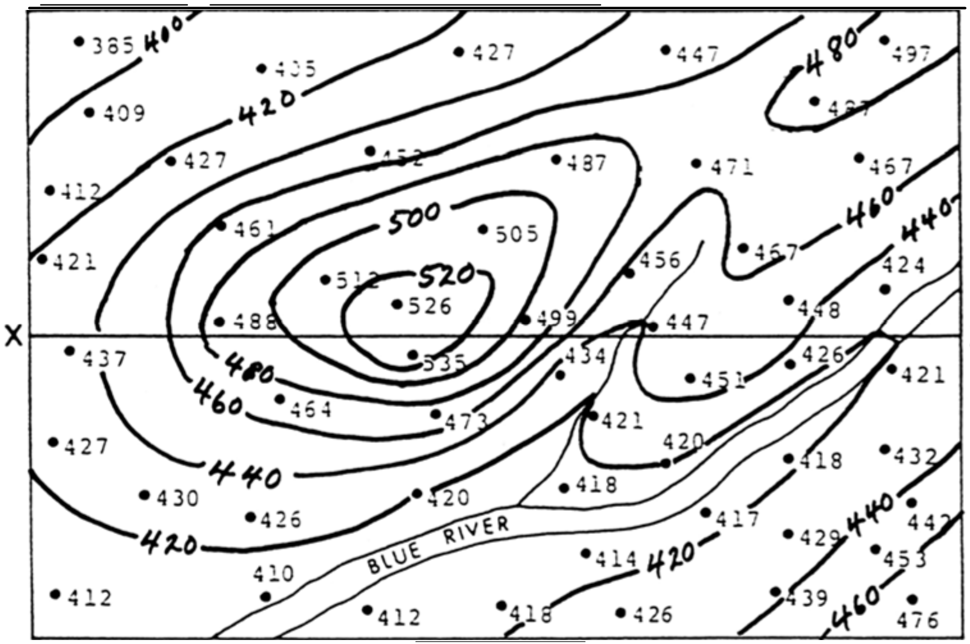
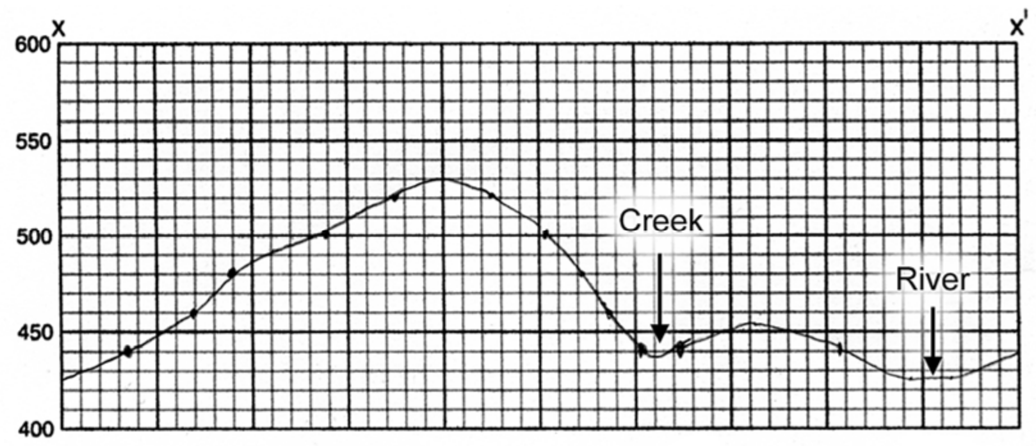
QUESTIONS 2, PART A
1. Construction of a Contour Map.



2. Construction of a Topographic Profile. State the vertical scale and vertical exaggeration in the spaces provided.



Horizontal scale is 1 inch equals 5280 feet (one mile), and the vertical scale is 1 inch equals 100 feet. Therefore the vertical exaggeration is 52.8x.

3. Use either Figure 2.7 or a map supplied by your instructor to answer the following questions. The answers below are based on Figure 2.7, topographic map of the Kalispell area, Montana.
a. What year was the map made? 1962
Revised? 1982

b. What year were the photographs taken that were used to create the map? 1956
Were later photographs also taken? If so, when? 1978

c. What are the UTM values for the southeast corner of the map? 5333600m N, 704650m E

The northing value can be determined by scaling the distance on the east side of the map between 5334000mN and 5335000mN. This distance, measured in decimal inches or millimeters, is equal to 1000m on the ground. The distance between 5334000mN and the southeast corner of the map can be measured (hopefully using the same units) as a fraction of the distance between 5334000mN and 5335000mN. The fraction, once converted to meters, is then subtracted from 5334000mN, as the southeast corner of the map is closer to the equator.

