

Chapter WB

BIOSTRATIGRAPHY, WILLISTON BASIN

By D.J. Nichols

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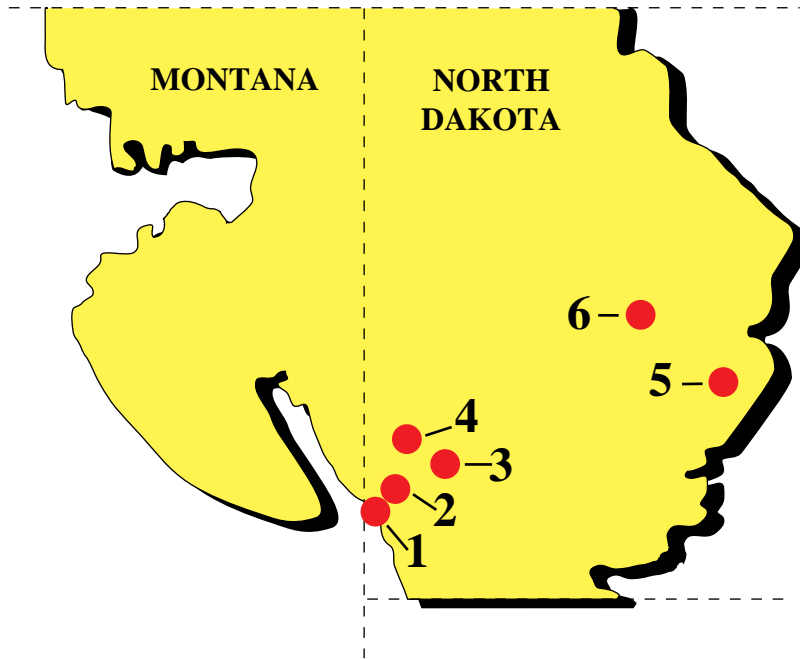
BIOSTRATIGRAPHY

- The most common fossils in coal and coal-bearing rocks are pollen grains and spores. Thus, biostratigraphy based on pollen and spores (palynostratigraphy) has been used to determine the age of the coal beds and coal zones in the Williston Basin.
- Palynostratigraphy in the Williston Basin ties reference sections (fig. WB-1) in selected outcrops and mines to subsurface data for correlation of coal-bearing intervals.
- Detailed analyses of occurrences and relative abundances of more than 100 taxa of fossil spores and pollen grains in about 70 samples from the reference sections were summarized and simplified to produce a practical palynological zonation.
- The zonation is based on 30 key taxa ranging through 500 m (about 1,650 ft) of composite stratigraphic section. Five of the six known Paleocene palynostratigraphic zones (fig. WB-2) have been identified in this interval, which includes the Ludlow, Tongue River, and Sentinel Butte Members of the Fort Union Formation.
- The principal coal zones (fig. WB-3) in the Williston Basin are the Hansen, Harmon, Hagel, and Beulah-Zap. These coal zones lie within palynostratigraphic Zones P3 through P5, in the middle to upper part of the Paleocene.

- Key coal beds in the Ludlow Member (fig. WB-4) in the Williston Basin have been placed within the palynostratigraphic zonation. The assemblage of fossil pollen that characterizes the Ludlow (fig. WB-5) is typical of the lower and middle Paleocene. These data contribute to the framework for correlation of all coal-bearing rocks in the basin.
- Key coal beds in the Tongue River Member (fig. WB-6) in the Williston Basin also have been placed within the palynostratigraphic zonation. The assemblage of fossil pollen that characterizes the Tongue River Member (fig. WB-7) is typical of the middle and upper Paleocene. These data also contribute to the framework for correlation of all coal-bearing rocks in the basin.
- Key coal beds in the Sentinel Butte Member (fig. WB-8) in the Williston Basin have been placed within the palynostratigraphic zonation. The assemblage of fossil pollen that characterizes the Sentinel Butte Member (fig. WB-9) is typical of the upper Paleocene. These data similarly contribute to the framework for correlation of all coal-bearing rocks in the basin.

