

Chapter PB

BIOSTRATIGRAPHY, POWDER RIVER BASIN

By D.J. Nichols

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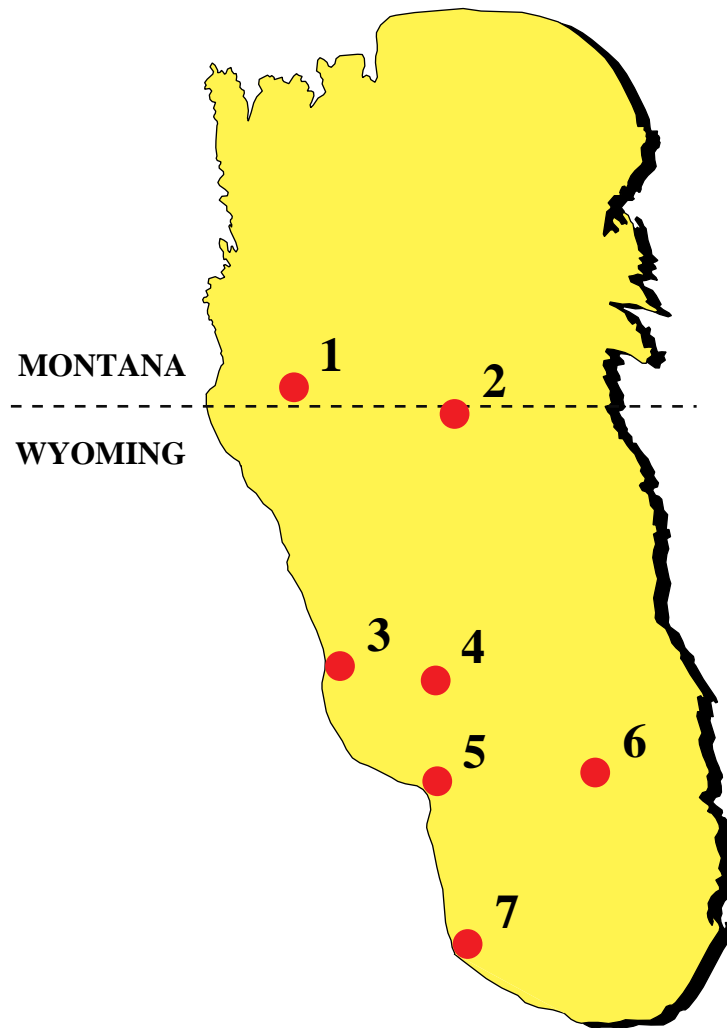
BIOSTRATIGRAPHY

- 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 Powder River Basin.
- Palynostratigraphy in the Powder River Basin ties reference sections (fig. PB-1) in selected outcrops and cores to subsurface data. Such data are used to correlate coal beds and coal zones.
- There are six palynostratigraphic zones (fig. PB-2) within the Paleocene of the Powder River Basin, designated (from lowest to highest) P1 to P6, which are defined by occurrences of certain species of fossil pollen.
- The principal coal zone being mined in the Powder River Basin is the Wyodak-Anderson (fig. PB-3). This coal zone is within palynostratigraphic Zones P5 and P6, in the upper part of the Paleocene.
- Palynostratigraphy reveals the areal distribution of coal deposits of late Paleocene age in the Powder River Basin (fig. PB-4). These deposits, which are all in palynostratigraphic Zones P5 and P6, are in the Wyodak-Anderson coal zone.