The easting value can be determined in a similar way, but the map makes this a bit more difficult. Students will have work eastward from the printed value of 702000mE to determine which marks on the bottom of the map have values of 703000mE and 704000mE. The 703000mE line is just to the left of the word "interior" along the bottom of the map, and the 704000mE line is located between the "i" and the "r" in the word "Virginia" along the bottom of the map. The dimension between the 704000mE line and the southeast corner of the map can then be measured, again using an appropriate ruler, and converted to meters. These meters get added to the 704000mE value, as the southeast corner of the map is east of 704000mE.

The values above are close but approximate. It may be helpful to remind students that it is not feasible to measure accurately dimensions to the nearest meter on maps of the scale of this topo.

d. What are the latitude and longitude values for the southeast corner of the map? 48 degrees, 07 minutes, and 30 seconds N; 114 degrees, 15 minutes, and 00 seconds W

e. What is the scale of the map? 1:24,000 was the scale of the original map. This is an unintentional trick question, if students note that the map in the book has been reduced. The scale of the map, as published, is approximately 1:50,400 (one inch equals about 4200 feet).

f. What is the contour interval of the map?
20 feet, with dotted contours equaling 10 feet (in areas of flat tomography, such as along the Flathead River).

g. What is the quadrangle immediately southwest of this quadrangle?
Kila

h. How many degrees difference are there between true north and magnetic north?
19 degrees (east) when the map was made in 1992.

4. True North (TN) and Magnetic North seldom are exactly the same and magnetic north changes continually.

a. What is the mean magnetic declination on the Zanesville West, Ohio, map (Figure 10.5 in the color plate section)?
The magnetic declination is mysteriously missing from the map that is referred to, as well as all the other maps in the colored plate section of the back of the book.

We suggest instead that you refer to the Kalispell map, and note that at the end of 2008, the declination was approximately 14 degrees and 55 minutes east, drifting about 0.10 degree west per year. Magnetic declinations can be determined by using the calculator at http://www.ngdc.noaa.gov/geomagmodels/Declination.jsp

b. Would you expect the magnetic declination to be the same the following year? No.

c. Explain why or why not.
There is annual drift.

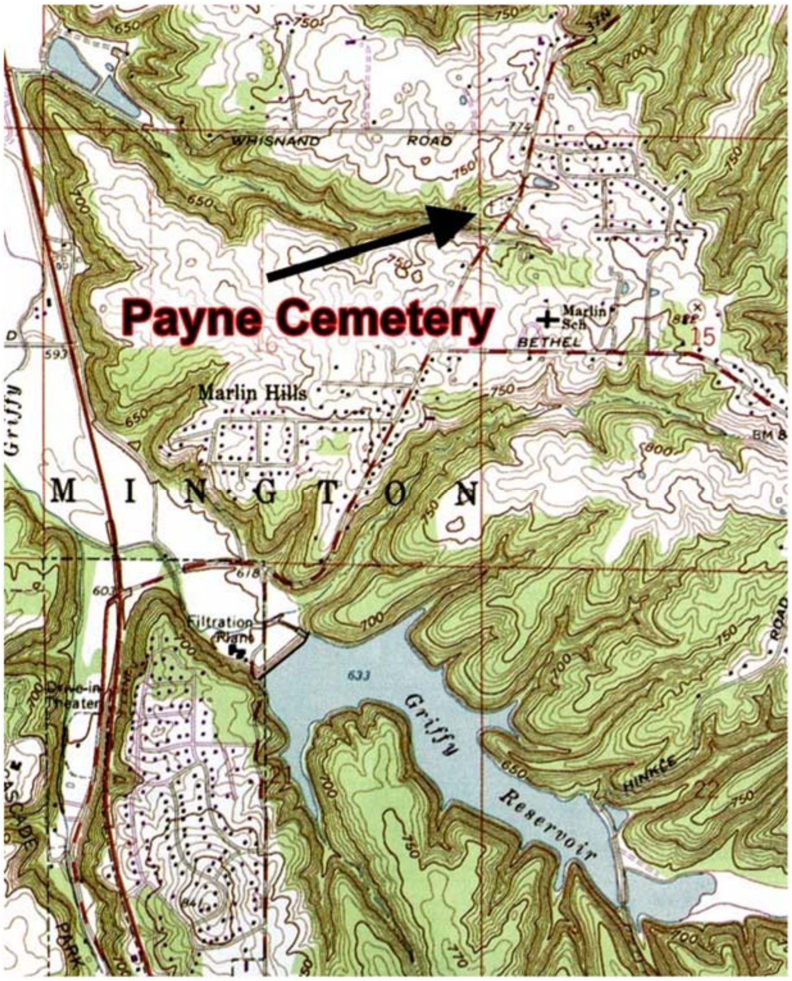
6. Use Figure 2.9 (inside front cover and also in the color plate section), the description of symbols used on U.S. Geological Survey topographic maps, and Figure 2. 10, the Bloomington, Indiana, minute quadrangle (in the color map section at the back of this book) to answer this question.
a. What is the fractional or ratio scale?
The scale of the Bloomington map has been reduced slightly to fit the book. Students can use a ruler and the foot scale to determine that one inch is approximately 2500 feet. This means that one inch is approximately 30,000 inches, or that the fractional scale of the map is 1:30,000.

