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# A Sub-surface Stratigraphic Marker in the Devonian Cedar Valley Formation

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## Introduction

Numerous spore-like bodies have been observed in the Cedar Valley formation of Late Devonian age during routine microscopic studies of cuttings from wells in East Central Iowa. The distribution of wells in which these individuals have been observed is shown on Plate 1. They occur above the basal sandy limestones of the Solon member in a zone approximately ten feet in thickness. Recently these spore-like bodies have been studied and the zone of occurrence correlated in an attempt to determine their value as a stratigraphic marker in sub-surface correlations. This paper should be regarded as an introduction to further study.

Dr. Charles Collinson and Alan J. Scott (1958) described a Chitinozoan (rhizopod protozoan) faunule from the Solon member in the Milan quarry in northwestern Illinois. There is apparently no resemblance between the specimens collected in the study in Iowa and those described by Collinson and Scott. A much more exhaustive study is necessary before any correlation can be made.

In 1947 Dr. L. R. Wilson, then of Coe College, examined some of the specimens from well cuttings and classified them as plant spores.

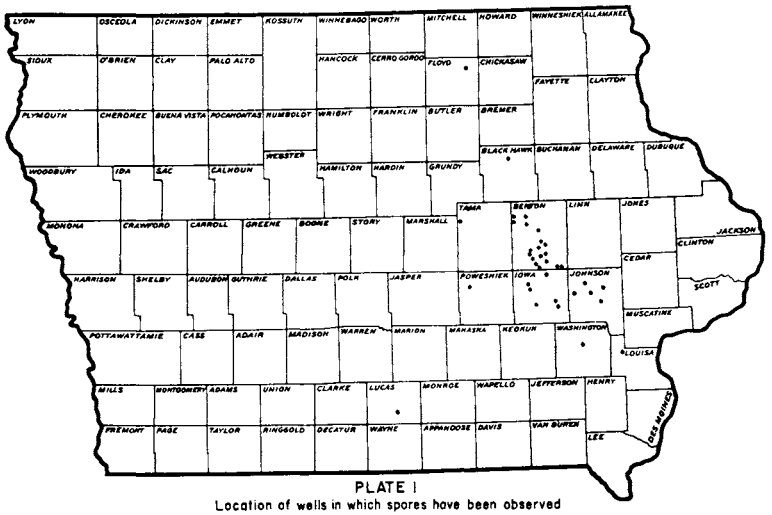



PLATE I
Location of wells in which spores have been observed

Therefore, for ease in discussion and for the presentation of the paper, I am adhering to the original premise that these individuals are of plant origin and will refer to them as "spores".

## Acknowledgments

All of the work in this study is being done as part of the routine work of the Iowa Geological Survey. The material is presented here with the permission of Dr. H. Garland Hershey, Director and State Geologist of the Iowa Geological Survey. To him and to various members of the staff the author is indeed indebted for their interest and helpful suggestions. I am extremely grateful to Dr. Wm. M. Furnish, Department of Geology, University of Iowa, for his aid in the camera lucida drawings.

## Methods of Study

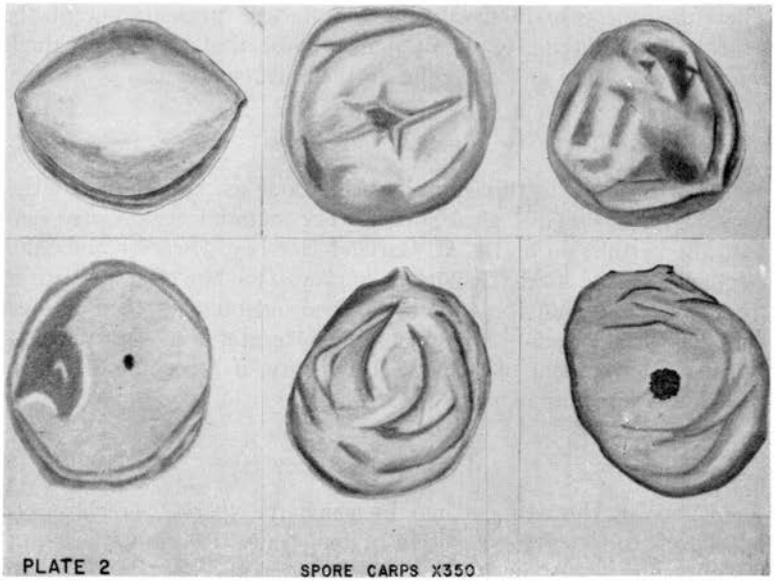
Portions of the well cuttings in which the spores were observed have been collected for a period of ten years. Recently these cuttings were dissolved in dilute hydrochloric acid. The clay particles and acid were decanted and water added. Then with the aid of a fine brush and a pipette the spores were placed on slides while wet. When dry the species adhered to the slides without cement and were well suited for handling and study. After study, the specimens were cemented in Canada balsam and these slides are now in the files of the Iowa Geological Survey. Samples from over 50 wells were prepared in this manner.

