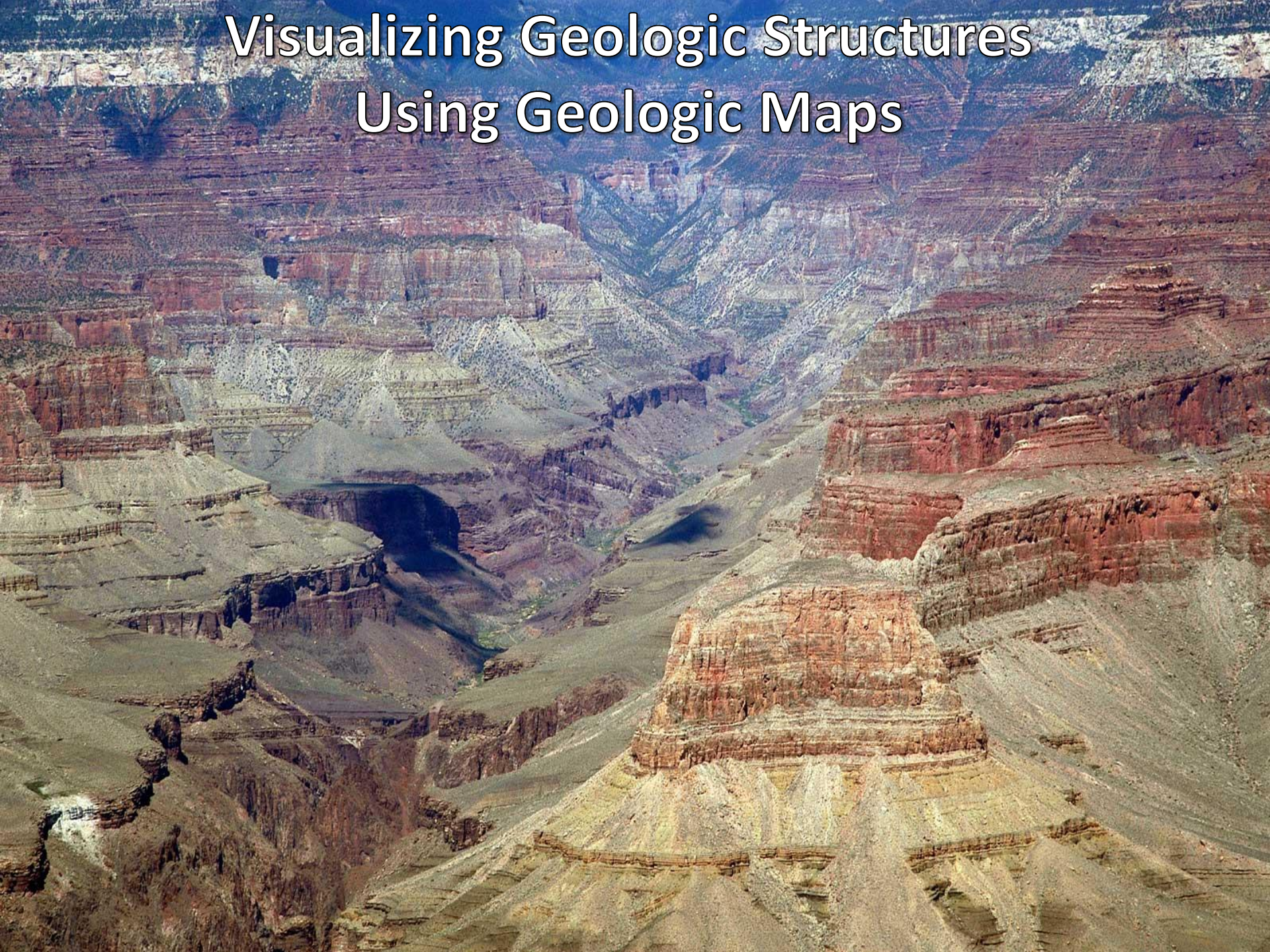
Visualizing Geologic Structures Using Geologic Maps