b. What is the contour interval?
Students will have to look for marked contours and count the number of contours between them. The contour interval is 10 feet.

c. What is the elevation of the filtration plant below Griffy Reservoir?
Between 600 and 610 ft

d. Using the township and range system, locate Payne Cemetery to the nearest 40 acres (quarter of a quarter section).
Note that Payne Cemetery is not on the map, but the cemetery symbol is shown. Use the following map to identify the location of the cemetery.

NW 1/4, NW 1/4, Sec. 15 T. 9N., R. 1 W.



e. What is the elevation of the major contour adjacent to the cemetery?

The 750' contour runs through the cemetery.

7. Using a topographic map of your local area (provided by your instructor), fill in the following information:

a. Name of the map?
b. Contour interval?
c. Datum plane?
d. Year area first surveyed?
e. Fractional or ratio scale?
f. E–W distance covered by map?
g. N–S distance covered by map?
h. Approximate area covered by the map (in both square miles and square kilometers)?
i. Latitude and longitude of the northeast, northwest, southeast, and southwest corners of the map?
(NE)
(NW)
(SE)
(SW)
j. Names of quadrangles located north, east, south, west, northeast, southeast, southwest, and northwest of this quadrangle?

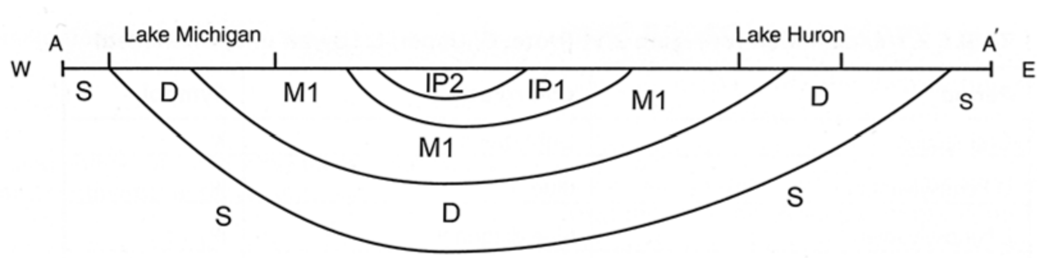
k. Note the variety of symbols used on the map. Find examples of each of the following and give its location by either latitude and longitude coordinates or by township, range, section, and quarter-section locations. Also note the relationship to major features or to the general area covered.
A bench mark.
A spot elevation other than a bench mark.
A school or church.
Features shown in:
blue:
brown:
black:
red:
green:

QUESTIONS 2, PART B
1. Using Table 2.1 and the explanation for Figure 2.11, give the words for the following symbols: pCm – middle Precambrian
D_1 – lower Devonian
K – Cretaceous

2. What is the age in millions of years of the boundary between the Cambrian and the Precambrian (Hint: Consult the geologic time scale in Appendix II)?
543 million years ago

3. Almost all of the Precambrian rocks are metamorphic or igneous?

4. The geologic cross section (Figure 2.12) for the bedrock geology map of central North America (Figure 2.11) shows the stratigraphy of part of the Michigan Basin between A, northwest of Milwaukee, Wisconsin and A', northeast of London, Ontario, Canada. In the cross section, the Silurian system is labeled (S). Label the other geologic units shown.



