PALYNOLOGY OF THE CONIFER MACROFOSSIL HORIZON FROM THE HAMILTON QUARRY, KANSAS

by

Ralph E. Taggart and Mohammed Ghavidel-Syooki, 1988

Department of Geological Sciences, Michigan State University, East Lansing, MI 48824

Abstract

A total of 15 genera and 23 species of spores, prepollen, and pollen have been noted in the conifer-rich limestone horizon at the Hamilton quarry. The palynofloral composition indicates a Lower Permian age for the macrofossil horizon and suggests that the source vegetation was dominated by gymnosperms, including number of species of true conifers.

Introduction

The tan to gray limestone horizon from the Main Pit area of the Hamilton quarry is notable for the diversity of fossil material recovered to date, including terrestrial arthropods, fish, amphibians, and a terrestrial macroflora. The latter is significant in that it includes structurally preserved compression material of Walchian conifers. The deposit represents a channel fill cut into the Hartford Limestone of the Topeka Limestone Formation, Shawnee group, of Virgilian age (Anderson, 1974; Zidek, 1976). The Hamilton conifers have great potential for the elucidation of early patterns of diversification in the Coniferales and the age of the channel deposits is therefor of critical importance. The Palynology Laboratory at Michigan State University was approached to conduct a palynological analysis of the channel limestone. Materials studied included slides prepared by G. Rothwell (Ohio University) and matrix processed at Michigan State University.

The Palynoflora

The palynomorph taxa noted in the examination of the Hamilton samples are noted below. Some of these forms may represent new palynospecies but we will defer formal systematic analysis until more material has been studied.

Acanthotriletes

This spore genus is represented in the Hamilton assemblage by a single species, A. teretriangulatus Balme and Hennelly 1956 (Fig. 1.2). This particular species has been reported from the Lower Permian.

Alisporites

This bisaccate pollen genus is represented by three species in our samples: A. nuthalensis Clarke 1965 (Fig. 1.7), A. gracilis Segroves 1969 (Fig. 1.8), and A. indarraensis Segroves 1969 (Fig. 1.6). Quantitatively the Alisporites complex ranks second in importance behind Potonieisporites in the Hamilton flora. All three species are characteristic of the Lower Permian.

Falcisporites

F. zapfei (Potonie and Klaus) Leschik 1956 (Fig. 2.5) is a rare component of the Hamilton assemblage. Reported stratigraphic ranges span the Lower Permian.

Hamiapollenites

At least two species are represented in the Hamilton samples. H. perisporites (Jizba) Tschudy and Kosanke 1966 (Fig. 2.15-2.18) is a variable morphotype which is quite common in the samples studied while the second, H. saccatus Wilson 1962 (Fig. 2.14) is less frequently noted. Both are Lower Permian taxa.

Leiotriletes

A single morphotype of this spore genus was noted (Fig. 1.1). This form is very rare and was probably produced by a fern. Similar morphotypes occur from the Upper Paleozoic to the Recent so this occurrence has no stratigraphic significance.

Lueckisporites

L. virkkiae Potonie and Klaus 1954 (Fig. 2.7) is occasionally noted in Hamilton preparations. Stratigraphically the species ranges from Lower to Middle Permian.

Limitosporites

This single morphotype of this genus (Fig. 1.1Ø) is very rare at Hamilton. Similar forms are widespread in Permian strata.

Nuskoisporites

N. triangularis Potonie and Lele 1961 (Fig. 1.3) is an occasional component of the Hamilton assemblage. Although the genus ranges from Upper Carboniferous through the Permian, this particular species is diagnostic of the Lower Permian.

Potonieisporites

Monosaccate pollen assignable to this genus is the quantitative dominate of all of the samples we have examined. At least three morphotypes are represented: P. granulatus Bose and Kar 1966 (Fig. 1. 5), P. neglectus Potonie and Lele 1961 (Fig. 1.12), and a third form, which may be an undescribed species

(Fig. 1.4). Pollen of this type is produced by Walchian conifers and is known from rocks ranging from Upper Pennsylvanian through the Permian. The Hamilton taxa are restricted to the Lower Permian.

Protohaploxypinus

A single Lower Permian species, P. samoilovichii (Jansonius) Hart 1964 (Fig. 2.12) has been noted in the Hamilton flora and it is rare.

Striatites

S. splendens Tschudy and Kosanke 1966 (Fig. 2.6) is a Lower Permian form occasionally noted from the Hamilton samples.

Striatoabietites

Two morphotypes assignable to this striate-bisaccate genus have been noted at Hamilton. A single grain, similar to S. multistriatus (Balme and Hennelly) Hart 1966 (Fig. 2.9) was found. A second morphotype that is definitely assignable to this taxon (Fig. 2.10, 2.11) is very common. Lower Permian.