REFERENCES

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- Warwick, P.D., Flores, R.M., Nichols, D.J., Murphy, E.C., and Obradovich, J.D., 1997, Fort Union chronostratigraphic and depositional sequences, Williston Basin, North Dakota, South Dakota, and Montana [abs.]: Geological Society of America, 1997 Annual Meeting, Abstracts with Programs, v. 29, no. 6, p. 204.



Biostratigraphic zonation of the Paleocene in the Williston Basin is based on palynologic analyses of samples from reference sections in southwestern North Dakota: (1) Pretty Butte, (2) Little Missouri River, (3) Rabbit Ears area, and (4) Medora West; and from (5) the BNI mine near Center and (6) the Coteau mine near Beulah, N. D.

Figure WB-1. Biostratigraphic reference sections in the Williston Basin.

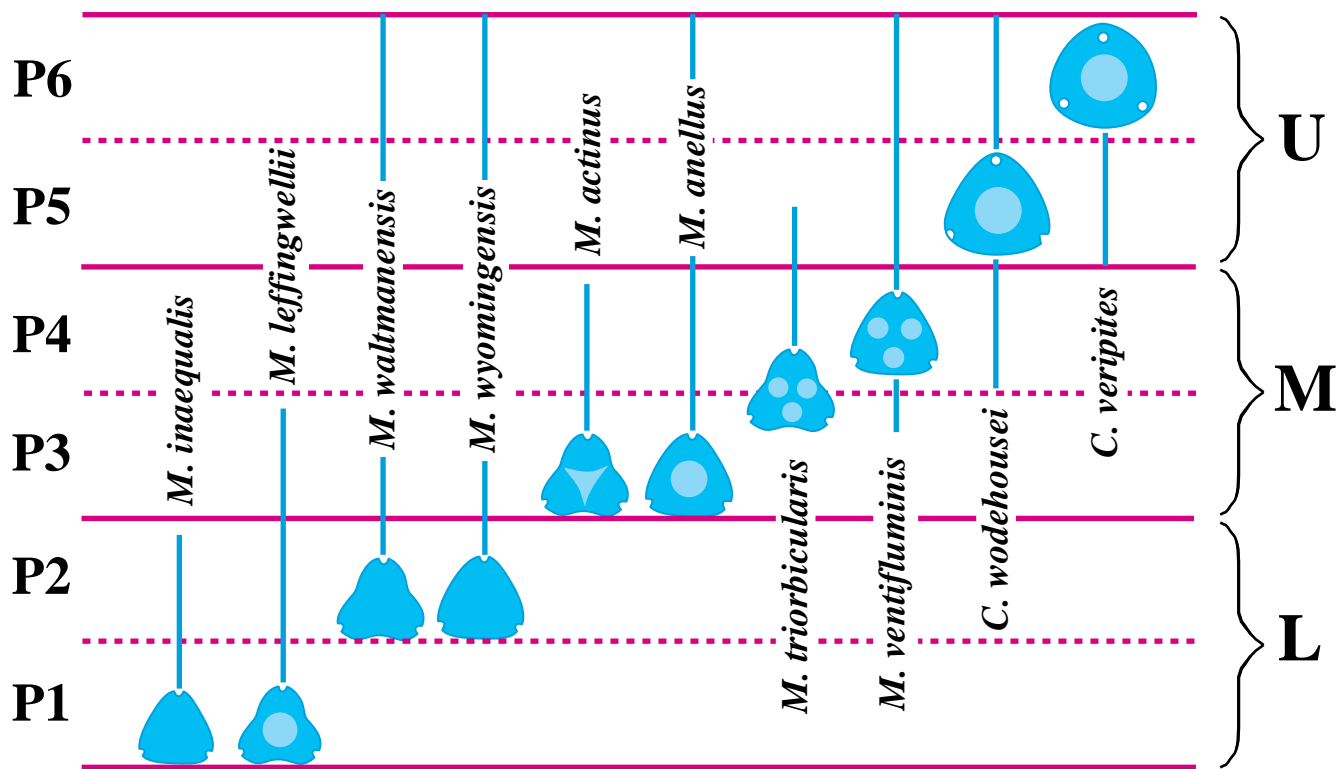
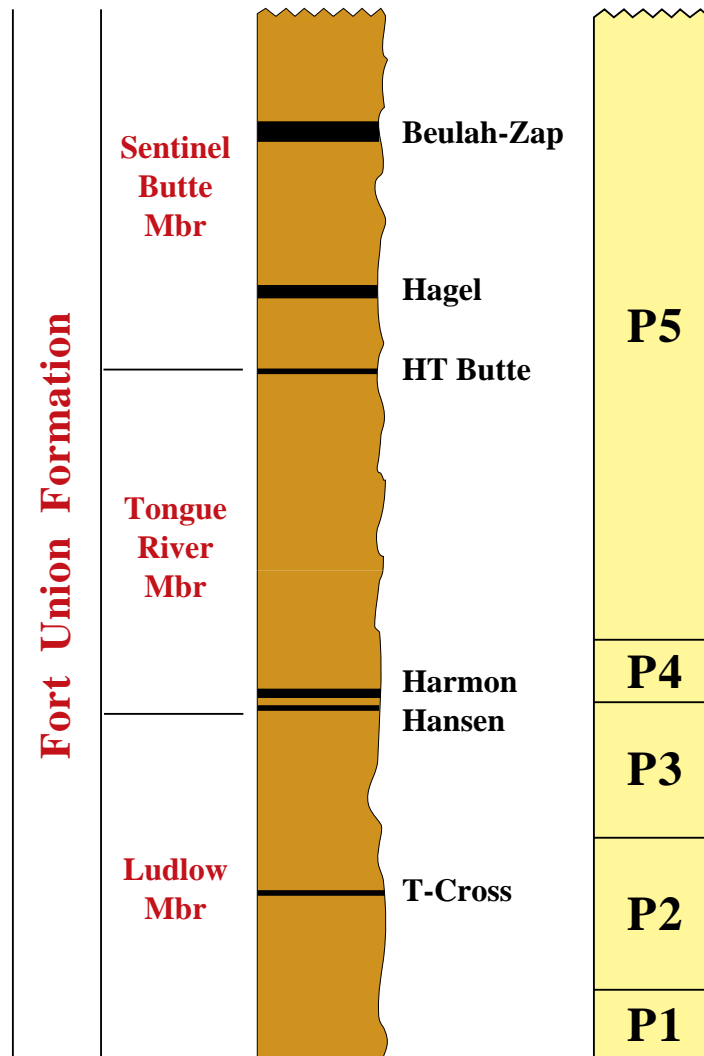