5. The circular geologic structure centered on the blue area in the lower peninsula of Michigan is a basin; however, in the cross section it appears as a:
The rocks form a broad syncline.

6. If you drilled a hole at the "D" north of Milwaukee, what geologic systems would you pass through before you reached the Precambrian igneous or metamorphic basement rocks? List the sequence of rocks from youngest to oldest.
Devonian
Silurian
Ordovician
Cambrian

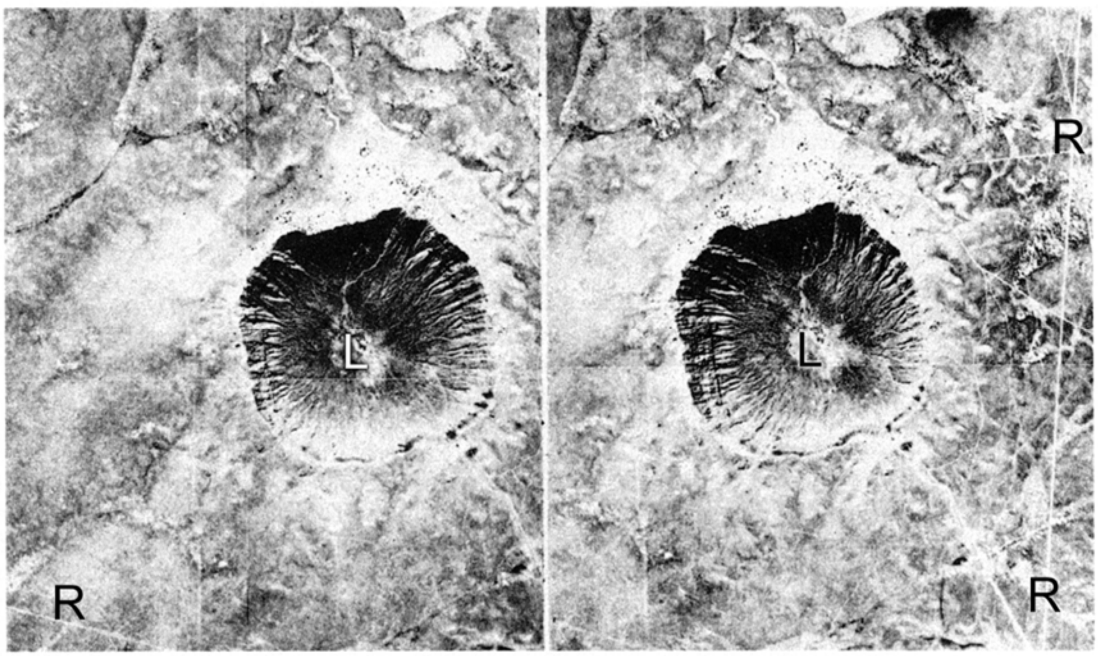
7. Which of the following cities is underlain by the oldest bedrock? (check one)
Chicago _____, Detroit_____, Duluth X

QUESTIONS 2, PART C

Meteor Crater

1. Examine Figure 2.13. Given the scale in the caption, what is the approximate diameter of the crater?
At a scale of 1 "=3500', 1¼" = 3500' + 875' = 4375' or 0.83 miles or nearly 1 mile.

2. Using a stereoscope to see the third dimension in Figure 2.13, outline the floor of the crater and mark the lowest point with an "L."



3. On Figure 2.13, label any other visible relief features, vegetation, roads and buildings. See above image. In this older image, there are a few roads, marked with "R," that form linear features across the landscape. Vegetation is scarce, and there are no major buildings. This older image can be compared with current imagery such as Google Earth, so students can see changes that have taken place. Among the items observant students might note is that north is toward the bottom of the photographs in the lab manual. Oops.

Boston

The following questions refer to Figure 2.14, which is in the color map section at the back of this book. If available, using Google Earth or a similar program may help students visualize the Boston area. Note that photographs of many of these sites are available through Google Earth (or at other sites on the internet).