- Palynostratigraphy in the Gillette coalfield makes use of core from a USGS drill hole at the Black Thunder mine. Palynological samples from this core have been analyzed in detail, and a palynological database has been constructed from these data. Samples from other mines in the coalfield supplement this database.
- These data and others from similar studies are the basis of detailed correlations in the upper part of the Fort Union Formation (fig. PB-5) within and beyond the Gillette coalfield.
- Samples from the mines in the Decker, Montana, area yield fossil pollen that are characteristic of uppermost Paleocene Zone P6 (fig. PB-5). They indicate that the Anderson-Dietz and Dietz coal beds in this area are correlative with the upper part of the Wyodak-Anderson coal zone in the Gillette area.
- Fossil pollen and spores (fig. PB-6) also can reveal much about the composition of plant communities that inhabited ancient coal-forming mires, and thus can contribute to studies on the origin of coal.
- Detailed analyses of occurrences and relative abundances of fossil spores and pollen grains (fig. PB-7) in samples from Black Thunder core BT558 (USGS locality D7141) support studies on the origin and nature of the Wyodak-Anderson coal. Detailed analyses also help to refine the palynostratigraphic zonation (fig. PB-8).

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Biostratigraphic age determination of the Wyodak-Anderson coal zone is based on palynologic analyses of samples from seven reference sections:

- (1) two mines near Decker, Montana**
- (2) cores and outcrop sections in the Powder River area**
- (3) outcrop sections in the TA Hills area, south of Buffalo, Wyoming**
- (4) core from the Big George coal bed**
- (5) outcrops near Linch, Wyoming**
- (6) core from the Black Thunder mine**
- (7) the Dave Johnston mine near Glenrock, Wyoming**

Figure PB-1. Biostratigraphic reference sections in the Powder River Basin.