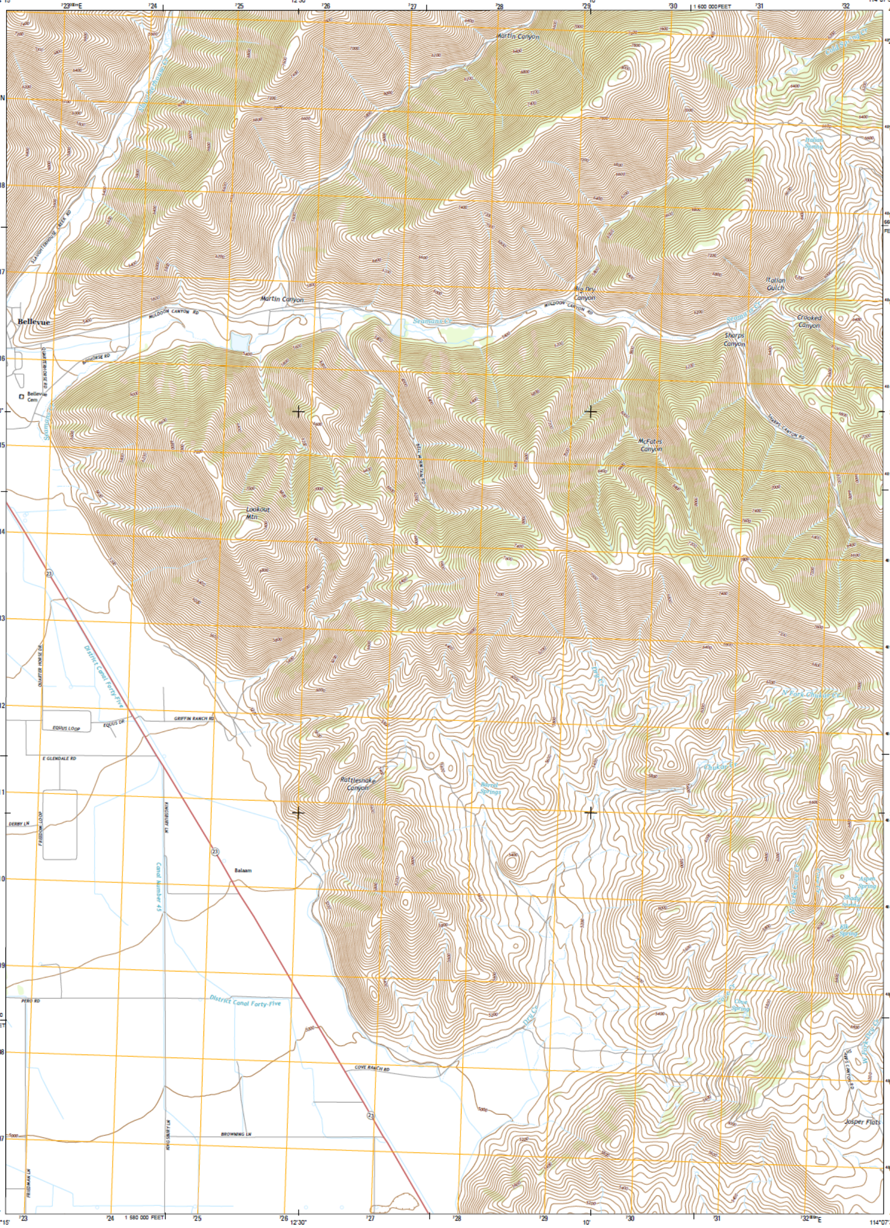


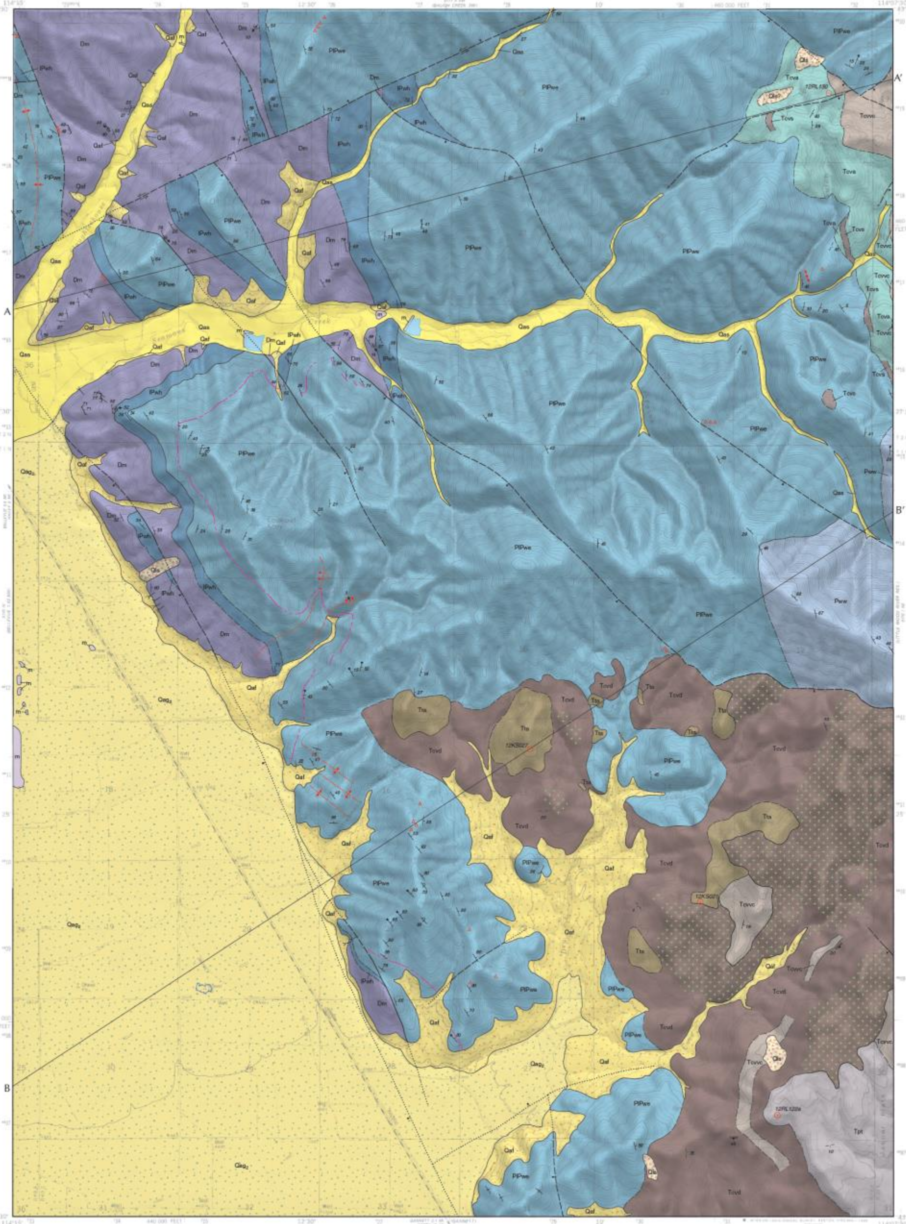
USGS science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY

The National Map US Topo

SEAMANS CREEK QUADRANGLE
IDAHO-BLAINE CO.
7.5-MINUTE SERIES





Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid: Universal Transverse Mercator, Zone 11T
10 000-foot ticks: Idaho Coordinate System of 1983 (central zone)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery....NAIP, June 2011 - August 2011
Roads....©2006-2013 TomTom
Names....GNIS, 2013
Hydrography....National Hydrography Dataset, 2011
Contours....National Elevation Dataset, 2002
Boundaries....Census, IBWC, IBC, USGS, 1972 - 2012
Public Land Survey System....BLM, 2011

UTM GRID AND 2013 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
1° 56′ 34 MILS
13° 15′ 236 MILS

U.S. National Grid
100,000-m Square ID
QJ
Grid Zone Designation
11T

SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.15

QUADRANGLE LOCATION

Hailey	Baugh Creek SW	Baugh Creek
Bellevue	Seamans Creek	Little Wood River Reservoir
Magic Reservoir East	Gannett	Picabo

ADJOINING 7.5' QUADRANGLES

ROAD CLASSIFICATION
Expressway — Local Connector
Secondary Hwy — Local Road
Ramp — 4WD
Interstate Route — US Route — State Route

SEAMANS CREEK, ID
2013

NSN
NGA REF NO.

Base Map Credit
Base scanned from 24,000-scale USGS film positive, 1979.
Shaded elevation from 10 m DEM.
Topography by photogrammetric methods from aerial photographs taken 1971. Field checked 1973. Map edited 1979.
Projection: Idaho coordinate system, central zone (Transverse Mercator). 1927 North American Datum.
10,000-foot grid ticks based on Idaho coordinate system, central zone.
1000-meter Universal Transverse Mercator grid ticks, zone 11.
Declination from NOAA National Geophysical Data Center.