Figure WB-2. Occurrences of *Momipites* and *Caryapollenites* pollen and the definition of palynostratigraphic zones P1-P6. L, M, and U designate lower, middle, and upper Paleocene.



The palynostratigraphic zonation is based on ranges of 30 species of fossil pollen. The composite stratigraphic section includes 500 m (about 1650 ft) of coal-bearing Paleocene rocks in western North Dakota (uppermost Paleocene rocks in Zone P6 were not sampled). Positions of key coal beds in the composite section are shown.

Figure WB-3. Coal zones and palynostratigraphy of the Paleocene in the Williston Basin composite reference section.

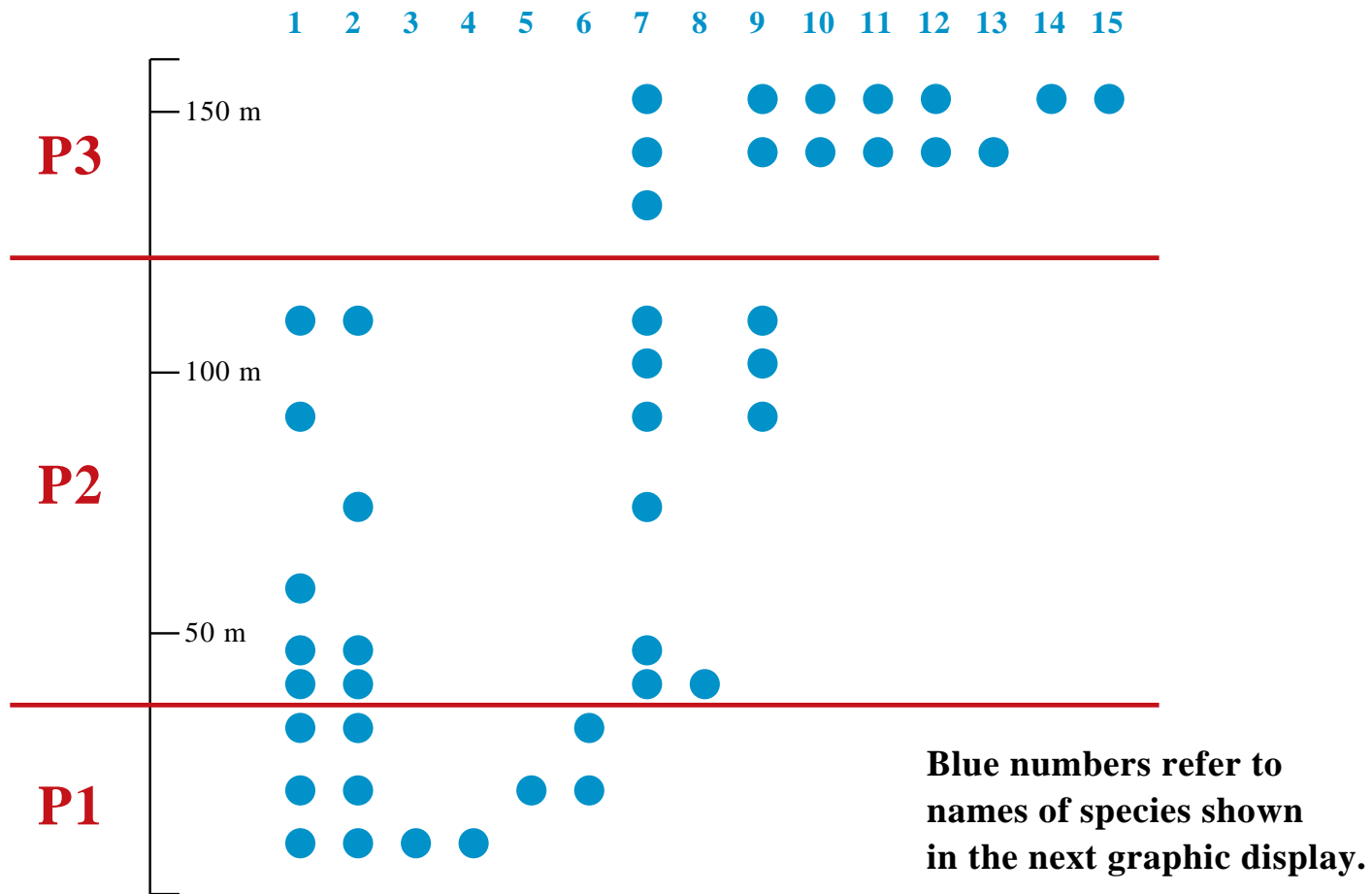
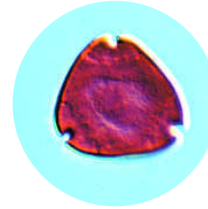


Figure WB-4. Distribution of biostratigraphically significant species in the Ludlow Member.

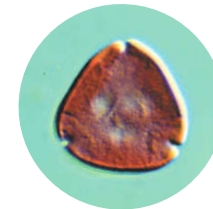
1. *Kurtzipites trispissatus*
2. *Kurtzipites circularis*
3. *Momipites inaequalis*
4. *Wodehouseia spinata*
5. *Aquilapollenites reticulatus*
6. *Discoidites parvistriatus*
7. *Momipites tenuipolus*
8. *Wodehouseia fimbriata*
9. *Triatriopollenites granulatus*
10. *Momipites leffingwellii*
11. *Momipites triorbicularis*
12. *Momipites waltmanensis*
13. *Insulapollenites rugulatus*
14. *Momipites anellus*
15. *Momipites ventifluminis*



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15.

illustrations of
selected specimens

Figure WB-5. Biostratigraphically significant species of fossil pollen from the Ludlow Member.