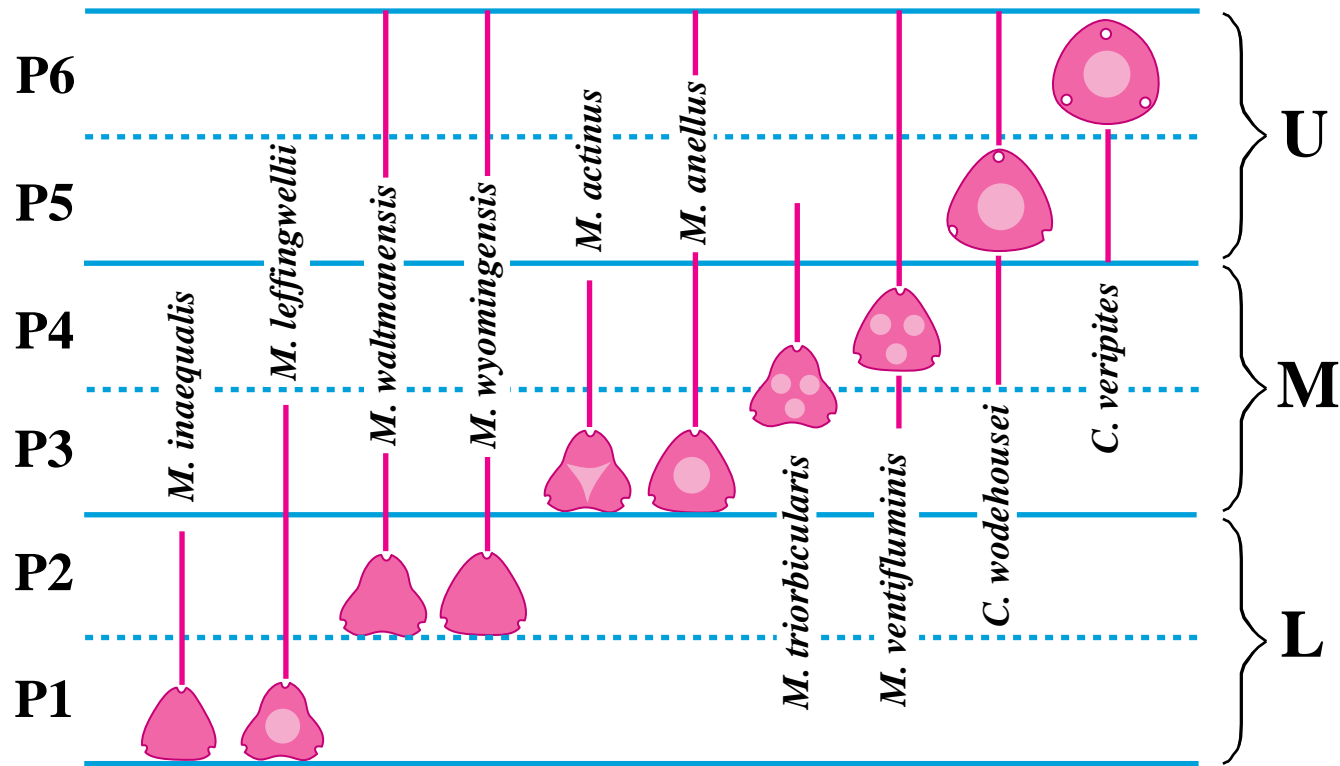
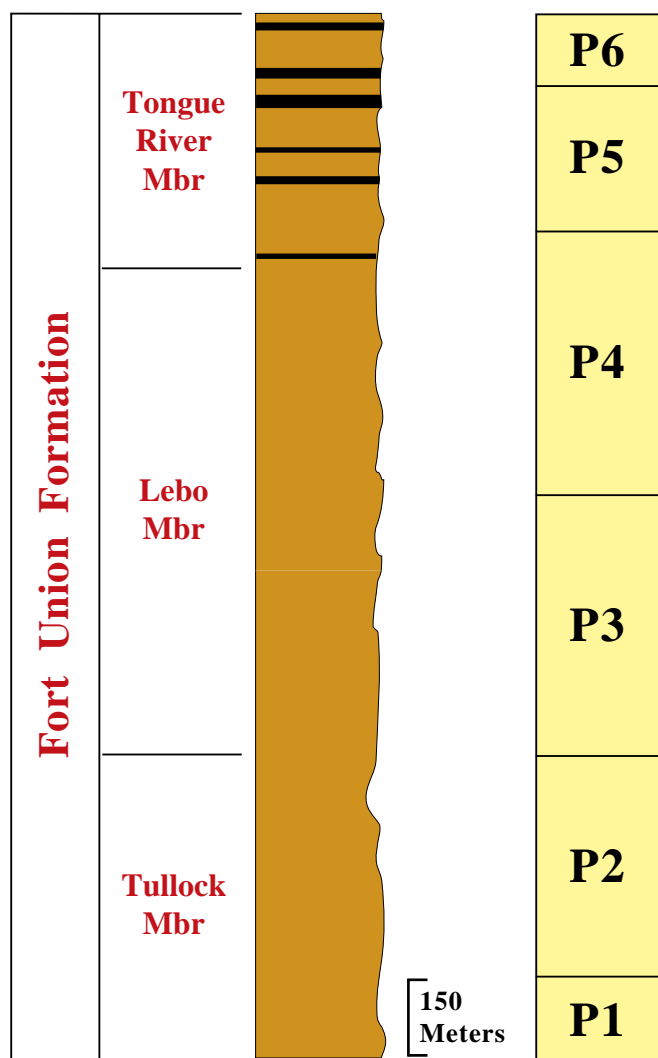
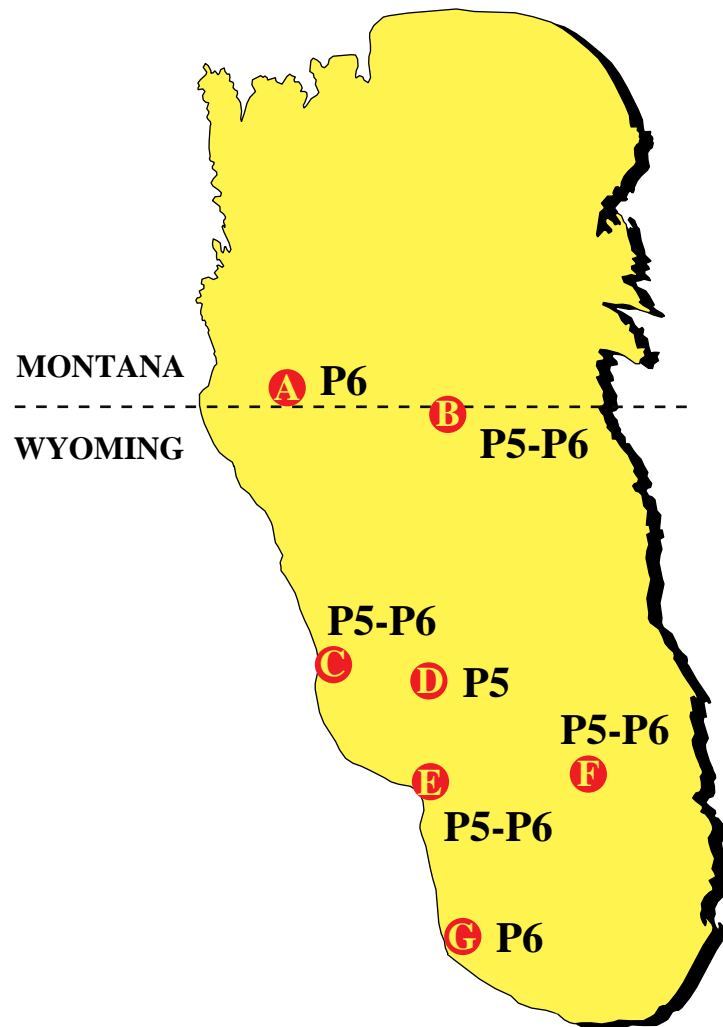