UTM Grid and 2014 Magnetic North Declination at Center of Map

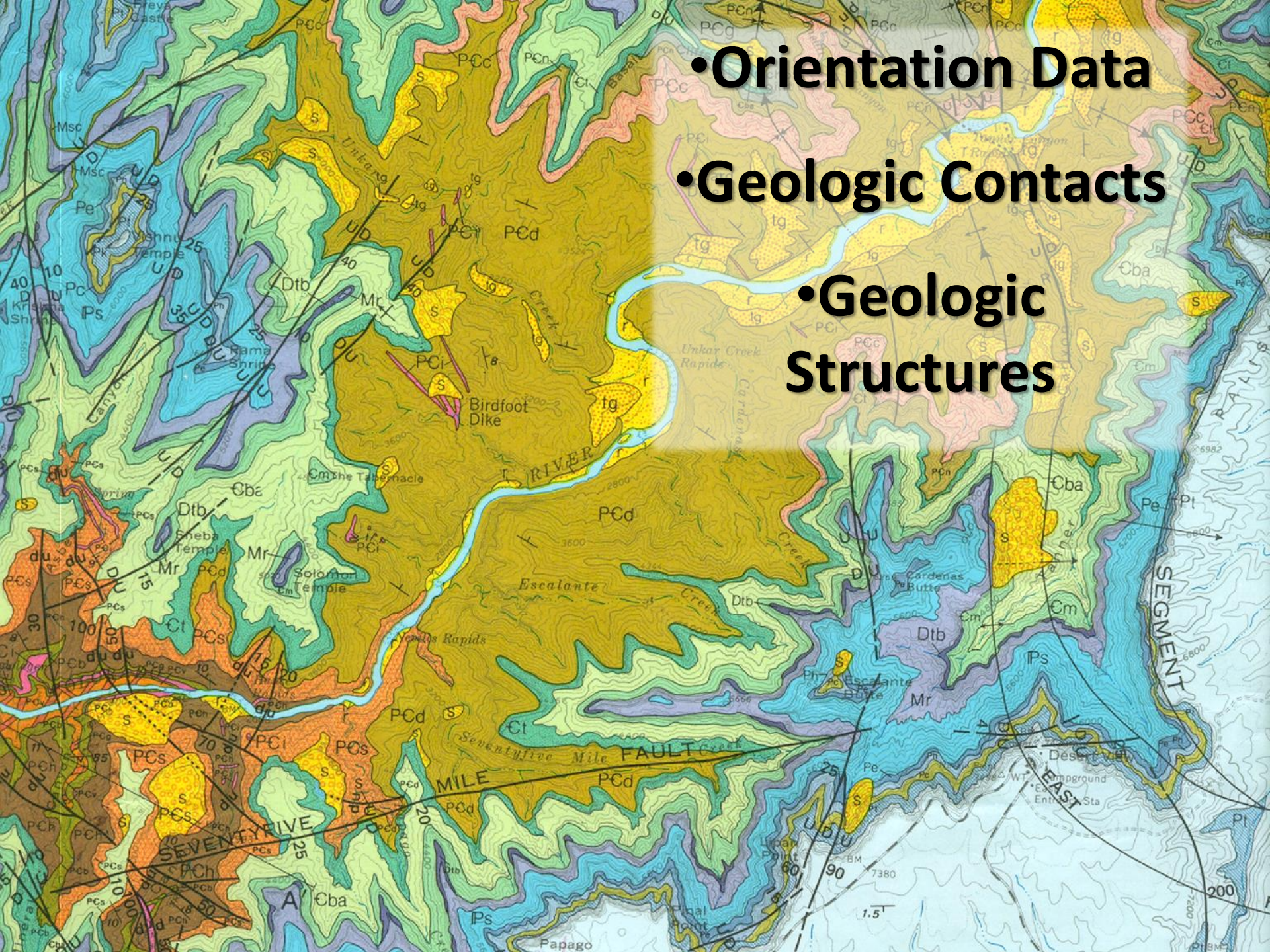
SCALE 1:24,000

Contour interval 40 feet
Supplemental contour interval 20 feet

QUADRANGLE LOCATION
ADJOINING QUADRANGLES

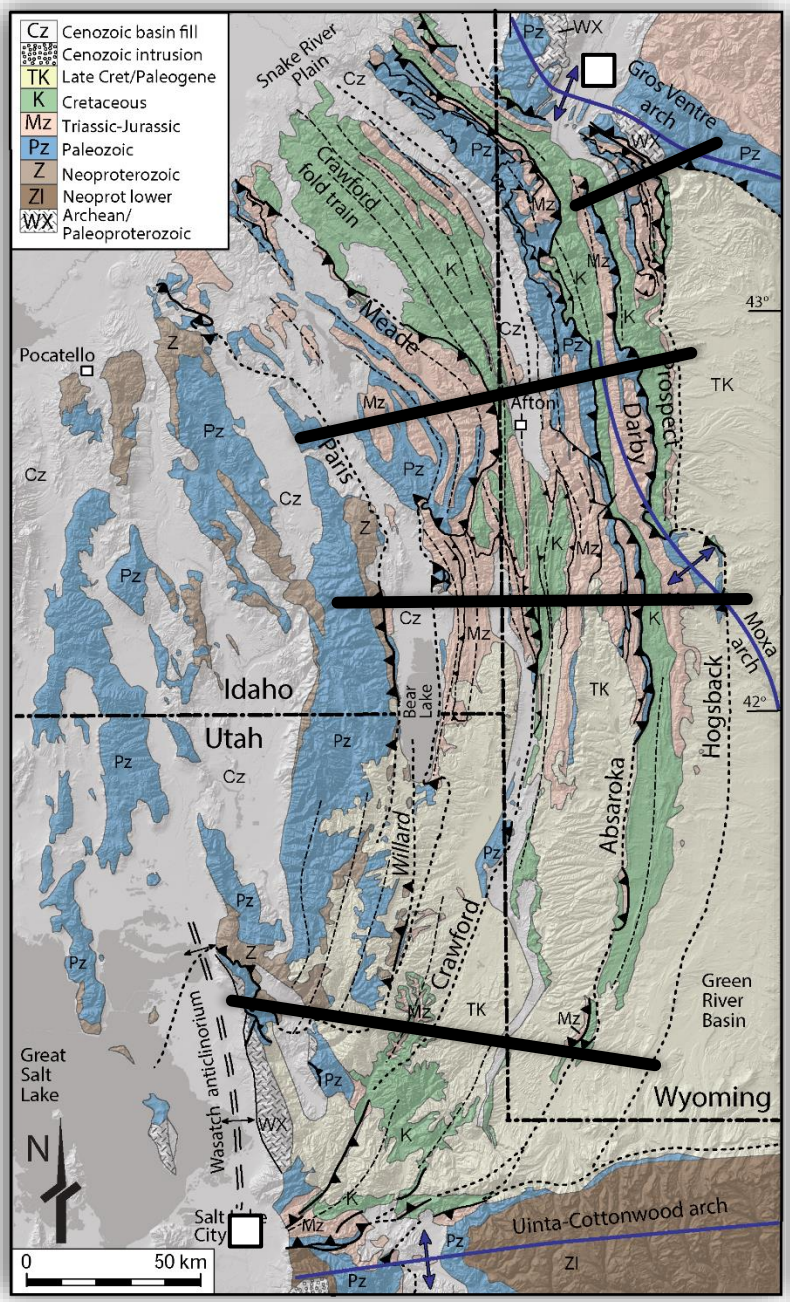
Field work conducted 2012.
This geologic map was funded in part by the U.S. Geological Survey National Cooperative Geologic Mapping Program, USGS award number G12AC20113.
Digital cartography by Jane S. Freed at the Idaho Geological Survey's Digital Mapping Lab.
Technical review status: Authors only.
Editorial review by Alyson R. Kral.
Map version 1-20-2015.
PDF (Acrobat Reader) map may be viewed online at www.idahogeology.org.

A′

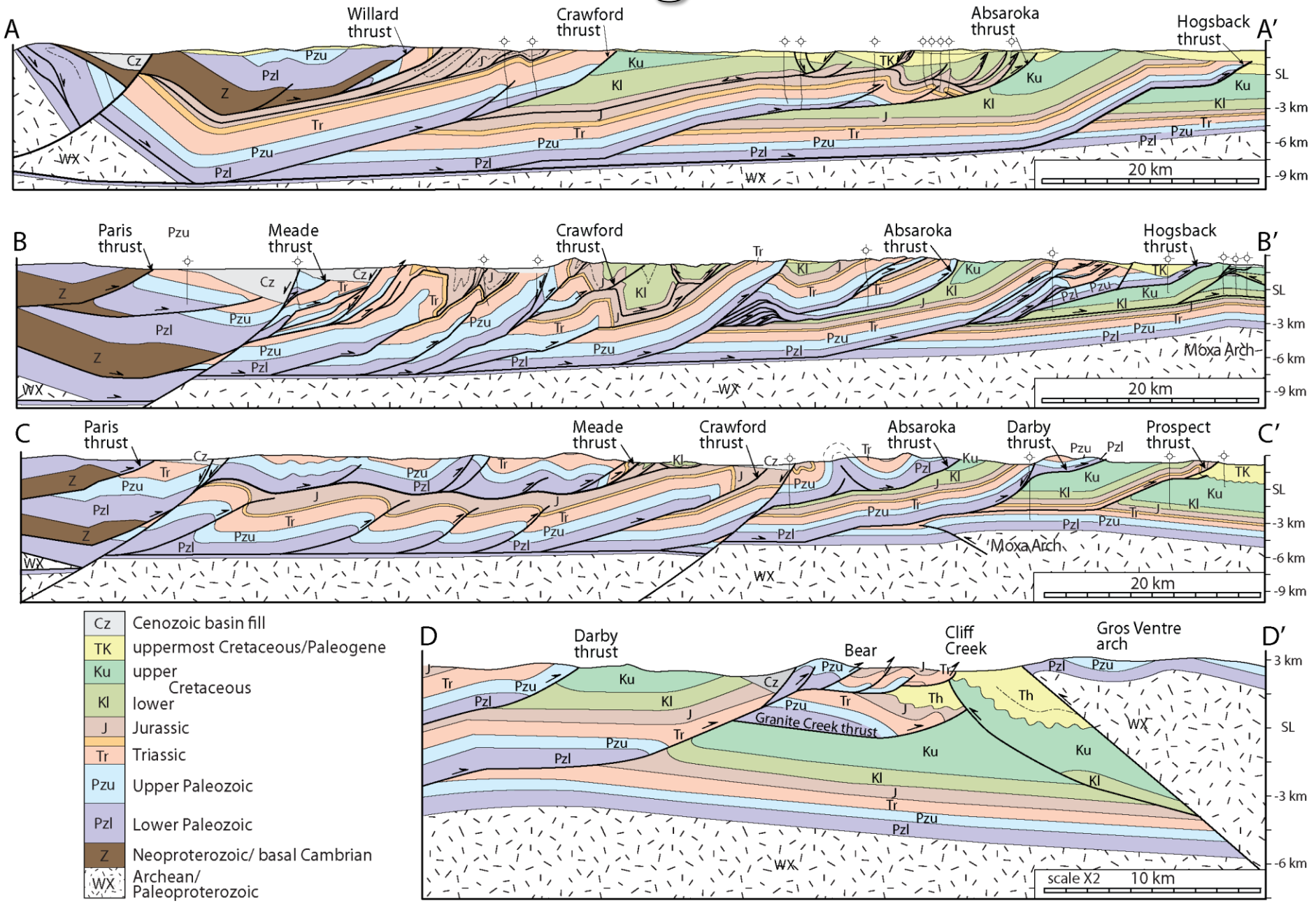

•Orientation Data
•Geologic Contacts
•Geologic Structures
Birdfoot Dike
Unkar Creek Rapids
Escalante Creek
Seventyfive Mile Creek
SEVENTYFIVE MILE FAULT
EAST SEGMENT
RIVER
Escalante Butte
Cardenas Butte
Sheba Temple
Solomon Temple
The Tabernacle
Papago