Topographic maps of various scales for this area can be downloaded from:
http://store.usgs. gov/b2c_usgs/b2c/start/(xcm=r3 standardpitrex_prd)/.do

Study the color high altitude photograph (Figure 2.14) using a magnifying glass or hand lens if necessary to identify geologic and cultural features. Label the following features on the photo, using the corresponding numbers 1–15.

1. park
2. airport runway
3. airport terminal with planes
4. tidal flat
5. beach
6. star-shaped fort (SE quarter of image)
7. road
8. bridge
9. railway
10. pond
11. small boat
12. large docked ship
13. racetrack
14. baseball field
15. oil and gasoline storage tanks

5. In which direction is the small boat traveling at the entrance to Boston Inner Harbor?
Northwest

6. Notice the diffuse white zone in the Mystic River, between the first and second bridges. What might cause such a zone in the river? What is your evidence from this photograph?
Mystic River enters from the northwest. White Zone is due to discharge of water with different reflectance (turbidity, organic contaminant on surface, dissolved materials?). Source may be the nearby oil storage facility.

7. Locate and mark the baseball field named Fenway Park.

See 14 on previous map.

8. The L Street Beach, which is located west of the circular bay in the SE quarter of the image, has structures that extend into the Old Harbor. Give the name for these erosion control structures and the direction of the longshore current in the area.
Groins project from land. Longshore currents are to the west here (see Exercise 11).

9. Many elongated hills in this glaciated landscape have influenced street patterns. In the NE quarter of the photograph is Suffolk Downs Racetrack.
Suffolk Downs Racetrack is number 13 on the image above.

What is the direction of elongation (which gives the ice-flow direction) and the name of the landforms beneath the communities of Beachmont (1 cm E of the racetrack) and Orient Heights (1 cm W of the racetrack)?
Approximately W-E or NW-SE. Drumlins are elongated hills. The streets curve around the sides of hills, “on the contours.” The names of these communities suggest high topography—Beachmont and Orient Heights.

10. If the long axis of Suffolk Downs is 650 m (2100 ft), what is the scale of the photograph?
1 cm = 650m; scale = 1:65,000 or 3/8" = 2100 ft; 1" = 67,200"; scale = 1:67,200"

11. Tall structures can be identified by their shadows. At what time of day (morning, noon, afternoon) in mid-April 1985 was the picture taken?
North is to the top of the image. Afternoon. See black shadows, elongated NE-SW, downtown.

Salt Lake City, Utah

The following questions refer to Figures 2.14 and 2.16. Figure 2.15 is a black and white stereo pair of aerial photographs taken of the Salt Lake City area in 1958. Figure 2.16 (back of book) shows color aerial stereo photographs of an area south of the black and white photographs. The color stereo photographs were taken in 1992. The area of Figure 2.16 is included on Figure 6.11, the colored topographic map of the Draper, Utah, quadrangle, which also is in the map section at the back of this book.

12. Using a pocket stereoscope, examine the stereo pair in Figure 2.15 to determine the nature of the landscape. The shades of gray indicate vegetation or soil moisture differences. Identify a feature that shows:

a. Darkest shading - reservoir or pond (B)
b. Lightest shading - some gravel roads (leading to M); newly exposed soil (gravel) near K; and roof of building or parking lot (I)
c. Intermediate shading - pasture land (K) highway (G)

13. Identify the natural or built feature at each of the following sites on Figure 2.15: Most can be identified without the stereoscope.
The top of the image is to the north. There is no “L.”

A. Race track
B. Pond
C. Houses/subdivision
D. Orchard

E. Orchard
F. Gravel pit
G. Highway
H. Gravel pit
I. Large building
J. Woods/forest/flood plain
K. Pasture (or terrace)
L. (none marked – Instructor's choice of a feature)
M. Woods

14. What land uses are visible in the 1958 stereopair (Figure 2.15)? Are other land uses visible on the 1992 photographs (Figure 2.16)?
Figure 2.16 is in colored figures section of book. In Figure 2.15, Farming (orchards); Ranching (pastures); Gravel extraction; Housing; Transportation (roads); Recreation (trails, ponds); In Figure 2.16, Reservoir, Mountain recreation; Commercial. This is a good image to learn use of the stereoscope and to learn 3D viewing.