Figure PB-2. Occurrences of *Momipites* and *Caryapollenites* pollen and the definition of palynostratigraphic zones P1-P6. L, M, and U designate lower, middle, and upper Paleocene.



The palynostratigraphic zonation for the Powder River Basin is based on ranges of fossil pollen and spores composited from reference sections. These sections include outcrops and cores. The economically important deposits of the Wyodak-Anderson coal zone (uppermost three black lines in diagram) are in the upper Paleocene palynostratigraphic Zones P5 and P6. Other coal beds in the Tongue River Member are in Zones P4 or P5.

Figure PB-3. Coal zones and palynostratigraphy of the Paleocene in the Powder River Basin.



Age determinations of the Wyodak-Anderson coal zone are based on palynologic analyses of samples from seven reference sections:

- (A) two mines near Decker, Montana
- (B) cores and outcrop sections in the Powder River area, Montana and Wyoming
- (C) outcrop sections in the TA Hills area
- (D) core from the Big George coal bed
- (E) outcrop sections near Linch, Wyoming
- (F) core from the Black Thunder mine
- (G) Dave Johnston mine near Glenrock, Wyoming

Zones P5 and P6 are late Paleocene in age.

Figure PB-4. Summary of age data, Wyodak-Anderson coal zone, Powder River Basin.