Idaho
Utah
Wyoming
© 2013 Google
Image Landsat

Examples from the Rockies of Wyoming



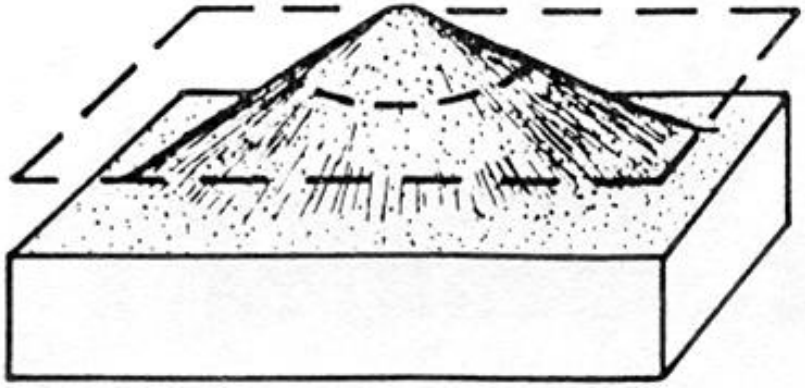
Tectonic Shortening >200 km ≅ 70%



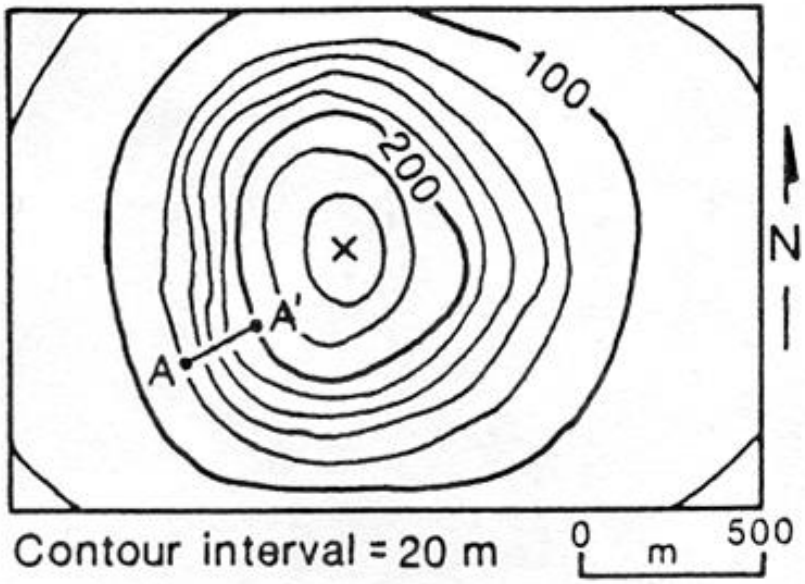
Yonkee & Weil, 2015

Contour Maps

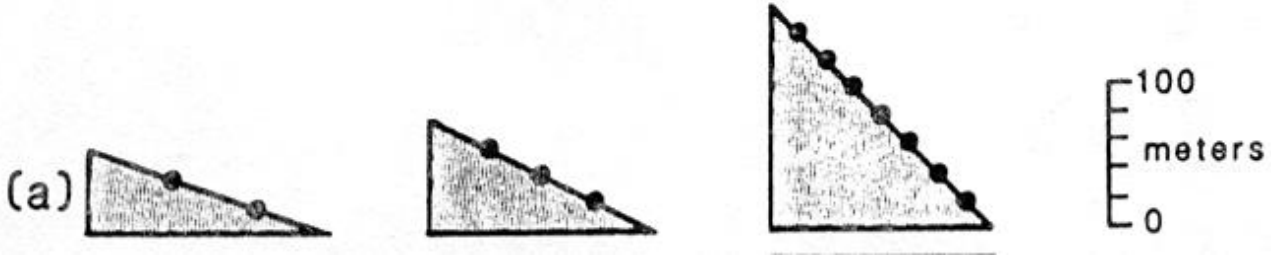
Contour Lines

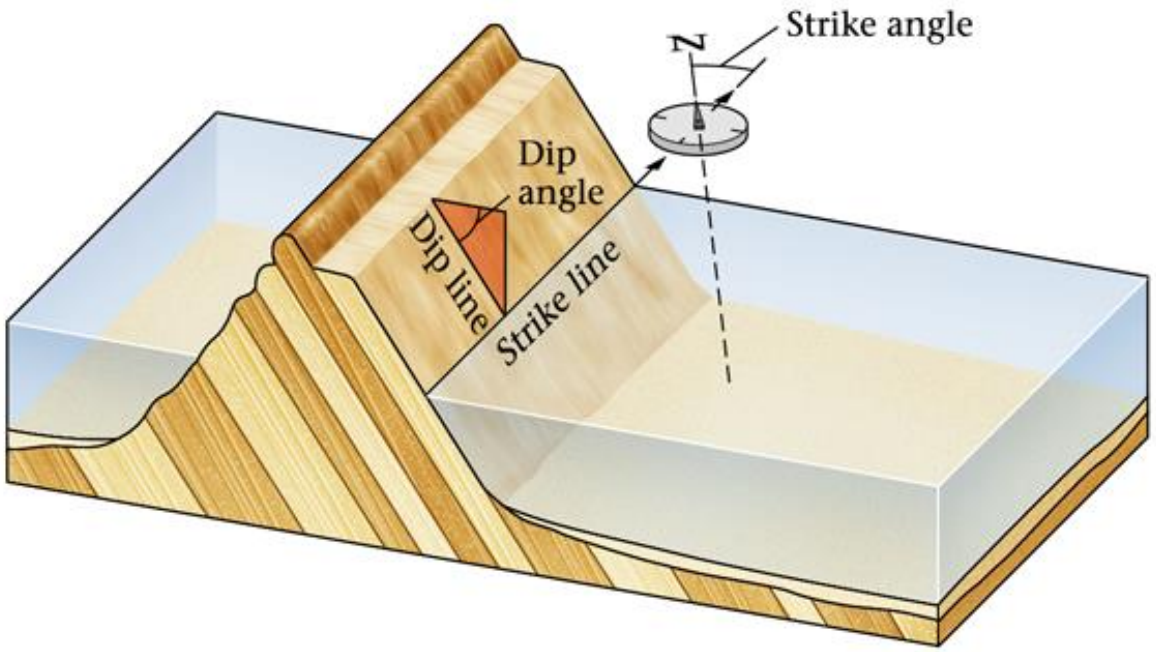


(a)



- Always form a loop
- Never split
- Never cross
- Slope rise or descent @ 90^{o} to contour
- If any 2 CL adjacent have the same elevation there must be a change in slope between them
- Index contours are depicted as heavy lines @ evenly spaced intervals
- Contour lines with hatches represent a depression - the first hatched contour has the same elevation is the upslope contour that surrounds

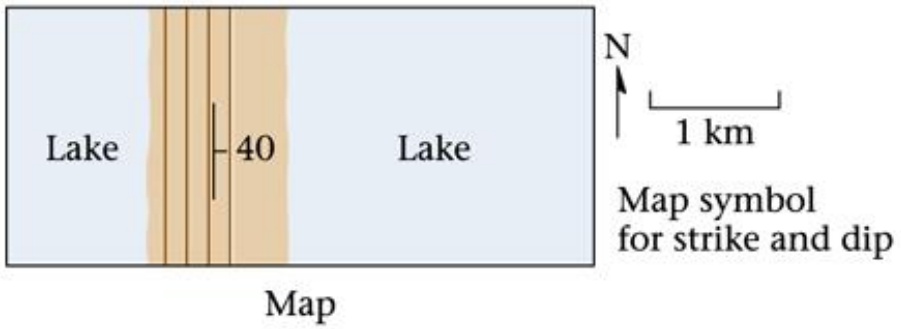




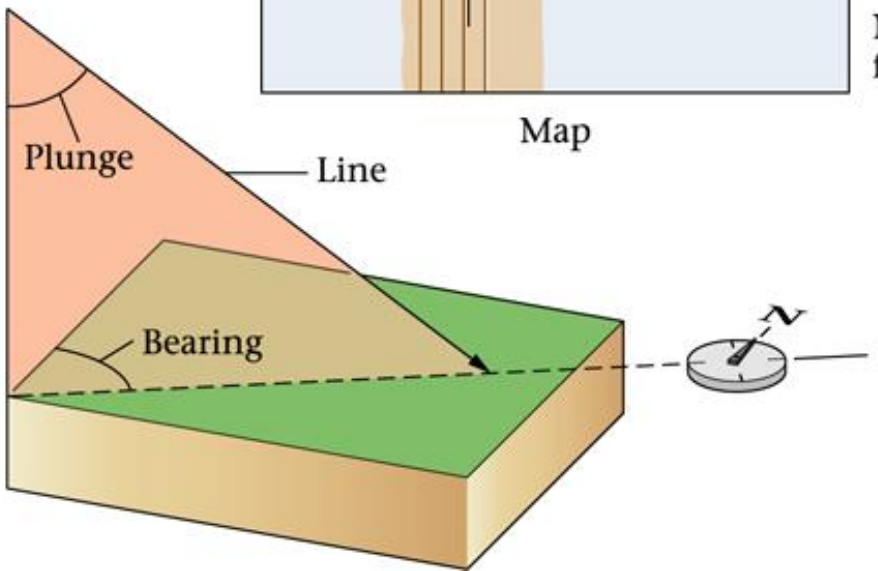
Strike – Horizontal line within a plane

Dip –angle between horizontal and the plane of interest measured perpendicular to strike