Striatopodocarpites

Two distinctive forms, sp. A. (Fig. 2.4) and sp. B (Fig. 2.8) were noted. The genus is distributed throughout the Permian.

Sulcatisporites

Two species of this bisaccate pollen genus were noted. S. splendens Leschik 1956 (Fig. 1.11,1.13) is a characteristic Lower Permian form. A second distinctive morphotype (Fig. 1.9) may represent an undescribed species.

Vittatina

Three morphotypes of this characteristic Permian taxon, V cf. subsaccata Samoilovich 1953 (Fig. 2.3), V. cf. verrucosa (Fig. 2.1), and an unassigned form (Fig. 2.2), were noted in the Hamilton samples. Similar morphotypes have been recorded from the Lower Permian of India, Pakistan, Iran, and the United States.

Age of the Assemblage

Palynologically, the Hamilton samples we have examined may be assigned to the Lower Permian with no ambiguity. The vast majority of the flora consists of Lower Permian taxa with the remainder composed of forms that range from the Upper Pennsylvanian through the Permian. There are no taxa diagnostic of the Upper Carboniferous nor are there taxa indicative of an exclusive Upper Permian assignment. The diversity of bisaccate gymnosperms (including striate types) and the paucity of spores is characteristic of Lower Permian Euro-American palynofloras.

Previous discussions of the evolutionary significance of the Hamilton Lebachia material (Rothwell, 1982) have treated the material as Upper Pennsylvanian. While the Hamilton Limestone, into which the channel is cut, is considered to be Virgilian (Upper Pennsylvanian), the channel fill deposits are, palynologically, Lower Permian in age. The palynological data are not inconsistent with a very early Permian assignment and it is probable that the complex of sediments at Hamilton may represent a boundary problem analagous to that presented by the Dunkard Group in Ohio and West Virginia (Cross, 1958). The biostratigraphic interpretation of these deposits is complicated by the potential for reworking of fossil material. We see no evidence for significant reworking of palynomorphs in the samples we have examined but the problem must be evaluated in any situations involving resistent fossil material.

Source Vegetation and Paleoecology

The palynological record from the megafossil horizon at Hamilton is exclusively terrestrial with no indication of marine or brackish water influence. The presence of macrofossil leaf and shoot material in the deposits suggests that the source vegetation was proximal to the depositional site and it is likely that the palynological assemblage is probably fairly representative of the source vegetation mosaic with little influence of winnowing or other selective transport. The extremely low diversity and abundance of spores would suggest that ferns and other cryptogams were rare components of the source vegetation. The preponderance of Potonieisporites suggests that the proximal communities were dominated by Lebachian conifers, an observation consistent with the Hamilton megafossil record. The relatively high diversity and abundance of bisaccate and striate bisaccate pollen types suggests the presence of more advanced conifers (cf. Ullmannia) and these may have grown at a somewhat greater distance from the depositional sites.

The successional status of the Hamilton source vegetation cannot be assessed without a study of the entire section. The limited data available however do suggest a range of relatively mature, conifer-dominated forest types. The paucity of material assignable to understory and ground level vegetation suggests that light may have been a limiting factor in these forests, effectively inhibiting the development of dense undergrowth beneath the main forest canopy.

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FIGURE 1

1 - <u>Leiotriletes</u> sp.

2 - <u>Acanthotriletes</u> <u>teretriangulatus</u> Balme and Hennelly 1965

3 - <u>Nuskoisporites</u> <u>triangularis</u> Potonie and Lele 1961

4 - <u>Potonieisporites</u> sp.

5 - <u>Potonieisporites</u> <u>granulatus</u> Bose and Kar 1966

6 - <u>Alisporites</u> <u>indarraensis</u> Segroves 1969

7 - <u>Alisporites</u> <u>nuthalensis</u> Clarke 1965

8 - <u>Alisporites</u> <u>gracilis</u> Segroves 1969

9 - <u>Sulcatisporites</u> sp.

10 - <u>Limitosporites</u> sp.