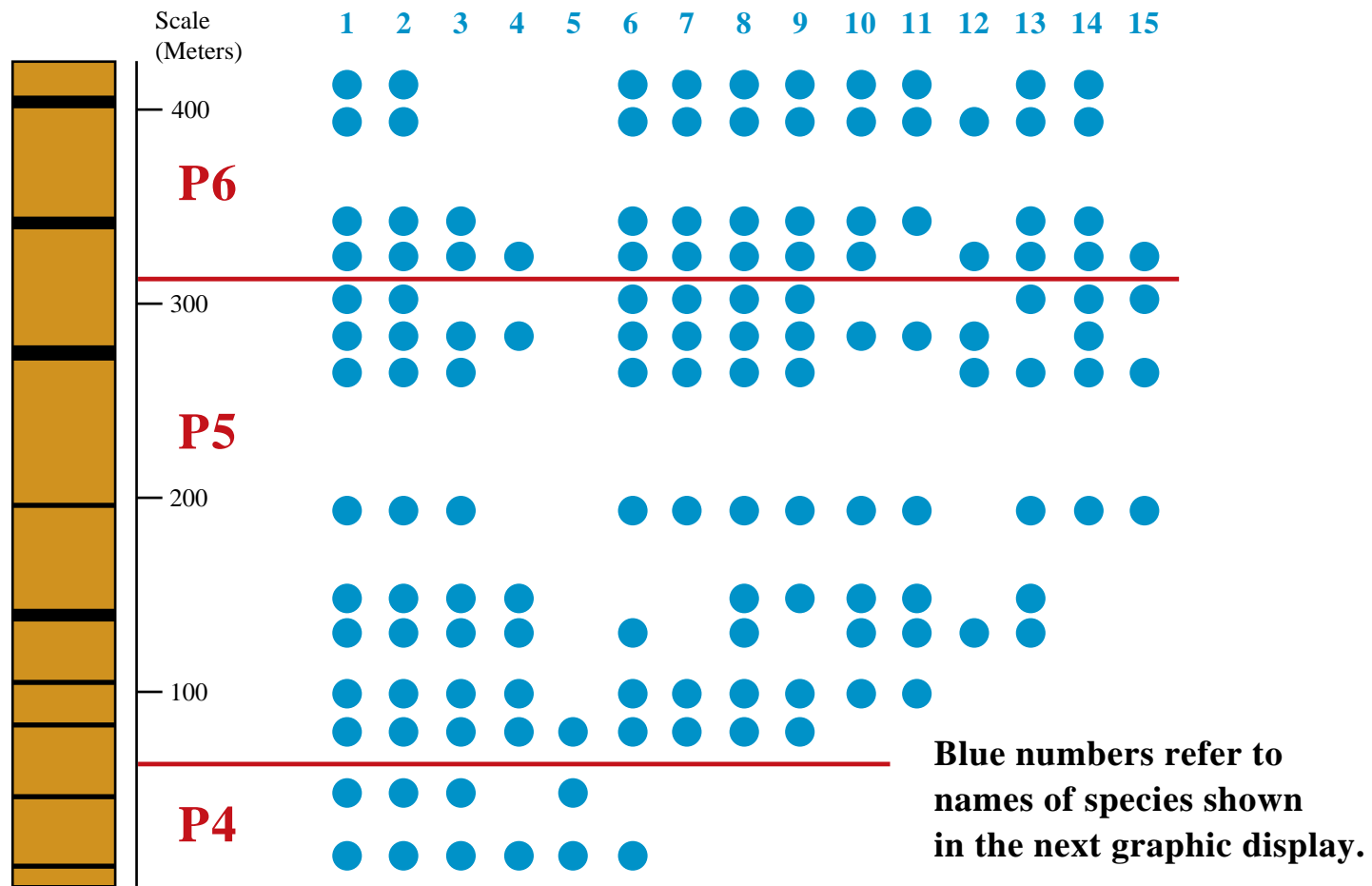


Figure PB-5. Distribution of biostratigraphically significant species in the upper part of the Fort Union Formation.

1. *Momipites ventifluminis*
2. *Momipites wyomingensis*
3. *Caryapollenites wodehousei*
4. *Triatriopollenites granulatus*
5. *Aquilapollenites spinulosus*
6. *Polyatriopollenites vermontensis*
7. *Caryapollenites inelegans*
8. *Caryapollenites veripites*
9. *Tilia vesicipites*
10. *Insulapollenites rugulatus*
11. *Talisiipites pulvifluminus*
12. *Alnipollenites scoticus*
13. *Periporopollenites* sp.
14. *Pistillipollenites mcgregorii*
15. *Paraalnipollenites* sp. cf. *P. confusus*