Dip Direction – compass direction of dip



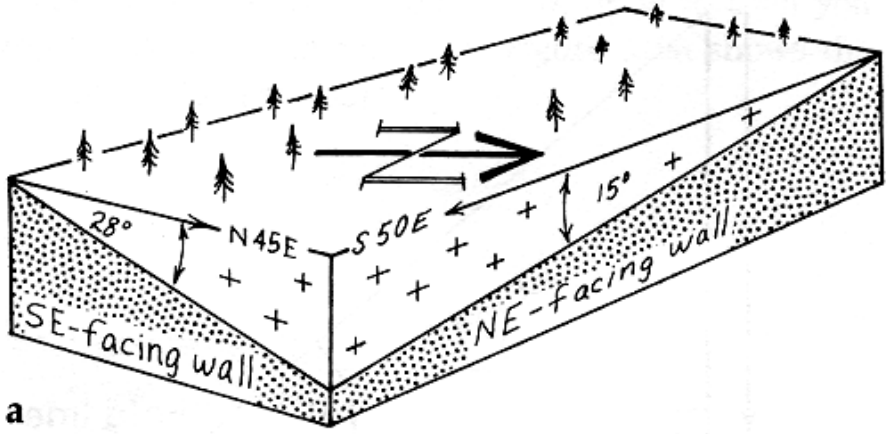
Trend – compass orientation of a linear feature

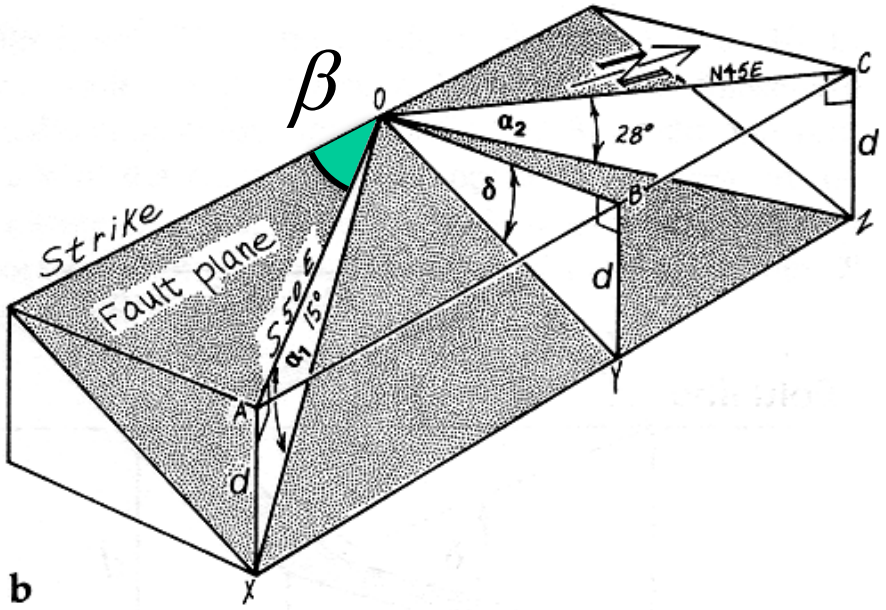


Plunge – angle between horizontal and lineation

Apparent Dip

If a dip angle is measured in a vertical plane between the strike and dip direction planes, the angle of dip (***apparent dip***) will **always** be less than the ***true dip***





$$tan\ AD = tan\ TD \times cos\ \beta$$

Apparent Dip
&
Apparent Thickness

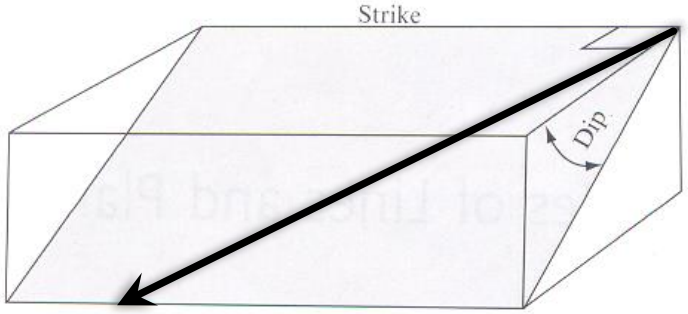


Fig. 1.1 Strike and dip of a plane.

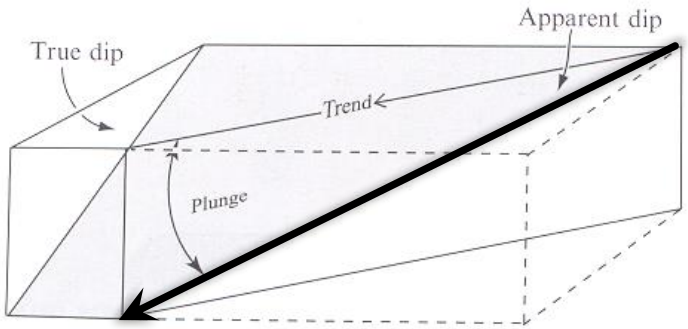
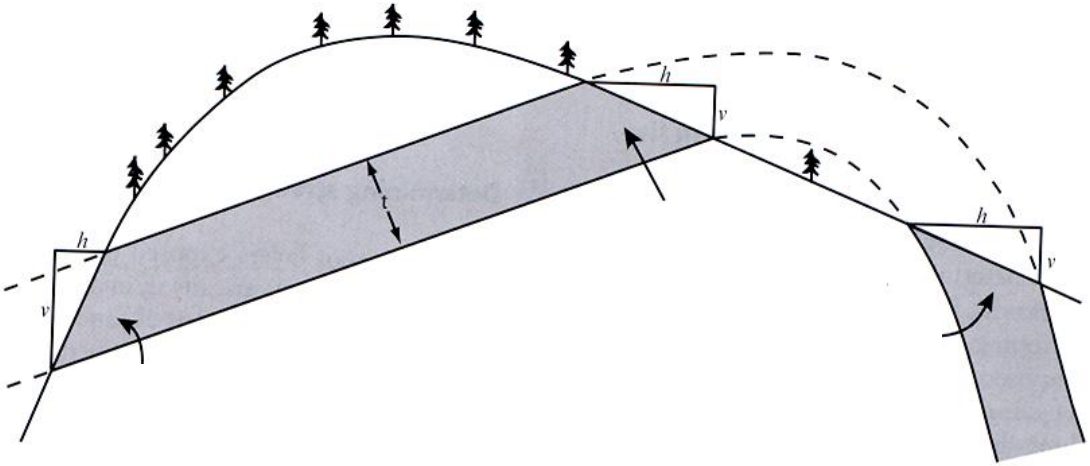


Fig. 1.2 Trend and plunge of an apparent dip.