11 - <u>Sulcatisporites</u> <u>splendens</u> Leschik 1956

12 - <u>Potonieisporites</u> <u>neglectus</u> Potonie and Lele 1961

13 - <u>Sulcatisporites</u> <u>splendens</u> Leschik 1956

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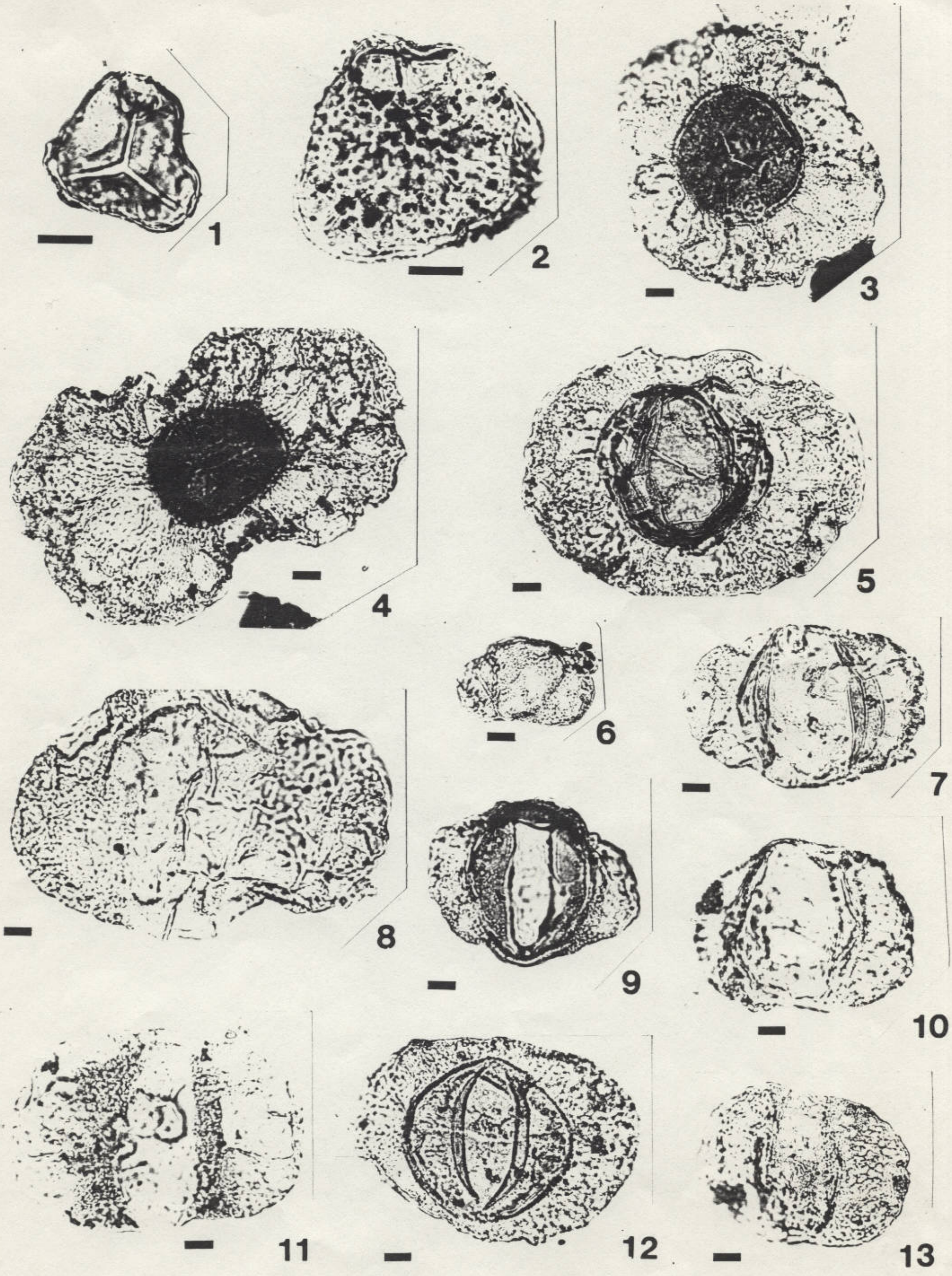

FIGURE 2

1 - *Vittatina* cf. *verrucosa* Tiwari 1968

2 - *Vittatina* sp.

3 - *Vittatina* cf. *subsaccata* Samoilovich 1953

4 - *Striatopodocarpites* sp. A

5 - *Falcisporites* *zapfei* (Potonie and Klause) Leschik 1956

6 - *Striatites* *splendens* Tschudy and Kosanke 1966

7 - *Lueckisporites* *virkkiae* Potonie and Klaus 1954

8 - *Striatopodocarpites* sp. B

9 - *Striatoabietites* *multistriatus* (Balme and Hennelly) Hart 1966

10 - *Striatoabietites* sp.

11 - *Striatoabietites* sp.