15. Use the definitions provided below to help determine in which geomorphic feature site "J" (Figure 2.15) is located. What is your evidence?
The area at "J" is a floodplain (low-lying area along a river that is flooded at high water). It looks a bit higher because of tall trees.

16. a. In Figure 2.15 what is the distance between the middle of the G to the middle of the H? 45 mm
b. Given that the scale of the photo is 1:14,400, what is the distance on the ground between G and H? 0.65 km (there are 1,000,000 mm in 1 km)

17. Compare similar features on the black and white stereo photographs (Figure 2.15) with those on the color stereo photographs (Figure 2.16).
a. Are the two sets of photographs the same or different scales? What is your evidence? Students might note that roads appear slightly wider in the black and white photos, which suggests that they are at a larger scale. Especially persistent students might compare (or a diabolic instructor might ask the students to compare) the color photographs with Figure 6.11, the topographic map of a portion of the Draper Quadrangle. By measuring the distances between identical places (for example, road intersections), students can determine that the scale of the Draper Quad as printed in the book is approximately 1:32,100. This is changed from the original 1:24,000 scale of the map.
The black and white photo scale, given in 16a above, is about 1:14,400.

b. What are some advantages of using color stereo photographs over using black and white stereo photographs?
Color provides better differentiation of vegetation types and homes, water, roads (type of pavement), and differences in rock types are more visible.

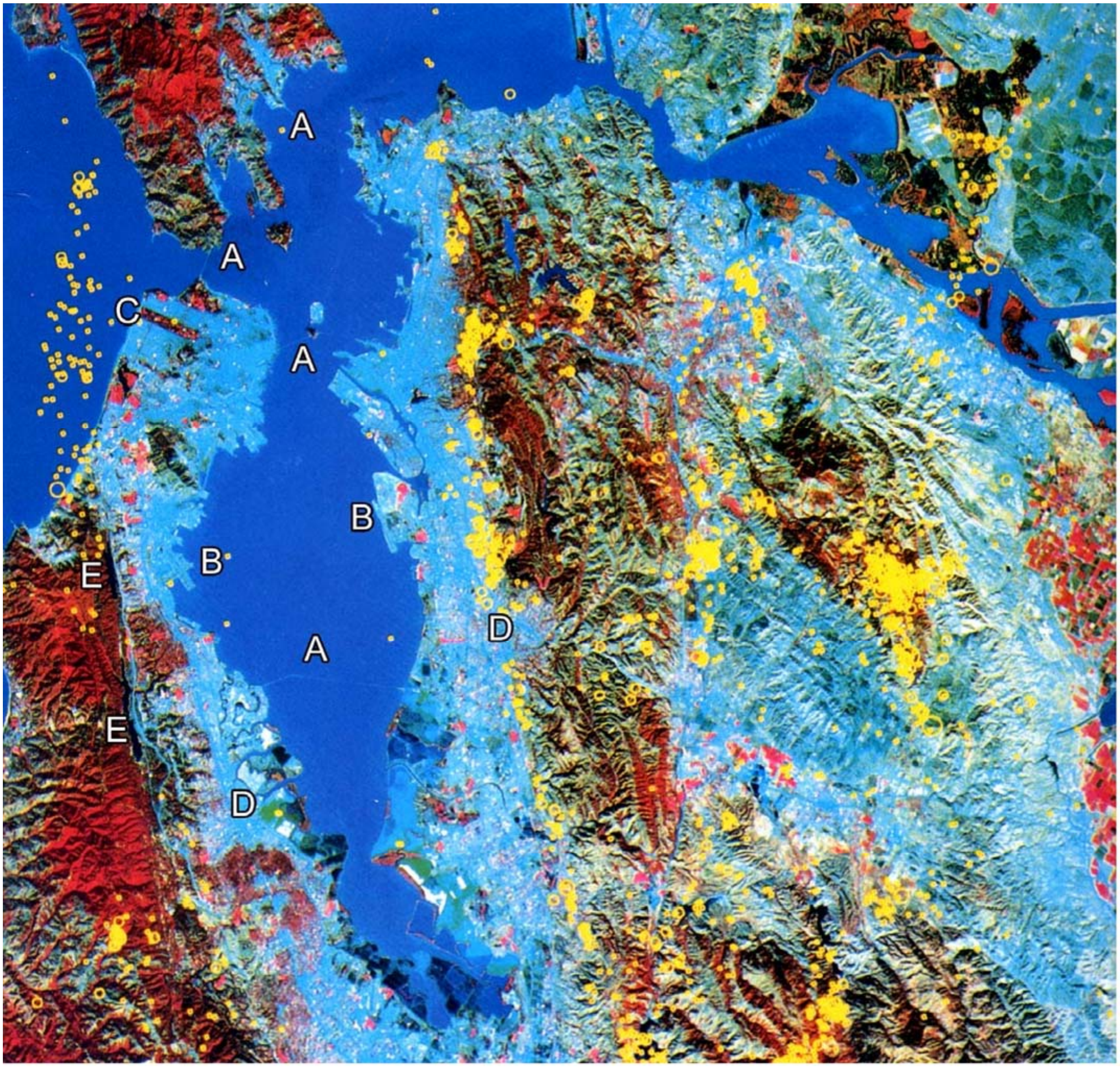
c. What are some advantages (if any) of using black and white photographs over color photographs?
San Francisco, California
Black and white prints are less expensive to obtain and reprint. Note, however, that excellent copies of color and black and white photos can be made using a color photocopy machine, and that it may be possible, for some areas of the country, to download from national, state, or university sources color stereo aerial photographs, which can then be printed for use in class. Much historic photography will be in black and white, however, so it will help students to work with interpretation of black and white as well as color imagery.