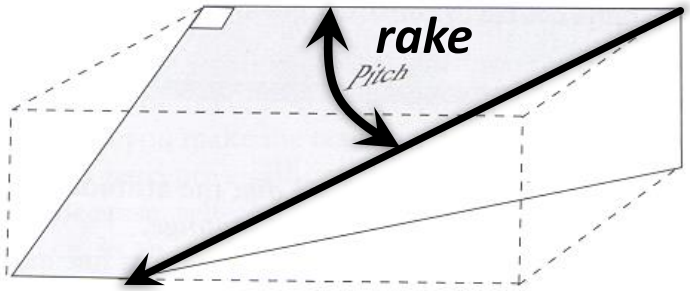
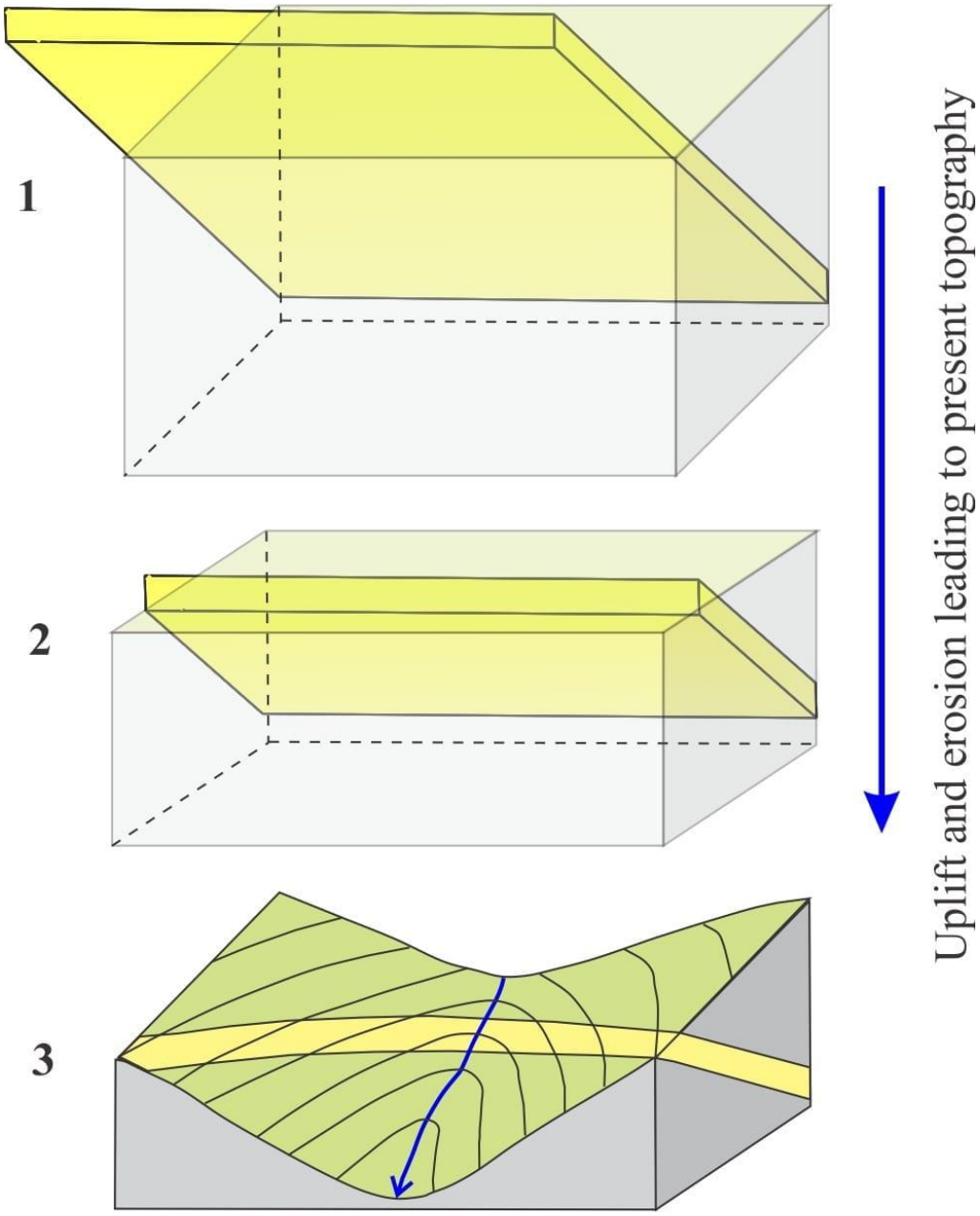
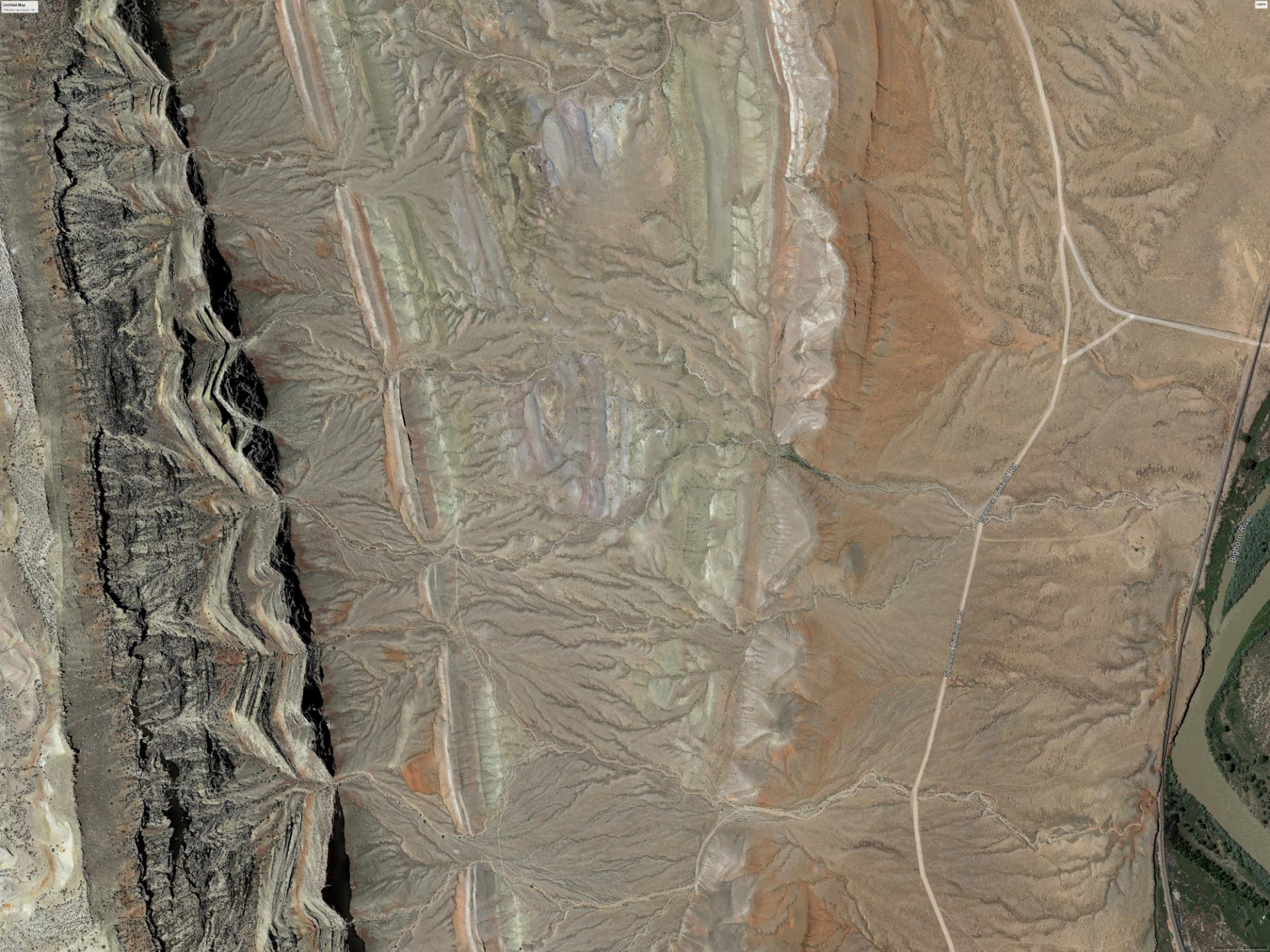
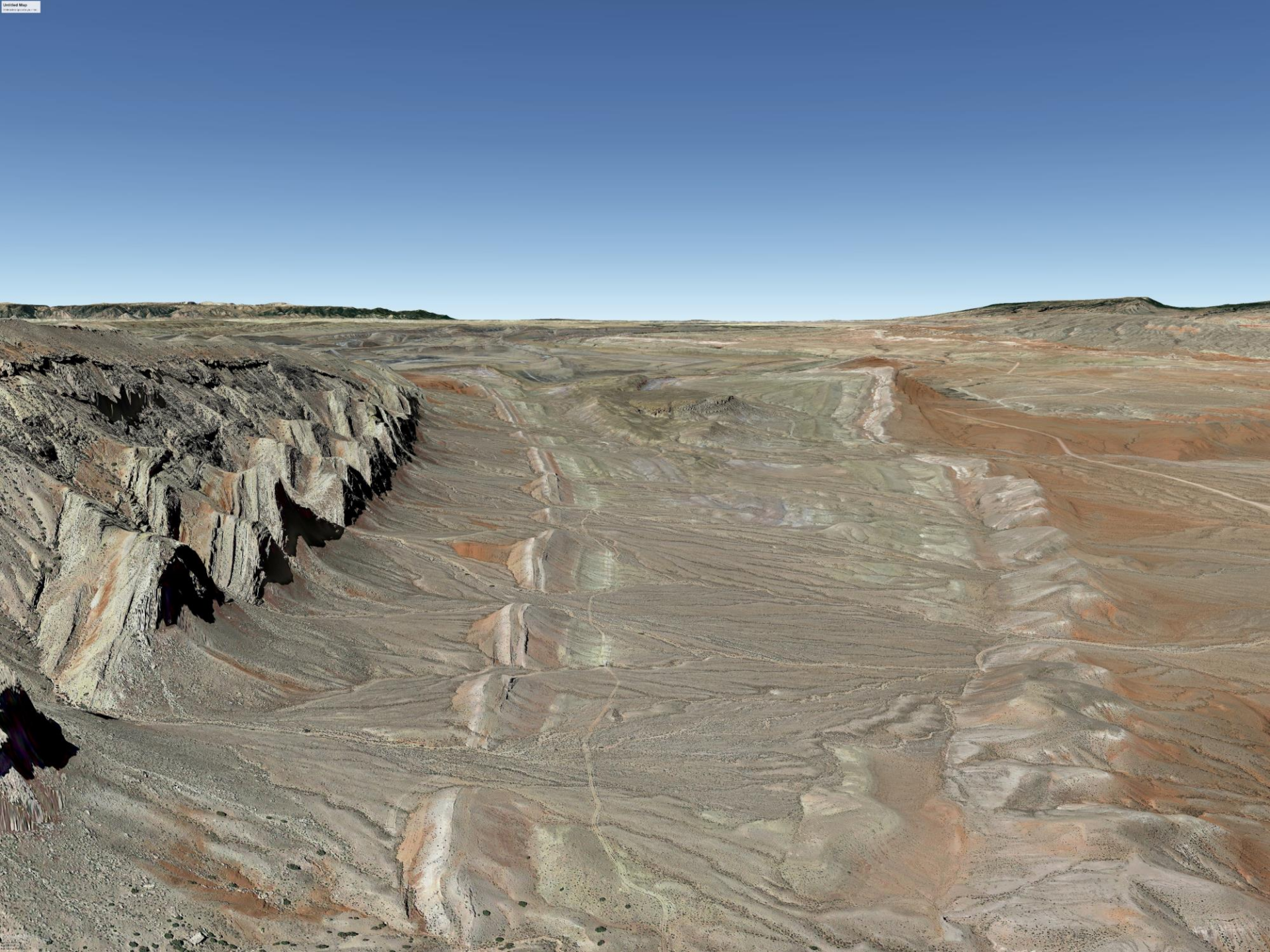


