11th ed.

[8] *Olenus* zone; *Peltura* sub-zone.

over and they are ready to provide for the next generation, they issue into the light and form sporangia of many and often beautiful shapes in positions favorable for scattering their spores.

One of these interesting organisms is *Physarum cinereum* Persoon. McBride describes it as common in New England and west to the Black Hills and the Pacific Coast. I have not examined the literature in detail, but I feel sure its occurrence in the southern United States can not have been overlooked. I have seen it often in North Carolina. Twice have I found it in its marvelous habit of "fairy ring" formation—once some four years ago on my lawn in Wake Forest, N. C., and again there this morning. The man mowing the lawn early to-day reported a lot of "sut or something" on the grass; he "reckoned some dog with it on his back had been wallowing in the yard." From the porch I at once recognized the "fairy ring" of Physarum. There were three complete rings. One was eleven feet in diameter, the other two six feet. The one seen previously was fifteen feet in diameter. Beside these three, there were fragments of several others here and there. These observations not only extend McBride's range of this species, but also quite enormously the size of its rings. He makes it "a few inches."

The discoloration of the grass in a circular band about four inches wide is, of course, due to the plasmodium at maturity creeping up and covering the grass blades with their dark sporangia. These little masses of spores become ashy gray as they mature. The formation of the ring may be explained in this way. The small plasmodium forms and begins its growth at the center of the future ring. Approximately circular itself, it creeps outward in search of food in the soil and the disc becomes a band which extends as it grows. This continues until the organism is grown, the size of the ring being in proportion to the favorableness of the conditions. Then it extends no more, the naked protoplasm creeps out of the nourishing soil and ascends the grass blades for the making and dissemination of its spores.

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AGE OF THE URANINITE FROM THE RUGGLES MINE, GRAFTON CENTER, N. H.

DURING the summer and early autumn of 1936, I collected a large number of uraninite specimens from the Ruggles mine, which is located one and a half miles north 40° west from Grafton Center (Cardigan quadrangle), N. H. The larger crystals, up to three quarter inch, are usually much altered; however, in places small well-developed crystals, which appeared to be quite fresh, occurred in association with albite, the latter intergrown with apatite. The freshest crystals were broken down in stages and hand sorted under a binocular until all visible foreign material was removed. From this 82 milligrams, having a specific gravity of 7.02, were sent to Frederick Hecht, of Vienna, for a microchemical analysis. His determination revealed a very pure uraninite having 3.37 per cent. lead; 0.38 per cent. thorium; 76.38 per cent. uranium with 0.04 per cent. sulfur. If we assume the sulfur to be combined with ordinary lead and, therefore, deduct a corresponding amount from the lead determined, the analysis would give, by Kovarik's constants and the logarithmic formula, simplified as in the report of the Committee of the Estimation of Geologic Age of April 27, 1935, page 2, and the latest values furnished by A. Kovarik for the disintegration of uranium and thorium, an age of 302 millions of years, which seems to be Devonian.[1]

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THE DESIGNATION OF CLONAL GENERATIONS

THE use of the word clone, suggested by Webber (SCIENCE, 18: 501–503, 1903), has come to be generally used to designate horticultural varieties propagated asexually by budding or grafting. Varying bud strains become new clones and if valuable are given varietal names. Several have already been awarded United States patent numbers.

In the study of clonal varieties and strains in clonal selection, it is frequently desirable to use some method to designate the number of selections in lineal sequence made in certain bud progeny lines. For this purpose, the writer has in his notes made use of the symbols C_1, C_2, etc., to designate the clonal generations, as F_1, F_2, etc., are used in genetical studies to designate the filial generations. This use is illustrated in the genealogical records of individual citrus trees in the variety studies of the Citrus Experiment Station, of which the following is a sample:

P (*Corona Lemon Co., 1–27–11 on Sweet Orange roots, 1893*)
↓
C_1 (*Citrus Exp. Sta. ABC–22–15 on Sour Orange roots, 1918*)
↓
C_2 (*Citrus Exp. Sta. 3B–10–6 on Bessie Sweet Or. roots, 1927*)
↓
C_3 (*Citrus Exp. Sta. S1–B1–1 to 11 incl. on Rough Lemon roots, 1937*)

Some uniform method of designating clonal generations should be used, and the writer suggests the consideration of the method here described.

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[1] Private communication from Dr. A. C. Lane.