PART 8D: INFER THE GEOLOGIC HISTORY OF FIELD SITES

Now that you have developed knowledge and skills of relative and absolute dating, use them to analyze and interpret outcrops of rock at three field sites.

ACTIVITY 8.4

Infer Geologic History from a New Mexico Outcrop

Take a field trip to a surface mine (strip mine) in northern New Mexico, and use field evidence to infer the geologic history of the site.

ACTIVITY 8.5

Infer Geologic History from a Pennsylvania Outcrop

Take a field trip to a surface mine (strip mine) in northeast Pennsylvania, and use field evidence to infer all that happened to fossil plants that lived there long ago.

ACTIVITY 8.6

CSI (Canyon Scene Investigation) Arizona

Look into the Grand Canyon and analyze the scene using your geologic knowledge and skills.

PART 8E: CONSTRUCT AND INTERPRET A SUBSURFACE GEOLOGIC CROSS SECTION

Often geologists must infer geologic relationships that exist underground. One of the main tools available for this comes from wells. Some wells are drilled simply for exploratory purposes, to gather evidence of the subsurface geology. The evidence may be a core of rock or chips of rock from the well. When data from two or more wells are combined, then geologists use them to construct and interpret geologic cross sections.

ACTIVITY 8.7

Subsurface Geology Inferred from Well Data

Tear out the Activity 8.7 activity sheet. Part A is a cross section of five wells drilled along a west–east line. At the bottom of Part A are well logs for these wells. These logs are a record of the faults and rock units (layers) intersected by each well. The dip (inclination) of faults or any rock units that are no longer horizontal is also noted. You also need to know these lithologic descriptions of the rock units:

Unit 1: Cross-bedded eolian (wind-blown) sandstone

Unit 2: Brown-to-gray siltstone with shale zones and some coal seams

Unit 3: Parallel-bedded, poorly sorted sandstone

Unit 4: Conglomerate

Unit 5: Poorly sorted sandstone with some clay, silt, pebbles

Unit 6: Black, clayey shale

Unit 7: Parallel-bedded, well-sorted, coarse-grained sandstone

Unit 8: Black shale

Unit 9: Gray limestone

Complete the cross section in Part A like this. On each well (vertical lines), mark with ticks the elevations of the contacts between units (lightly in pencil). For example, in well A, Unit 1 extends from the surface (2400 feet) to 2100 feet, so make tick marks at these points; Unit 2 extends from 2100 to 2050 feet, so make ticks at these points; and so on. Label each unit number lightly beside each column, between the ticks.

Pay careful attention to the *dip* (inclination) *angles* indicated for faults and some rock units that are not horizontal. When you make tick marks, it is very helpful to angle them approximately to indicate dip (use a protractor). This is especially true if you encounter any *faults* in the cross section.

When you have all units plotted in the five wells, connect corresponding points between wells. (You are *correlating* well logs when you do this. You are also preparing a subsurface cross section of the type actually constructed by petroleum-exploration geologists.)

