**The Earth Through Time**

# Chapter 11—Late Paleozoic Events

**Multiple Choice Questions**

**Select the best answer.**

1. The late Paleozoic was the time of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

a. assemblage of Pangea

b. assemblage of Laurasia

c. Caledonian orogenics

d. Acadian orogenics

e. Hercynian orogenics

2. Laurenia and Baltica combined to form \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

a. Alleghenian

b. Pangea

c. Mississippi

d. Laurasia

e. Valtica

3. What is the name of the orogeny in late Carboniferous that resulted from Gondwana colliding with North America?

a. Alleghenian

b. Pangea

c. Mississippi

d. Laurasia

e. Valtica

4. Mountain building events of the Carboniferous Period lead to the formation of extensive continental deposits containing vast \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

a. schist clasts

b. carbonate deposits

c. shale

d. sandy shale or siltstone.

e. coal beds

5. The Mississippian Period was typified by epicontinental seas on the North American craton that lead to the deposition of the thick \_\_\_\_\_\_\_\_\_\_\_\_\_\_deposits.

a. coal beds

b. limestone

c. shale.

d. sandy shale or siltstone.

e. schist

6. What shape was the Pangea landmass at the end of the Paleozoic?

a. the land mass stretched out in a east-west orientation

b. the land mass stretched out in a north-south orientation

c. the land mass stretched out in a northeast-southwest orientation

d. equidimensional

e. rectangular

7. The Devonian North America featured \_\_\_\_\_\_\_\_\_\_.

a. passive margins on all sides

b. passive margin on three sides and on the fourth side a transcontinental arch surrounded by shallow seas

c. orogenic belts on two sides and a transcontinental arch surrounded by shallow seas

d. passive margin on one side, orogenic on another side and unknown on the last two sides

e. None of the above

8. What is the name of the sandstone deposited with the transgression of the Kaskaskia Sea?

a. Oriskany

b. Chattanooga

c. Mississippi

d. Upper Devonian

e. Lower Permian

9. What is the name of the clastic wedge formed during the Devonian?

a. Queenston

b. Catskill

c. Old Red

d. New Red

e. Newark

10. Why is the Chattanooga shale an important regional correlation marker?

a. Widespread

b. Easy to recognize

c. Can be dated ratiometrically

d. Locally restricted

e. All but d.

11. Which of the following is the depositional environment for the Chattanooga shale?

a. Fast moving water

b. Oxygen rich water

c. Stagnant oxygen deficient water

d. Volcanic magma

e. None of the above

12. Mississippian Limestones contained vast numbers of which type of fossil?

a. Oölites

b. Crinoids

c. Phytoplankton

d. Cyclothemic animals

e. Flatirons

13. During the Devonian the Williston basin was the site of reefs, evaporates, and oil formations. What type of structure was the Williston basin?

a. Open basin

b. Deep basin

c. Barred basin

d. Paradox basin

e. Oquirrh basin

14. The Mississippian and Pennsylvanian systems are separated by an extensive\_\_\_\_\_\_\_\_\_\_\_\_.

a. unconformity

b. Sandstone

c. Limestone

d. Mass extinction event

e. shale

15. The Pennsylvanian period of eastern and central North America is dominated by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

a. glacial depositional environments

b. marine depositional environments

c. island arcs

d. continental depositional environments

e. passive margin

16. During the Pennsylvanian cyclic sequences of marine and non marine strata groups called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ were formed.

a. limestone groups

b. sandstone surges

c. regional metamorphism

d. barred basins

e. cyclotherm

17. What rock type marks the transition from non marine to marine conditions in the Pennsylvanian cyclic sequences?

a. Coal

b. Limestone

c. Shale

d. Sandy shale or siltstone

e. Schist

18. What is the likely cause of the Pennsylvanian cyclic sequences of marine/non marine rocks?

a. earthquakes

b. local subsidence

c. isostatic rebound

d. worldwide sea level changes related to glaciation

e. All the above

.