Camera lucida drawings were made because the spores are so small that photographic reproductions were not satisfactory.

## Stratigraphic Occurrence and Classification

The limestone in which these spores occur is gray, fine-grained, fossiliferous, granular to fractured, and argillaceous. These beds are undoubtedly shallow water deposits. The spore-bearing beds are approximately ten feet in thickness and occur commonly 20 to 30 feet above the base of the Cedar Valley limestone. Within the Rapid dolomite member of the Cedar Valley formation there occurs a light gray, mottled chert which is a good subsurface marker. The spore bearing horizon generally is found 50 to 60 feet below this chert.

The occurrence of marine invertebrate fossils—brachiopods, bryozoa, and crinoid stems—is more or less abundant in beds containing the spores. However the spores are not accompanied by any vegetive portion of the plants that produce them and may or may not be indigenous. They perhaps represent the *Psilophytales*—plants about which little is known. They are a bridge in plant evolution between




the Bryophytes (mosses) and Pteridophytes (ferns). Sir William Dawson first assigned this classification in 1859 to plant fossils of the Devonian of Canada and New York State.

Most of the specimens thus far collected are the spore-carps—the spherical or oval sacs which contain the spores. Under 10x magnification and direct light they appear spherical in shape, or in the flattened state as discs with rounded edges. They are rich amber to light brown in color, translucent, and waxy. The discs are somewhat thickened toward the circumference. The surfaces of many are raised into irregular folds owing no doubt to the collapsing of the sac at the time of the abortion of the spores, but some of the folds may be a result of compression at the time the sediments were consolidated. Most of the spore sacs measured .31 millimeters in diameter, however they range in size from .21 to .46 millimeters. Camera lucida drawings illustrating the size and shape of the spore-carps with an enlargement X350 are shown on Plate 2.

The spores themselves are quite primitive. They are spherical in shape and the surface is smooth. A few of them under 50x magnification show fine pitting on the surface. They are darker brown than the spore-carps and are approximately .05 millimeters in diameter.

## Summary

The spore zone is an excellent stratigraphic marker as can be seen from the cross section, Plate 3. The wells were chosen at random for

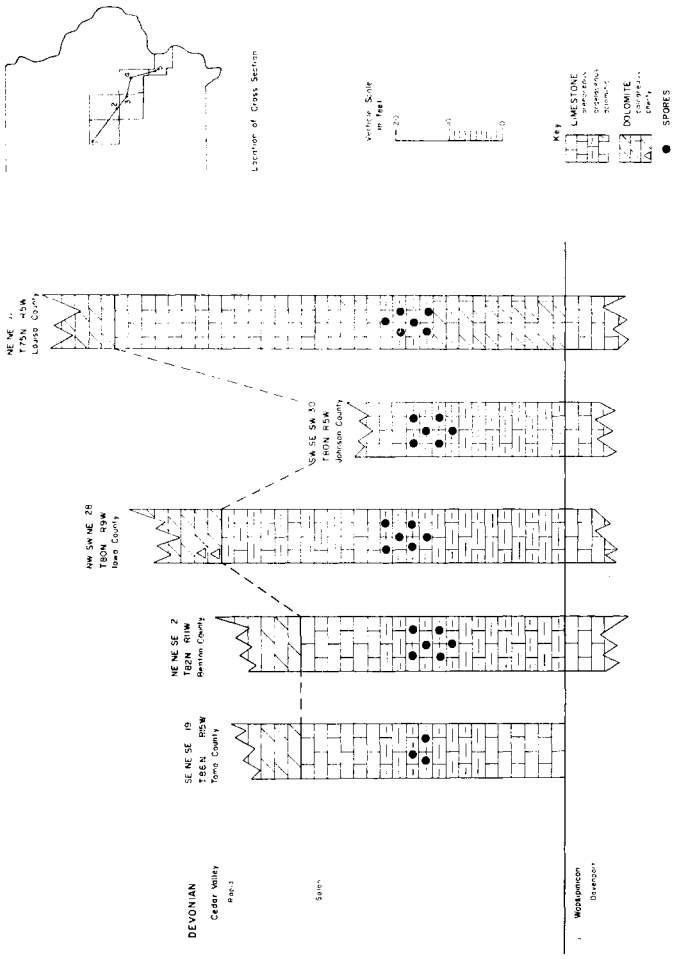



PLATE 3

Cross Section showing use of Spores in Stratigraphic Correlation

the cross section and a selection of any other wells would show similar correlations. The Solon member in the well in Louisa County is slightly dolomitic and the spore-carps have been preserved with no perceptible alteration. It is hoped that future study will enable us to make more accurate correlations in the southern and western parts of the state where the Cedar Valley formation becomes almost completely dolomitized and difficult to correlate. To date no systematic search for the spore zone has been made in this area.

Additional correlation between sub-surface and surface exposures is needed to determine the faunal zone in which these spores occur.

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