San Francisco, California

The following questions refer to Figure 2.17, which is a satellite image of the San Francisco Bay area. The dots and small circles are earthquake epicenters, which are discussed in Exercise 6. Note that Figure 2.17 is on the back cover of the lab manual.

18. Locate examples of the following land uses on the satellite image. Mark these features and a north arrow on the outline map of the San Francisco Bay area (Figure 2.18):
The north arrow is given on the figure.
a. bridges across San Francisco Bay – faint lines across bay
b. airport(s) – look for runways; San Francisco is on the left (west) and Oakland is on the right (east); observant students may also identify the Alameda naval Air Station, which is just southeast of the third "A" from the top of the image
c. an urban park – Golden Gate Park is marked; others may be noted, too.
d. a major highway The letters are in the general area where linear features that are highways are located
e. elongated lakes along the San Andreas Fault – San Andreas Lake is to the north, and Crystal Springs Reservoir is to the south.

See following image.



19. What pattern differences help distinguish natural vegetation areas from vegetation patterns in agricultural areas?
Natural vegetation shows margins controlled by topography and streams. Agriculture has square patterns as in eastern part of image.

20. Compare natural and human features on this satellite image with those on the black and white and color stereo photographs. What are some of the advantages and disadvantages of using satellite images rather than aerial photographs in environmental studies? Under what conditions do you think that satellite images might be especially useful?
At the scale of this satellite image, houses are not visible, but major roads are visible. There is better resolution for the stereo black and white and color photographs. The satellite allows a larger area to be viewed at the same time. It shows similarities and differences in water, vegetation, and large geologic structures.

Bainbridge Island near Seattle, Washington. (see Figures 2.19 and 2.20)

21. What are the kinds of features that can more easily be seen on the LIDAR image than on the topographic map? Which of these features are natural and which are related to human activity? What is your evidence?
The general trend of topography (in this case, drumlins from the last glaciations) is more immediately visualized on the LIDAR image. There are also linear features that cut across the drumlins; these are roads. One primary line of evidence is that nature typically makes more rounded features, and humans like angular roads and road intersections. Long curvilinear features that cut and fill topography are also likely to be roads.

22. What are the kinds of features that can more easily be seen on the topographic map than on the LIDAR image?
The topographic map clearly identifies roads, docks and smaller features like homes.

23. How does having a topographic map help interpret human-related features on a LIDAR image? When looking for natural features, such as a fault (see Figure 6.14 on page 99 for another LIDAR example), topographic maps can help identify human-related linear features from natural linear features. Students might also refer to the types of linear images they encountered in the satellite image on the back cover.

24. When would the use of each type of map be an advantage? A disadvantage?
Want to know the lay of the land, especially when the area is heavily forested? Use LIDAR. Want to know human features, with their names? Use a topographic map.