19. During the Pennsylvanian period, mountains grew in the region centered on the present day Colorado. What caused the mountain building event?

a. Crustal stretching

b. Formation of Rodinia

c. Laurentia collided with Gondwana

d. Opening of the Atlantic Ocean

e. None of the above

20. Which of the following was a Pennsylvanian mountain range in the Colorado region?

a. Appalachian

b. Uncompahgre

c. Teconic

d. Sierra Nevada

e. None of the above

21. What is the name of the clastic red beds formed from weathering of the Colorado region?

a. Old Red Beds

b. Young Red Beds

c. St. Peter Sandstone

d. Tapeats Sandstone

e. Fountain Formation

22. What is the name of a restricted marine basin located in the Four Corners region during the Pennsylvanian period?

a. Illinois

b. Michigan

c. Barred

d. Paradox

e. Oquirrh

23. West Texas during the Permian period was characterized by

a. lagoons

b. reefs

c. basins

d. shallow submerged platforms

e. All of above

24. Laurentia collided with Baltica and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to produce the Acadian orogeny.

a. India

b. Avalon terrane

c. South America

d. China

e. Antarctica

25. The late Carboniferous Alleghenian orogeny resulted from North America colliding with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

a. Asia

b. Europe

c. Africa

d. Hawaii

e. None of the above

26. The Acadian orogenic belt extended from Newfoundland to \_\_\_\_\_\_\_\_\_\_\_\_.

a. West Virginia

b. Maryland

c. New Jersey

d. Florida

e. Ohio

27. The rapid sediment changes from sandstone to shale produced traps for \_\_\_\_\_\_\_\_\_\_\_\_\_ in the Catskill clastic wedge.

a. copper

b. petroleum

c. coal

d. diamonds

e. gold

28. In which direction (use modern orientation of North America) did the Acadian orogeny progress?

a. North to South

b. South to North

c. East to West

d. West to East

e. Northeast

29. The red beds of the Catskill Wedge were deposited in which of the following settings?

a. marine conditions

b. glaciation

c. braided streams

d. continental rise

e. lagoons

30. The Pennsylvanian system is characterized by coal seams formed from ancient \_\_\_\_\_\_\_\_\_\_\_\_\_.

a. continental rise sediments

b. continental shelf sediments

c. glacial deposits

d. plankton oozes

e. mangroves-like forests

31. The Allehenian orogeny extended from \_\_\_\_\_\_\_\_\_\_to Alabama.

a. New York

b. New Jersey

c. New Hampshire

d. Pennsylvania

e. Ohio

32. Rocks of the Appalachian Mountains have been pushed across the craton to the \_\_\_\_\_\_\_\_\_\_\_\_.

a. Northwest

b. Northeast

c. Southwest

d. Southeast

e. West

33. What is it called when basement rocks are not deformed while the overlying sedimentary rocks break and fold above?

a. Normal faulting

b. Basin and Range

c. Extensional tectonics

d. Thin-skinned tectonics

e. Passive margin

34. What are Novaculites?

a. An igneous rock type

b. A type of fossil

c. bedded cherts that have been subjected to heat and pressure

d. A course grained clastic rock

e. None of the above

35. The remnants of the mountains chains built during the Ouachita Orogeny are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

a. Taconic Mountains

b. Alleghany Mountains

c. Rocky Mountains

d. Ouachita Mountains

e. Sierra Nevada Mountains

36. Which of the following orogenic events took place in the Cordilleran?

a. Avalonian

b. Acadian

c. Alleghenian

d. Appalachian

e. Antler

37. The Sonoma orogeny resulted from which of the following events?

a. collision with a microcontinent

b. collision with Baltica

c. collision with China

d. collision with a volcanic island arc

e. collision with South America

38. The Caledonian orogenic belt produced the Caledonian classic wedge also called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

a. Queenston

b. Catskill

c. Paradox

d. Old Red Continent

e. St. Peter

39. During the late Paleozoic Gondwana was covered by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

a. glaciers

b. tropical forests

c. epicontinental seas

d. braided streams

e. Both a. and c.