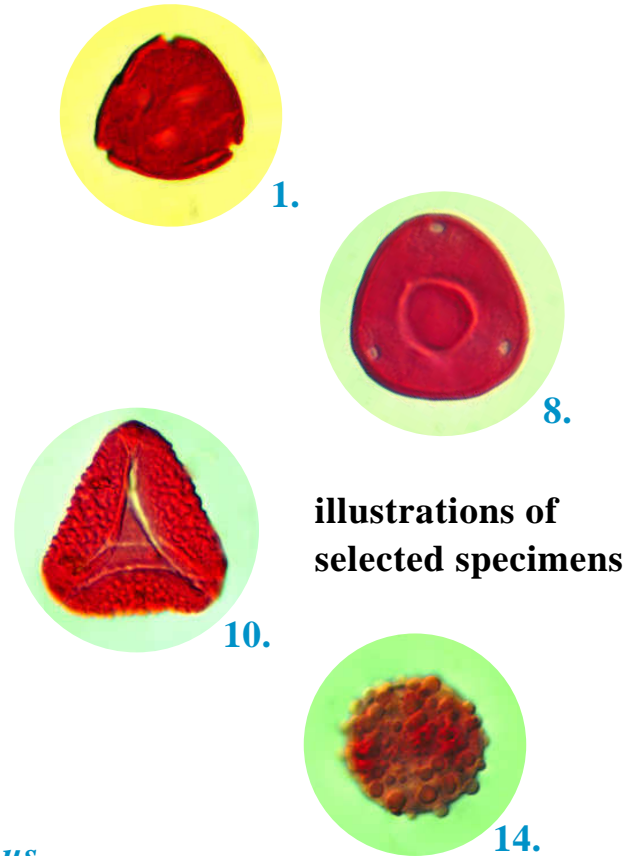


Figure PB-6. Biostratigraphically significant species of fossil pollen in the upper part of the Fort Union Formation.