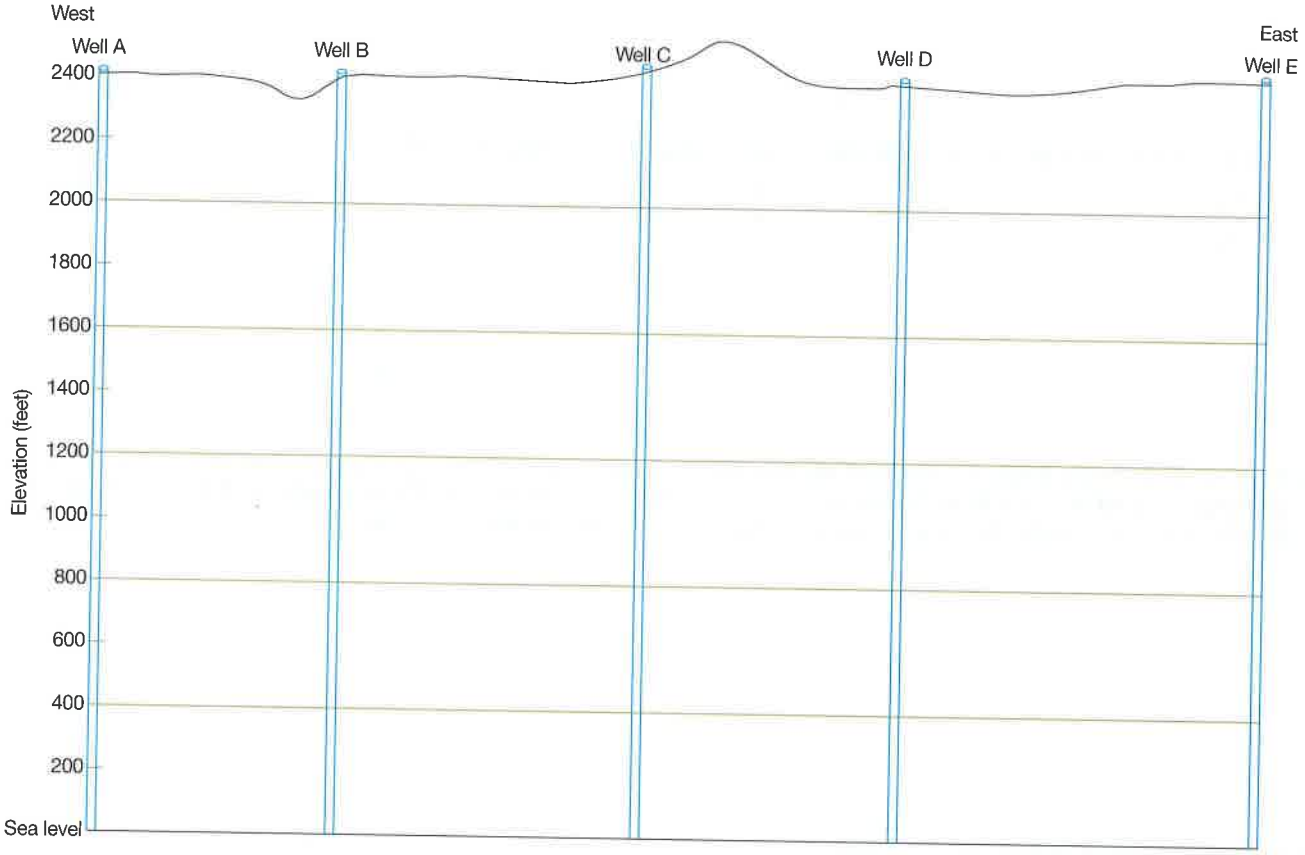
From the lithologic descriptions given, you can fill in some of the rock units with patterns—for example, sandstone (dots), conglomerate (tiny circles), and coal (solid black). Use the symbols given in Page 4 Then complete the questions in Part B of the activity.

ACTIVITY 8.7 Subsurface Geology Inferred from Well Data

Name: _____ **Course/Section:** _____

Materials: Ruler, protractor, pencil, one colored pencil.

A. Use the well data provided here, and instructions in the text (page 185), to construct a geologic cross section.



Well A

2400–2100	Unit 1, horizontal
2100–2050	Unit 2, horizontal
2050–1700	Unit 3, dips westward 15°
1700–1150	Unit 4, dips westward 15°
1150–800	Unit 5, dips westward 15°
800–550	Unit 6, dips westward 15°
550–200	Unit 7, dips westward 15°
Bottom of well	

Well B

2300–2100	Unit 1, horizontal
2100–1980	Unit 2, horizontal
1980–1650	Unit 3, dips westward 15°
1650	Fault; dips eastward 60°
1650–1350	Unit 4, dips westward 15°
1350–1000	Unit 5, dips westward 15°
1000–750	Unit 6, dips westward 15°
750–200	Unit 7, dips westward 15°
200–sea level	Unit 8, dips westward 15°
Bottom of well	

Well C

2350–2100	Unit 1, horizontal
2100–1900	Unit 2, horizontal; coal seam at 1950
1900–1700	Unit 3, dips westward 15°
1700–1150	Unit 4, dips westward 15°
1150–800	Unit 5, dips westward 15°
800–550	Unit 6, dips westward 15°
550–200	Unit 7, dips westward 15°
200	Fault; dips eastward 60°
200–100	Unit 9, dips westward 15°
Bottom of well	

Well D

2300–2100	Unit 1, horizontal
2100–1800	Unit 2, horizontal; coal seam at 1950
1800–1350	Unit 4, horizontal
1350–1000	Unit 5, horizontal
1000–750	Unit 6, horizontal
750–200	Unit 7, horizontal
200–100	Unit 8, horizontal
Bottom of well	

Well E

2400–2100	Unit 1, horizontal
2100–1650	Unit 2, horizontal; coal seams at 1950 and 1850
1650–1450	Unit 3, dips eastward 21°
1450–900	Unit 4, dips eastward 21°
900–550	Unit 5, dips eastward 21°
550–300	Unit 6, dips eastward 21°
300–200	Unit 7, dips eastward 21°
Bottom of well	

CONTINUED

B. Refer to the geologic cross section that you completed in Part A.

1. What is the nature and geologic origin of the bottom contact of Unit 2?

2. Why is coal not found in wells A and B, whereas two coal seams are found in well E?

3. Wells A and E are **dry holes,** so-called because they produced no petroleum. But the others produce petroleum. An oil pool is penetrated in well B from 750 feet to 650 feet, in well C from 550 down to 500 feet, and in well D from 750 down to 500 feet. Color and label the oil pools on the cross section and explain why the oil was trapped there.