40. Which of the following has been proposed as a mechanism for triggering the Paleozoic Gondwana ice age?

a. Burial of organic matter

b. Meteorite impact

c. Increase in free oxygen

d. Transgressions

e. Breakup of Pangea

**Answers to Questions**

1. a 11. c 21. e 31. a

2. d 12. b 22. d 32. a

3. a 13. c 23. e 33. d

4. e 14. a 24. b 34. c

5. b 15. d 25. c 35. d

6. b 16. e 26. a 36. e

7. c 17. a 27. b 37. d

8. a 18. d 28. a 38. d

9. b 19. c 29. c 39. a

10. e 20. b 30. e 40. a

**The Earth Through Time, 10th Edition**

**by Harold L. Levin**

# Chapter 11—Late Proterozoic Events

**Multiple Choice Questions**

1. The supercontinent that assembled during Late Paleozoic was called:

1. Rodinia.
2. Gondwana.
3. Laurentia.
4. Pangea.
5. Siberia.

Ans: d

Feedback: See page 304

2. What orogeny occurred during Devonian as a result of North America (Laurentia) and Europe (Baltica) colliding to form Laurasia?

1. Taconic
2. Acadian
3. Alleghanian
4. Appalachian
5. Antler

Ans: b

Feedback: See page 305

3. What orogeny occurred as a result of Gondwana colliding with Laurasia (North America and Europe) during Late Carboniferous?

1. Taconic
2. Acadian
3. Alleghanian
4. Caledonian
5. Antler

Ans: c

Feedback: See page 305

4. What characterizes Mississippian sedimentary deposits of the interior of North America?

1. clay-rich glacial deposits
2. clean, well-rounded sandstones
3. limestones with many criniods
4. continental red beds
5. shales, sandstone, and coal beds

Ans: c

Feedback: See pages 306 and 310

5. What characterizes Pennsylvanian sedimentary deposits of eastern North America?

1. clay-rich glacial deposits
2. clean, well-rounded sandstones
3. limestones with many criniods
4. continental red beds
5. shales, sandstone, and coal beds

Ans: e

Feedback: See pages 308 and 310

6. What is the name of the Late Paleozoic orogeny that occurred in the western U.S.?

1. Taconic
2. Antler
3. Alleghanian
4. Caledonian
5. Acadian

Ans: b

Feedback: See page 323

7. The Chattanooga Shale is a thin, but extraordinarily widespread, black or dark gray shale, which lacks fossils of bottom-dwelling invertebrates, and which contains uranium, finely disseminated pyrite and organic matter. These characteristics indicate that it accumulated in what type of depositional environment?

1. back-reef
2. clastic wedge
3. high-energy nearshore
4. oxygen-deficient ocean
5. oxygen-deficient coal swamp

Ans: d

Feedback: See page 306

8. What unusual Permian sedimentary deposit formed in a relatively deep marine basin in Wyoming, Montana, and Idaho?

1. uranium-rich shales
2. cherty limestones
3. phosphatic sediments
4. sodium and potassium salts
5. copper, zinc, and lead

Ans: c

Feedback: See page 326

9. What does the presence of tillites and striations on bedrock suggest occurred near the south pole during Permian?

1. sea level rises and falls
2. tectonic orogeny
3. downwarping of the Earth’s crust
4. glacial ice movement and melting
5. first appearance of reptiles

Ans: d

Feedback: See page 305

10. During Late Paleozoic, the South Pole was situated over what present-day continent, continent?

1. Antarctica
2. Africa
3. North America
4. Australia
5. South America

Ans: b

Feedback: See page 327

11. What are the two major North American cratonic sequences that formed as a result of transgressions during Late Paleozoic?

1. Sauk and Kaskaskia
2. Sauk and Tippecanoe
3. Kaskaskia and Tippecanoe
4. Kaskaskia and Absaroka
5. Sauk and Absaroka

Ans: d

Feedback: See page 306

12. What sediment was deposited in eastern North America after the Devonian Acadian Orogeny in the Appalachian region?

1. evaporites
2. reefs
3. shales
4. red beds
5. coal

Ans: d

Feedback: See pages 295, 309, and 311

13. The erosion of the Uncompahgre Mountains produced great wedge-shaped deposits of Pennsylvanian and Permian red arkosic sandstone (including the Fountain Formation), some of which is now exposed at the Garden of the Gods, Red Rocks Amphitheater, and the “flatirons.” In which state are these three places located?