12 - *Protohaploxypinus* *samoilovichii* (Jansonius) Hart 1964

13 - *Protohaploxypinus* *samoilovichii* (Jansonius) Hart 1964

14 - *Hamiapollenites* *saccatus* Wilson 1962

15 - *Hamiapollenites* *perisporites* Tschudy and Kosanke 1966

16 - *Hamiapollenites* *perisporites* Tschudy and Kosanke 1966

17 - *Hamiapollenites* *perisporites* Tschudy and Kosanke 1966

18 - *Hamiapollenites* *perisporites* Tschudy and Kosanke 1966

~~2-? *Hamiapollenites* *perisporites* (Jizba) Tschudy and Kosanke 1968~~

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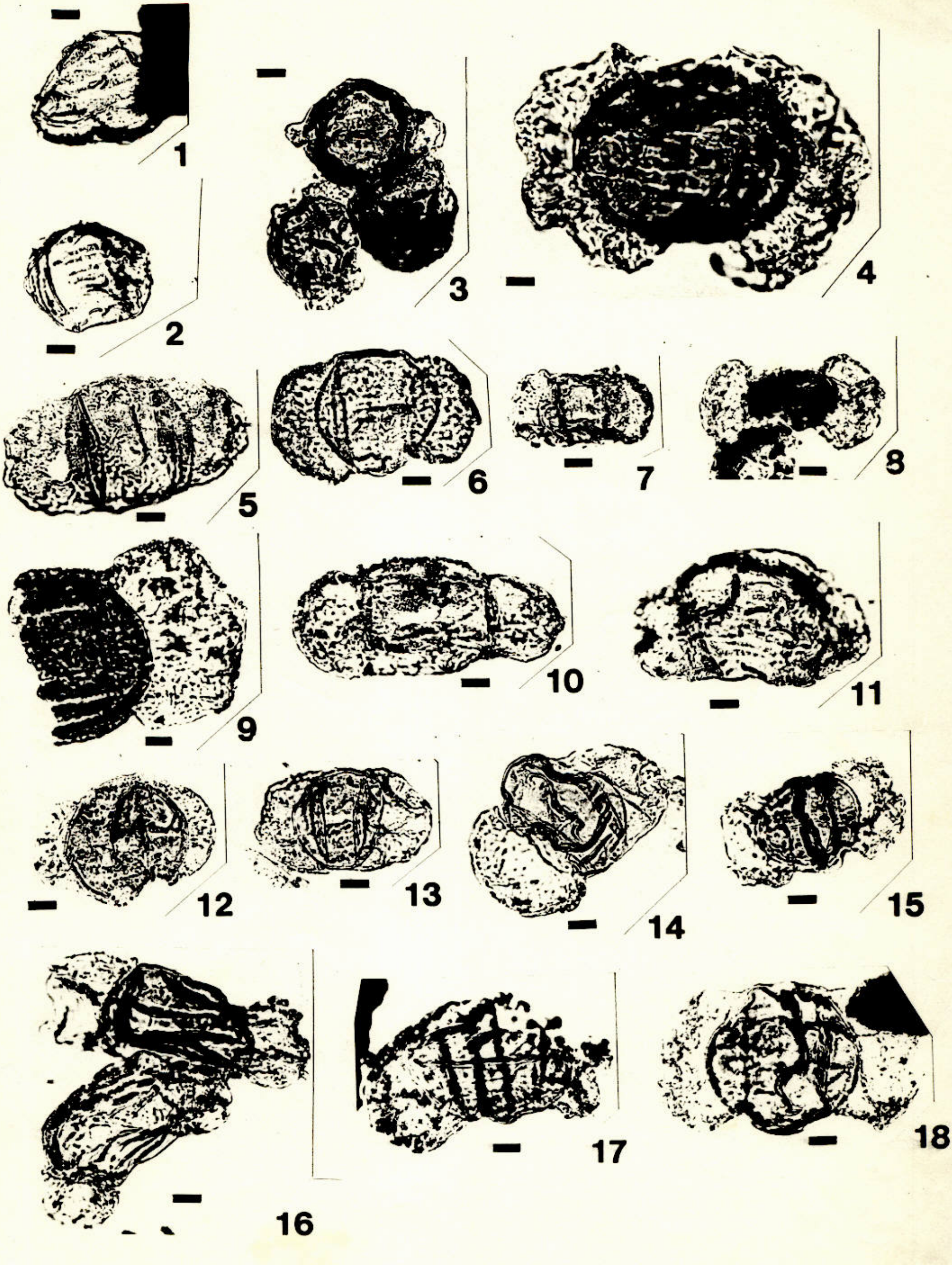
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