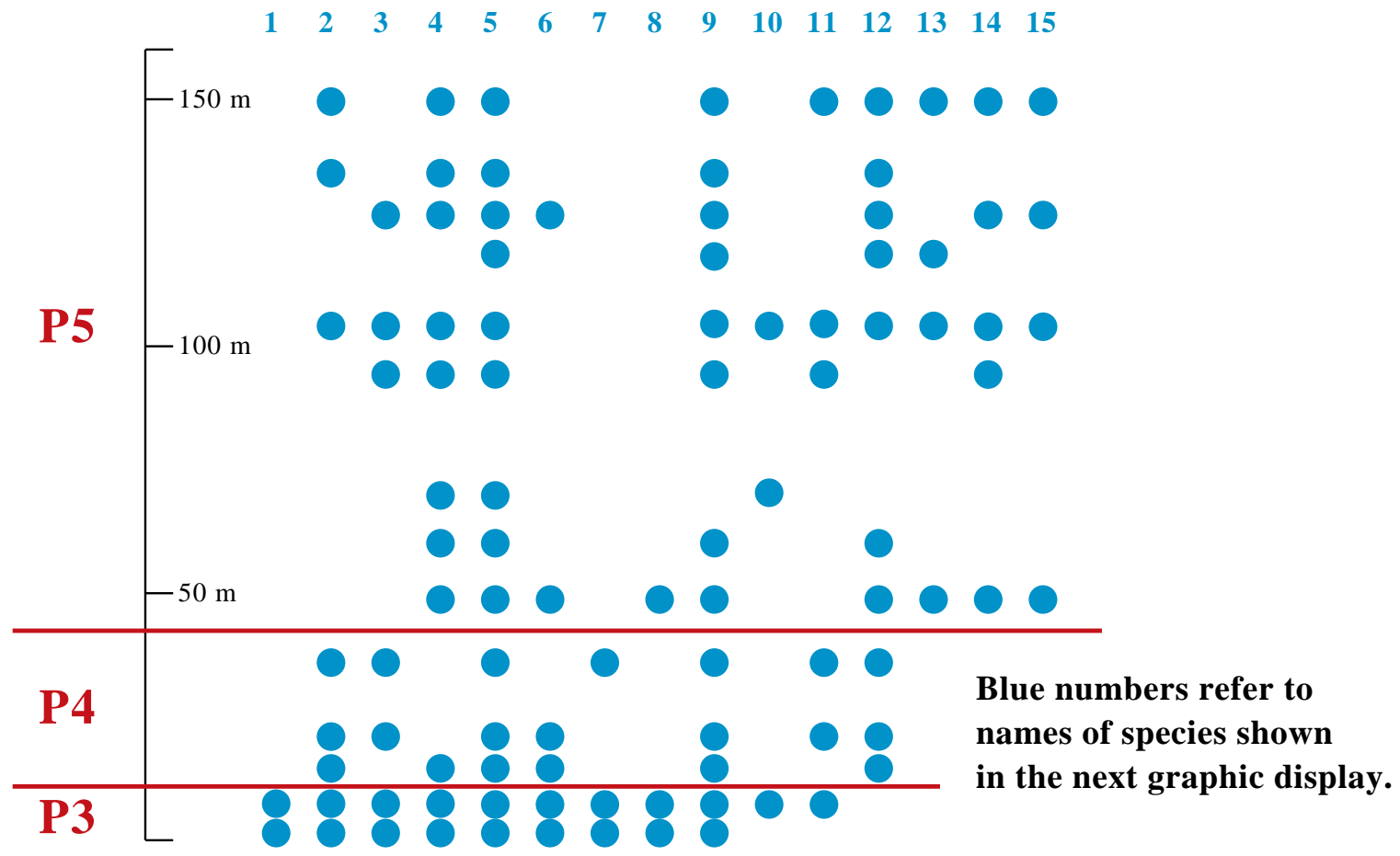
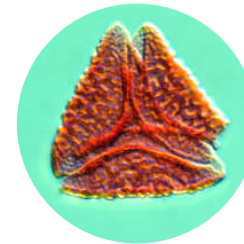
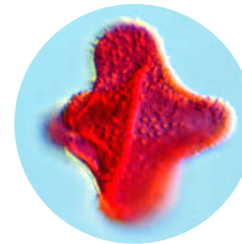


Figure WB-6. Distribution of biostratigraphically significant species in the Tongue River Member.