1. New Mexico
2. Colorado
3. Utah
4. North Dakota
5. Arizona

Ans: b

Feedback: See page 309

14. The Delaware basin and other basins in West Texas and New Mexico had reefs around the edge, and were associated with evaporite deposits. What age are the deposits of these Late Paleozoic basins, which are now exposed in the Guadalupe Mountains?

1. Devonian
2. Mississippian
3. Pennsylvanian
4. Carboniferous (both Mississippian and Pennsylvanian)
5. Permian

Ans: e

Feedback: See pages 311-312

15. A typical Pennsylvanian cyclothem contains ten units marking the transgressions and regressions of inland seas. The lower half of the cyclothem consists of nonmarine sediments, which is overlain by what type of deposit?

1. nonmarine shales
2. marine shales and limestones
3. nonmarine sandstones
4. marine limestones and cherts
5. nonmarine conglomerates

Ans: b

Feedback: See pages 308 and 313

**Test 3**

**Multiple-Choice Questions**

1. What two orogenies during Late Paleozoic brought North America and Europe together as a combined land mass called Laurussia?

a. Hercynian and Allegheny c. Caledonian and Acadian

b. Cassair and Sonoma d. Grenville and Trans-Hudson

2. The first inland sea of Late Paleozoic is called

a. Absaroka Sea. c. Iapetus.

b. Kaskaskia Sea. d. Rodinia.

3. An additional collision occurred during Late Carboniferous when northwest Africa moved against the southern part of the Appalachian region. This encounter was called

a. Taconic Orogeny. c. Avalon Terrane.

b. Acadian Orogeny. d. Allegheny Orogeny.

4. During the passage from to time, highland source areas that provided the Chattanooga Shale were reduced and the quantity of muddy sediment decreased. Carbonates then became the most abundant and widespread kind of sediment in the epicontinental seas of the platform.

a. Devonian / Mississippian c. Mississippian / Permian

b. Devonian / Mesozoic d. Pennsylvanian / Permian

5. The Ouachita, Allegheny, and Hercynian orogenies represent the

a. mountain-building events in the Cordillera. c. suturing of Laurasia and Gondwanaland.

b. rifting event that formed the Iapetus ocean. d. deposition of the Catskill Clastic Wedge.

6. The Catskill clastic wedge is a result of erosion from uplifted highlands formed as a result of the

a. Acadian Orogeny. c. Allegheny Orogeny.

b. Taconic Orogeny. d. Caledonian Orogeny.

7. Minerals which are resistant to weathering and erosion (like quartz), but which have a high density are called

a. clastic sediments. c. chemical sediments.

b. heavy minerals. d. ore minerals.

8. The reason that the Chattanooga Shale has a high content of carbon (and uranium) is because it was deposited

a. along a passive plate boundary. c. in an oxygen-rich environment.

b. along an active plate boundary. d. in an oxygen-deficient environment.

9. The separation between the Kaskaskia and Absaroka cratonic sequences in North America is based on the presence of

a. widespread cyclothem deposition. c. changes in the fossil assemblage.

b. regional unconformities. d. absolute ages determined by radiometric techniques.

10. Gondwana experienced glacial conditions during

a. Silurian. c. Carboniferous.

b. Devonian. d. Permian.

11. The Uncompahgre Mountains, also called the ancestral Rockies, were the result of

a. the collision recorded by the Ouachita Orogeny.

b. the mountain-building event of the Sonoma Orogeny.

c. domal uplift due to the basin subsidence to the south and east during the Pennsylvanian.

d. uplift of crustal blocks along extensive vertical reverse faults.