4. Why is there no oil in either well A or well E?

5. Using the laws of original horizontality, superposition, and cross cutting (page 176) describe the sequence of events that developed this geologic cross section.

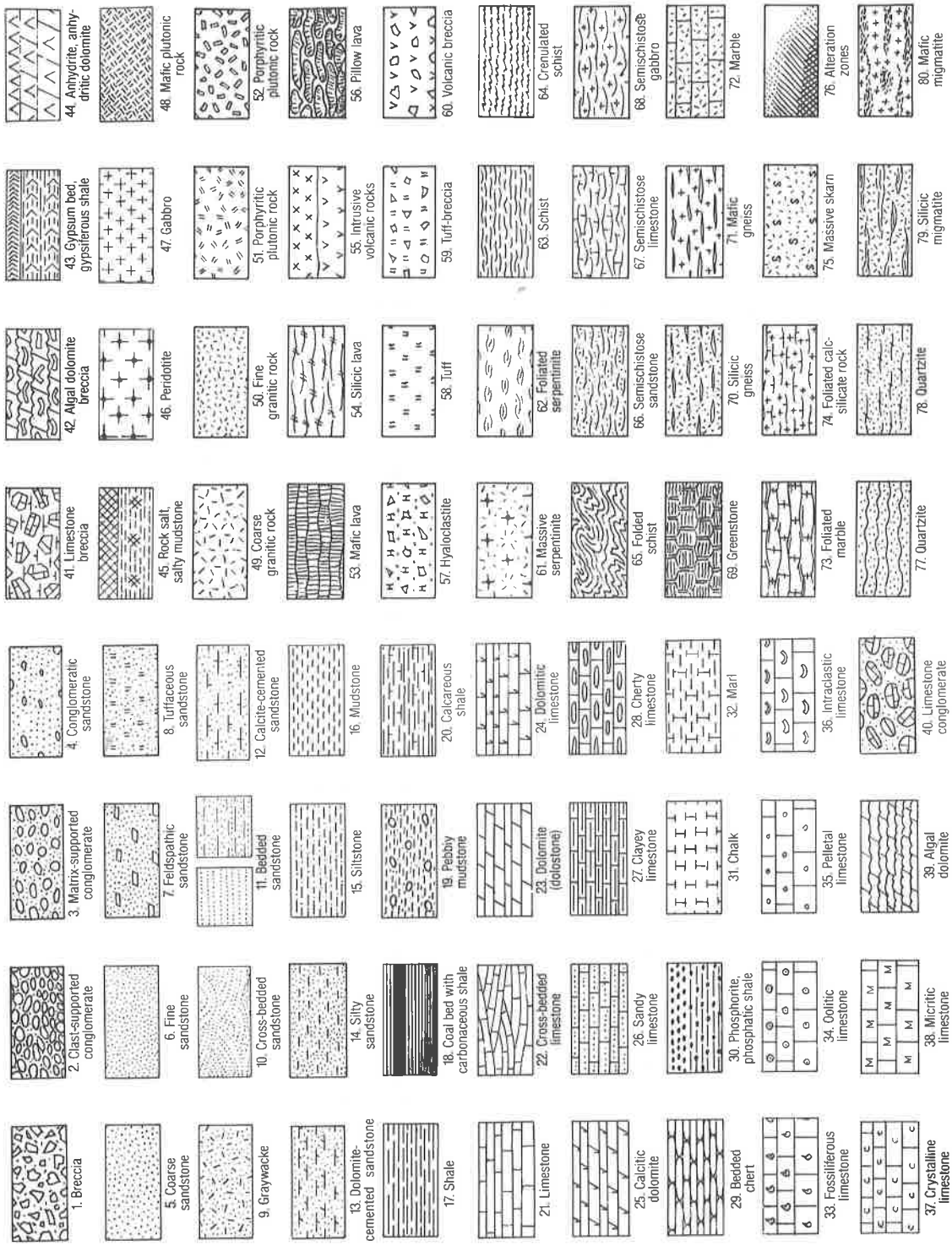


Figure 5.12. Rock patterns, fossil and structure symbols for graphic columns. From R. R. Compton, 1985, *Geology in the Field*, Wiley, New York, Appendix 8 and 9, p. 376-378. Copyright c 1985, John Wiley & Sons, Inc. Reprinted by permission of John Wiley & Sons, Inc.