1. *Momipites leffingwellii*
2. *Momipites triorbicularis*
3. *Insulapollenites rugulatus*
4. *Momipites anellus*
5. *Momipites ventifluminis*
6. *Caryapollenites prodromus*
7. *Momipites actinus*
8. *Momipites leboensis*
9. *Momipites wyomingensis*
10. *Aquilapollenites spinulosus*
11. *Tilia vespipites*
12. *Caryapollenites wodehousei*
13. *Caryapollenites veripites*
14. *Pistillipollenites mcgregorii*
15. *Pseudoplicapollis* sp.



3.



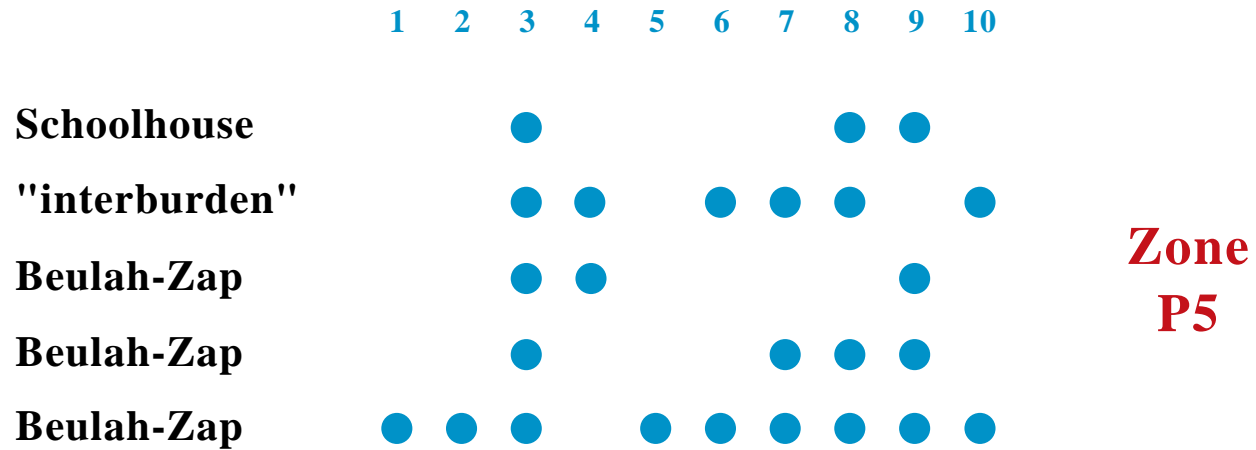
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illustrations of
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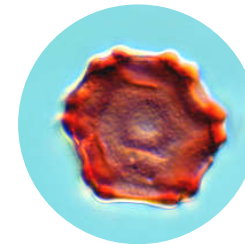
Figure WB-7. Biostratigraphically significant species of fossil pollen from the Tongue River Member.



Blue numbers refer to names of species shown in the next graphic display, where some specimens are illustrated.

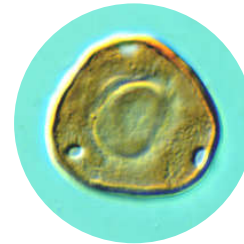
Figure WB-8. Distribution of biostratigraphically significant species in the Beulah-Zap seam and Schoolhouse rider, Sentinel Butte Member.

1. *Insulapollenites rugulatus*
2. *Momipites anellus*
3. *Momipites ventifluminis*
4. *Alnipollenites scoticus*
5. *Momipites amplus*
6. *Momipites wyomingensis*
7. *Momipites rotundus*
8. *Caryapollenites wodehousei*
9. *Caryapollenites veripites*
10. *Pistillipollenites mcgregorii*

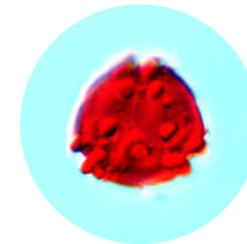


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illustrations of
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Figure WB-9. Biostratigraphically significant species of fossil pollen from the Sentinel Butte Member.