12. The rock unit called Chattanooga is composed of

a. Upper Pennsylvanian conglomerates and sandstones.

b. Upper Permian red beds.

c. Upper Devonian to Lower Mississippian black shales.

d. Mississippian fossiliferous limestones and chert.

13. The Fountain Formation and the famous “flatirons” were formed from clastic sediments derived from the erosion and weathering of the

a. Ouachita Mountains. c. Allegheny Mountains.

b. Colorado Mountains. d. Sierra Nevada Mountains.

14. What group of particularly coarse sediments, including conglomerates, were deposited and form some of the resistant ridges of the Appalachian Mountains in Pennsylvania?

a. Sonoma Group c. Pocono Group

b. Dunkard Group d. Monongahela Group

15. The orogeny in southern Europe that is a contemporary of the Allegheny Orogeny in North America during Late Paleozoic is called

a. Grenville. c. Ellsmere.

b. Sonoma. d. Hercynian.

16. A dark gray concretionary variety of calcium phosphate used in the manufacture of fertilizers and other chemical products is

a. phosphatic shales. c. phosphorite.

b. phosphates. d. phosphorus.

17. Permian-Triassic disturbances of the Cordilleran region have been named the in British Columbia and the in the southwestern United States.

a. the ancient British rock group c. Mississippian Orogeny, American Orogeny

b. the Permian-Triassic Orogeny d. Cassiar Orogeny, Sonoma Orogeny

18. During Devonian, subduction of oceanic lithosphere beneath the western margin of the continent was initiated resulting in the beginning of a disturbance known as

a. Cassiar Orogeny. c. Antler Orogeny.

b. Sonoma Orogeny. d. Allegheny Orogeny.

19. Upper Paleozoic-Triassic cratonic sequences are called

a. Kaskaskia and Acardian. c. Catskill and Acadian.

b. Kaskaskia and Absaroka. d. Caskill and Absaroka.

20. The Alleghenian and Ouachita orogenies were events in the final assembly of the supercontinent called

a. Pangea. c. Gondwanaland.

b. Laurentia. d. Laurasia.

**Fill in the Blank**

1. The cyclic deposits, which are found in Pennsylvanian rocks of the Absaroka sequence and are used as a stratigraphic marker are called .

2. The final orogeny to affect the Cordilleran region during Paleozoic was the   
 .

3. The Catskill Delta is the result of the Orogeny.

4. Late Paleozoic was when most of the separate land masses of earlier periods were assembled into the great supercontinent called .

5. The Permian-Triassic disturbance of the Cordilleran region of British Columbia has been called the   
 .

1. The vast region of alluvial deposition found both in North America and Western Europe whose most famous formation is the Old Red Sandstone is called the   
    .

7. The displaced continental fragment that collided with the Appalachians by Late Devonian and resulted in the Acadian Orogeny was called .

8. A term applied originally to rocks suitable for whetstones in America that is applied to very tough, uniformly grained cherts composed of microcrystalline quartz is .

9. Upper Devonian shale found along the eastern margin of North America that is widespread, easily recognizable, and serves as a stratigraphic marker is called   
 .

10. The orogenic belt that bordered the interior platform of North America on the east from Newfoundland to Georgia, with its southwestward extension called the Ouachita orogenic belt is called the .

11. The Late Paleozoic orogeny that forms a great range of mountains across central Europe is called  
 .

12. The Caledonian and Acadian orogenies brought North America and Europe together as a combined land mass named .

13. The basin that lay adjacent to the ancient Uncompahgre Mountains by Middle Pennsylvanian and became restricted by thick beds of salt, gypsum, and anhydrite is called   
 .

14. The kind of deformation in which basement rocks are largely unaffected and the overlying “skin” of weaker sedimentary rocks breaks into multiple thrust faults is known as \_\_\_\_\_\_\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

15. Today carbon dioxide keeps our planet warm by trapping heat radiated from the Earth’s surface; this phenomenon is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**True-False**

1. In North America, Upper Paleozoic sedimentary rocks area divided into the Kaskaskia and Absaroka cratonic sequences. They both reflect the marine and non-marine sedimentation of that time interval.