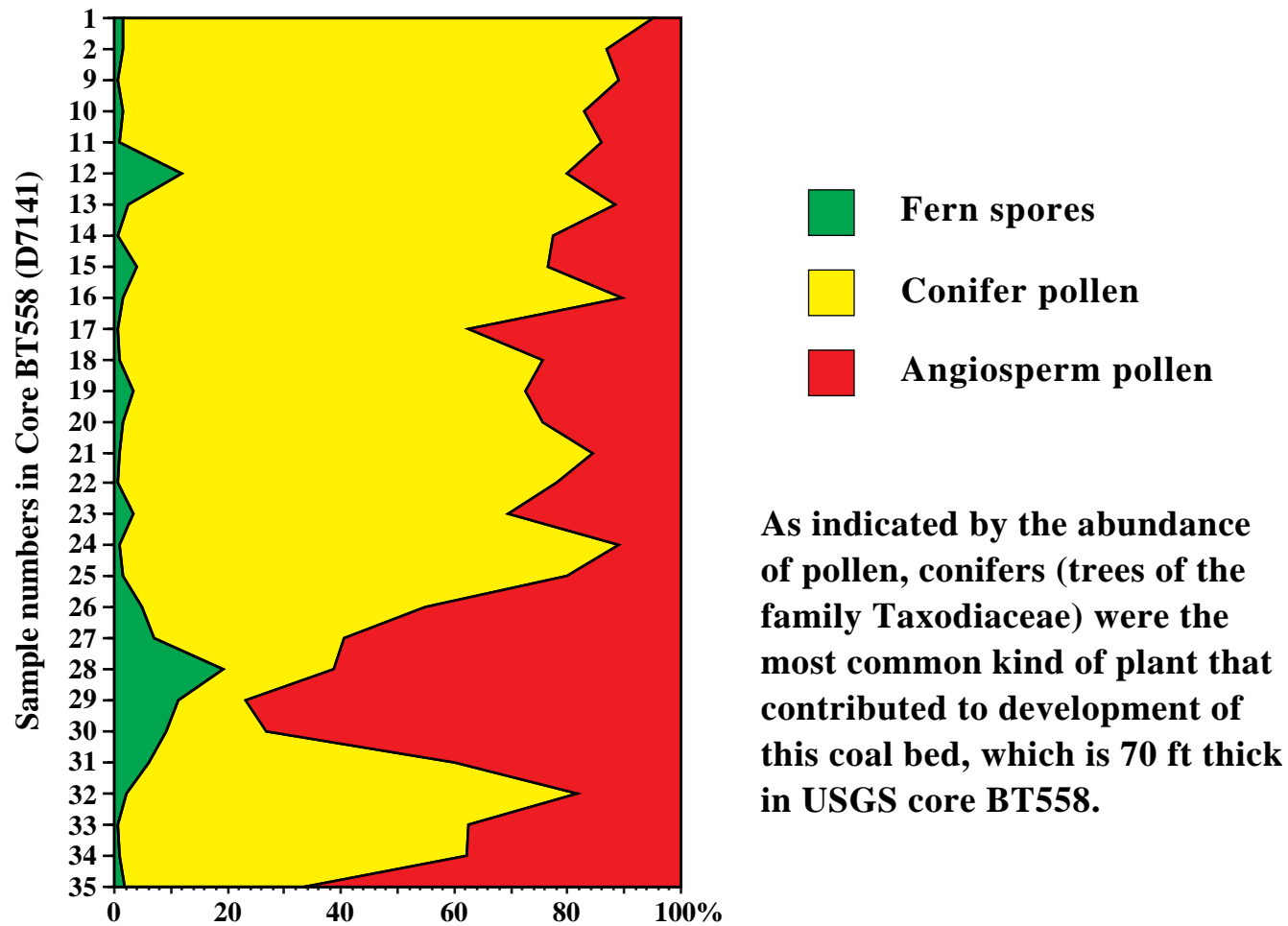
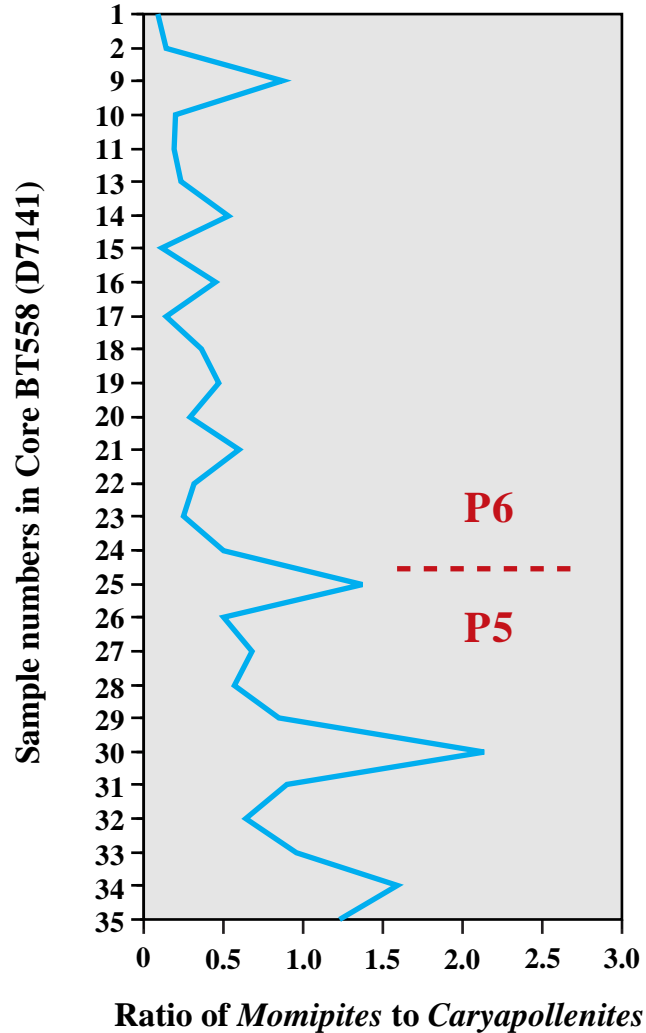


Figure PB-7. Relative abundances of major groups of spores and pollen in Wyodak-Anderson coal.



Detailed palynostratigraphic zonation of the interval is possible on the basis of the ratio between kinds of fossil pollen present in the coal. The ratio of the total number of specimens of all species of the genus *Momipites* to that of specimens of all species of the genus *Caryapollenites* is consistently less than 1.0 in uppermost Paleocene Zone P6. These data can be used to place the Zone P5-P6 boundary.

Figure PB-8. Ratio of relative abundances of selected pollen genera in Wyodak-Anderson coal.