2. The Catskill Group consists of predominantly marine sandstones and shales.

3. The Oriskany Sandstone of New York is an example of the sediment deposited during the regression of the Kaskaskia Sea.

4. The Catskill Delta of the late Devonian of the eastern margin of North America was characteristic of conglomerates and sandstones; however, further to the west a widespread sheet of muds produced the Chattanooga Shale.

5. Tillite and glacial striations over large areas of Gondwanaland (South America, Africa, Australia) indicate continental glaciation during Late Carboniferous and Permian.

6. The erosion of the Kaskaskia resulted in one of the most widespread regional unconformities in the world and therefore provides a basis for separating Carboniferous rocks into what we call Mississippian and Pennsylvanian rocks in North America.

7. The development of the Catskill clastic wedge was a result of erosion of highlands formed during the Acadian Orogeny.

8. Late Devonian and Mississippian Acadian Orogeny included episodes of mountain building involving folding and thrusting along a belt across Nevada to southwestern Alberta.

9. The Ouachita deformation during Mississippian and Pennsylvanian was the result of oceanic to continental plate collision.

10. Permian rocks of west Texas and New Mexico are commonly associated with reef and evaporite deposits.

**Answer Key**

**Multiple Choice**

1. c
2. b
3. d
4. a
5. c
6. a
7. b
8. d
9. b
10. c
11. d
12. c
13. b
14. c
15. d
16. c
17. d
18. c
19. b
20. a

**Fill Ins**

1. cyclothemes
2. Sonoma Orogeny
3. Acadian
4. Pangea
5. Cassiar Orogeny
6. Old Red Continent
7. Avalon Terrane
8. novacilite
9. Chattanooga Shale
10. Appalachian orogenic belt
11. Hercynian Orogeny
12. Laurussia
13. Paradox Basin
14. thin-skinned tectonics
15. greenhouse effect

**True/False**

1. T
2. F
3. F
4. T
5. T
6. T
7. T
8. F
9. F
10. T

# RESPONSES TO QUESTIONS ACCOMPANYING SELECTED FIGURES

FIGURE 11–1 (p. 304) Traveling south from the present location of Louisiana in the Pennsylvanian period you would cross into South America.

FIGURE 11–11 (p. 313) Limestone found in a cyclothem with under clay above it and sandy shale or siltstone below it is a freshwater limestone. Limestone with shale above and below it would represent a marine limestone. The beds above bed 10 would be nonmarine.

FIGURE 11–18 (p. 317) The Cherry Canyon Formation is a shale. In arid regions, shale typically forms slopes between more resistant strata.

FIGURE 11–20 (p. 318) The shale beds at point *x* are about the same age as the sandstone beds at point *y*. The two rock types represent facies changes in a single chronostratigraphic unit.

FIGURE 11–25 (p. 320) A syncline is clearly visible at this location. Folding occurred during the Allegheny Orogeny.

FIGURE 11–29 (p. 323) Because of its hardness and fine texture, novaculite is widely used as an abrasive and whetstone.

FIGURE 11–30 (p. 324) Sandstones predominate in the panhandle of Oklahoma because the panhandle region was close to highland source areas formed during the Amarillo Uplift. Farther from the source area in Kansas, only shales and carbonates are deposited.

FIGURE 11–33 (p. 325) The Antler Orogeny provided the highland source areas for accumulation of thick sequences of the clastic sediment depicted in the cross section.

FIGURE 11–37 (p. 326) Phosphates are extensively used as fertilizers that are essential to the production of a quantity of food sufficient to feed the Earth’s expanding human population.

FIGURE 11–38 (p. 327) Because stratified drift is commonly reworked and winnowed by glacial meltwater, it is better sorted than till and often exhibits discrete layers and lenses of sand and gravel.

FIGURE 11–41 (p. 331) The derrick is the tall structure needed to hoist drill pipe vertically and screw it onto the pipe already in the bore hole. In taking pipe out of the bore hole, it is similarly lifted vertically, unscrewed, and removed.