Fig. 1.3 Pitch (or rake) of a line in an inclined plane.

Rule of Vs – describes intersection of planes w/topography

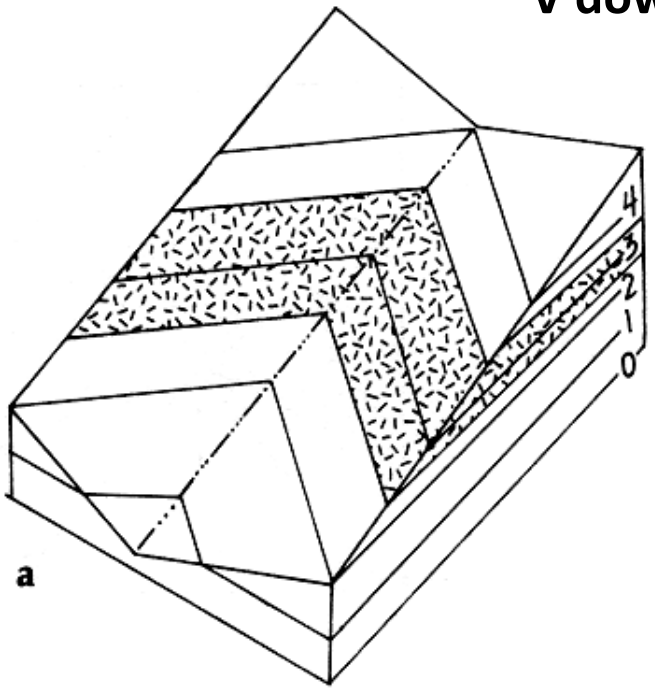


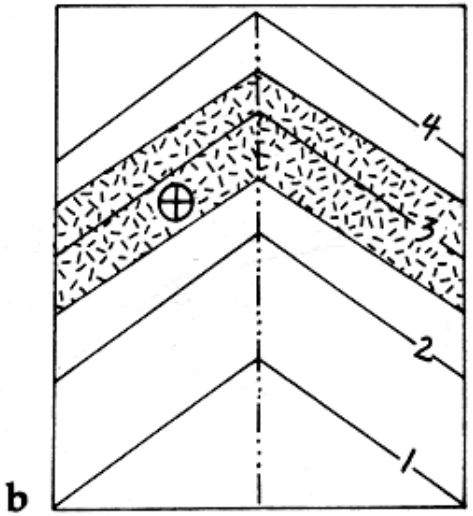

Untitled Map
Legend
Spence Oilfield Rd
Spence Oilfield Rd
Bighorn Rive

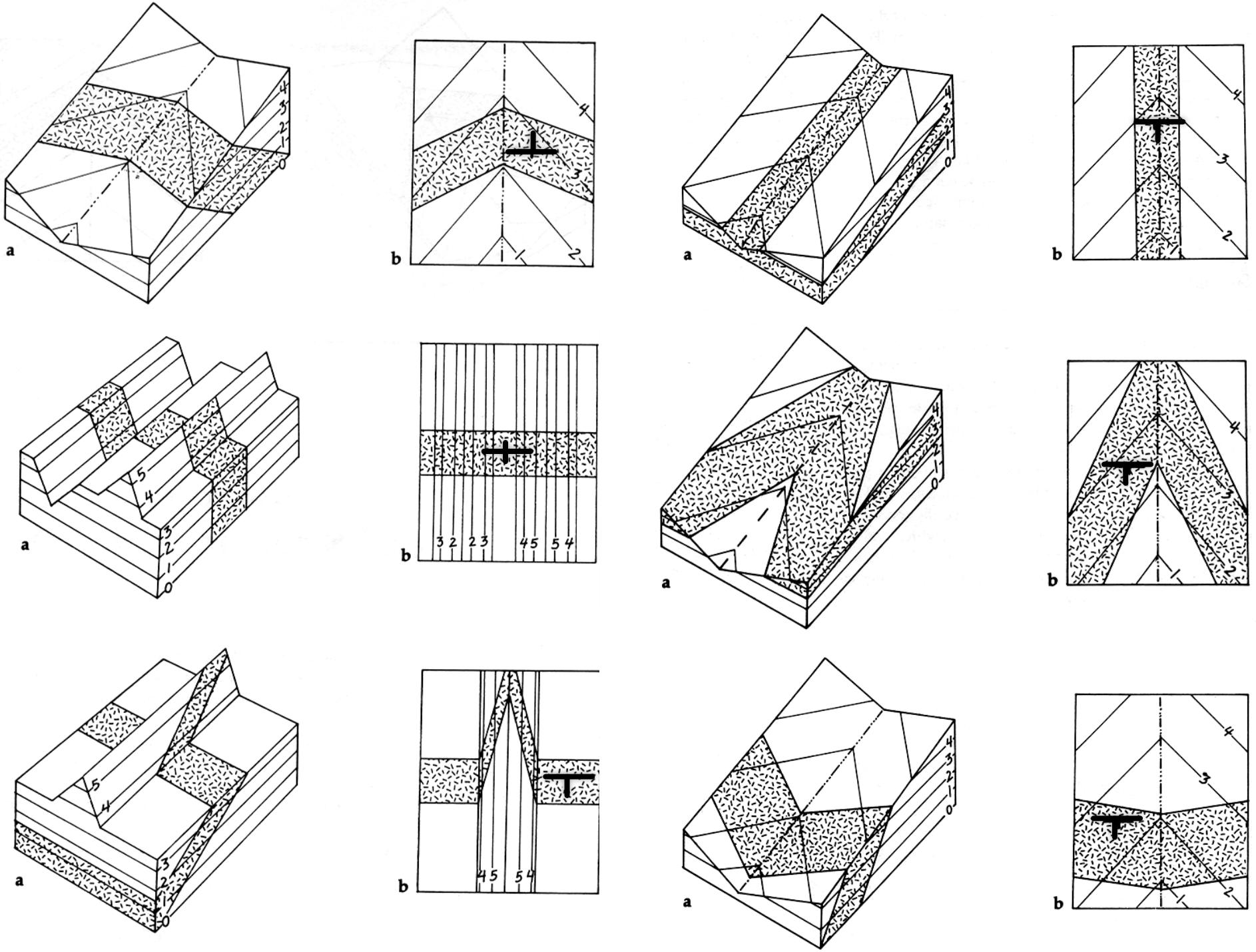


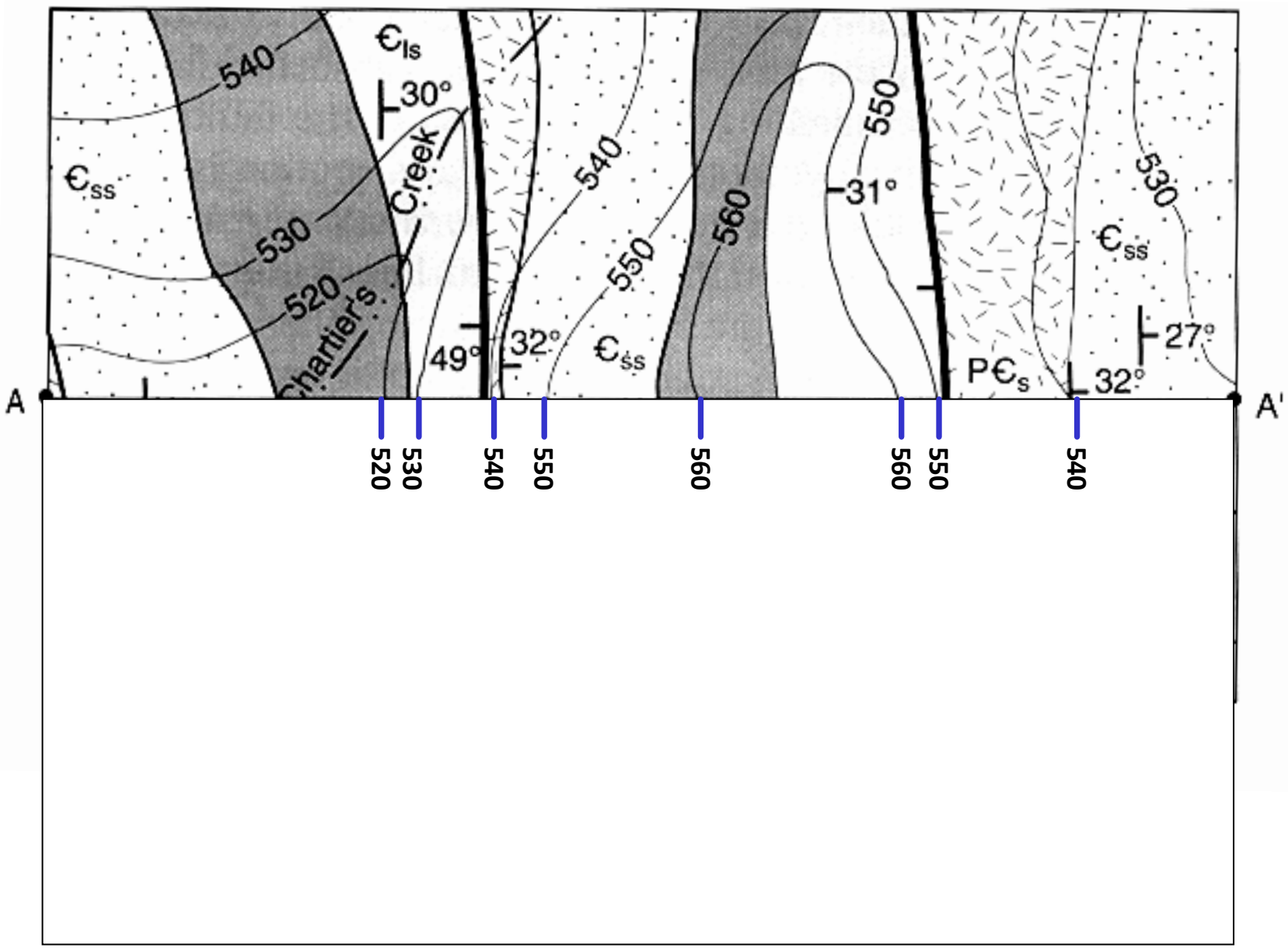
Rule of Vs – describes intersection of planes w/topography

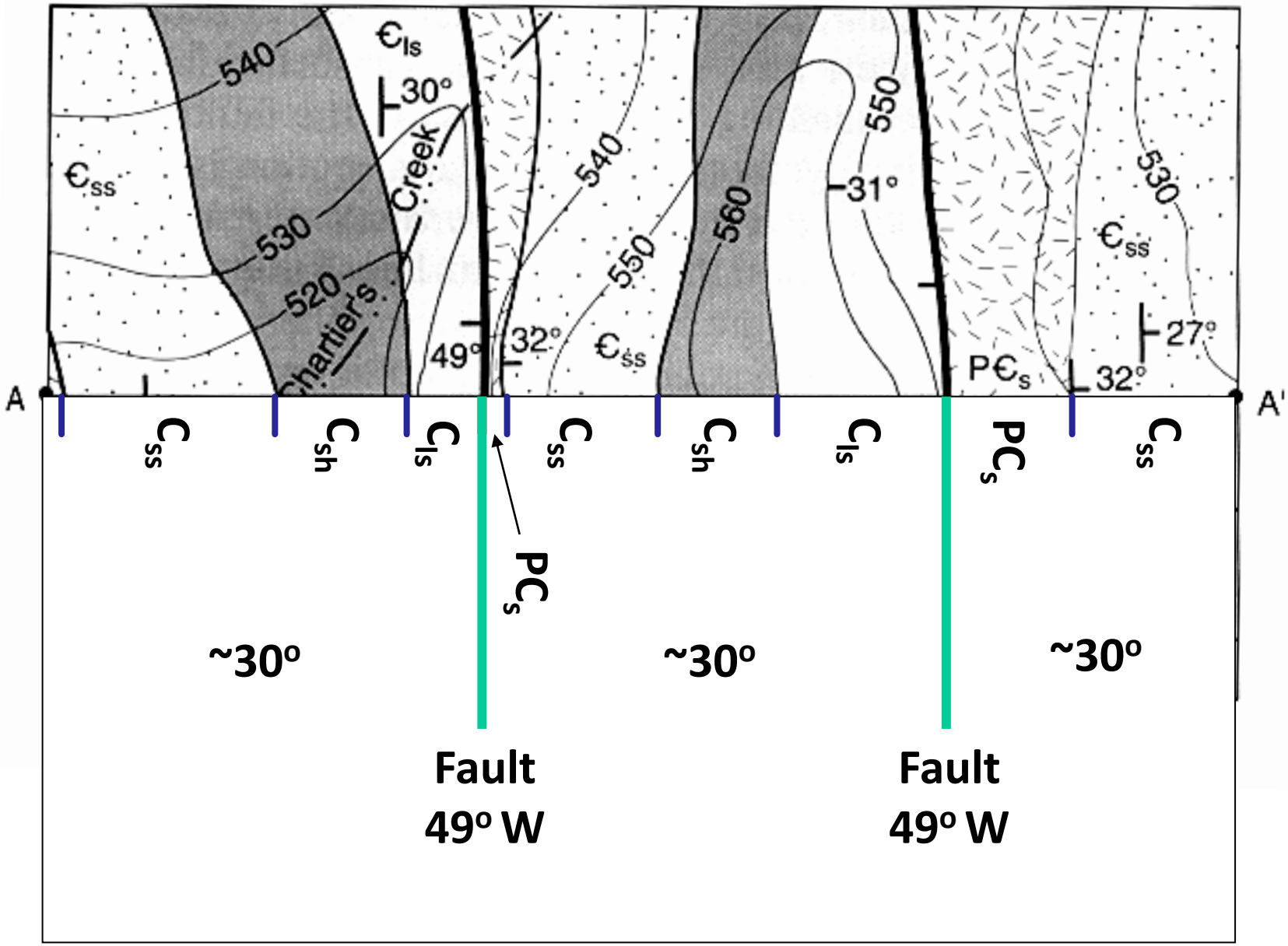
- Intersection of two planes is a line
- Horizontal planes appear parallel to contour lines and V upstream
- Vertical planes are always represented by a straight line
- Contact of a planar surface with non-planar topography creates a
- curved map pattern
- Planes that dip upstream V upstream
- Planes that dip downstream at the same gradient as valley appear parallel to the stream bed
- Planes that dip downstream at a steeper gradient than the stream bed V downstream

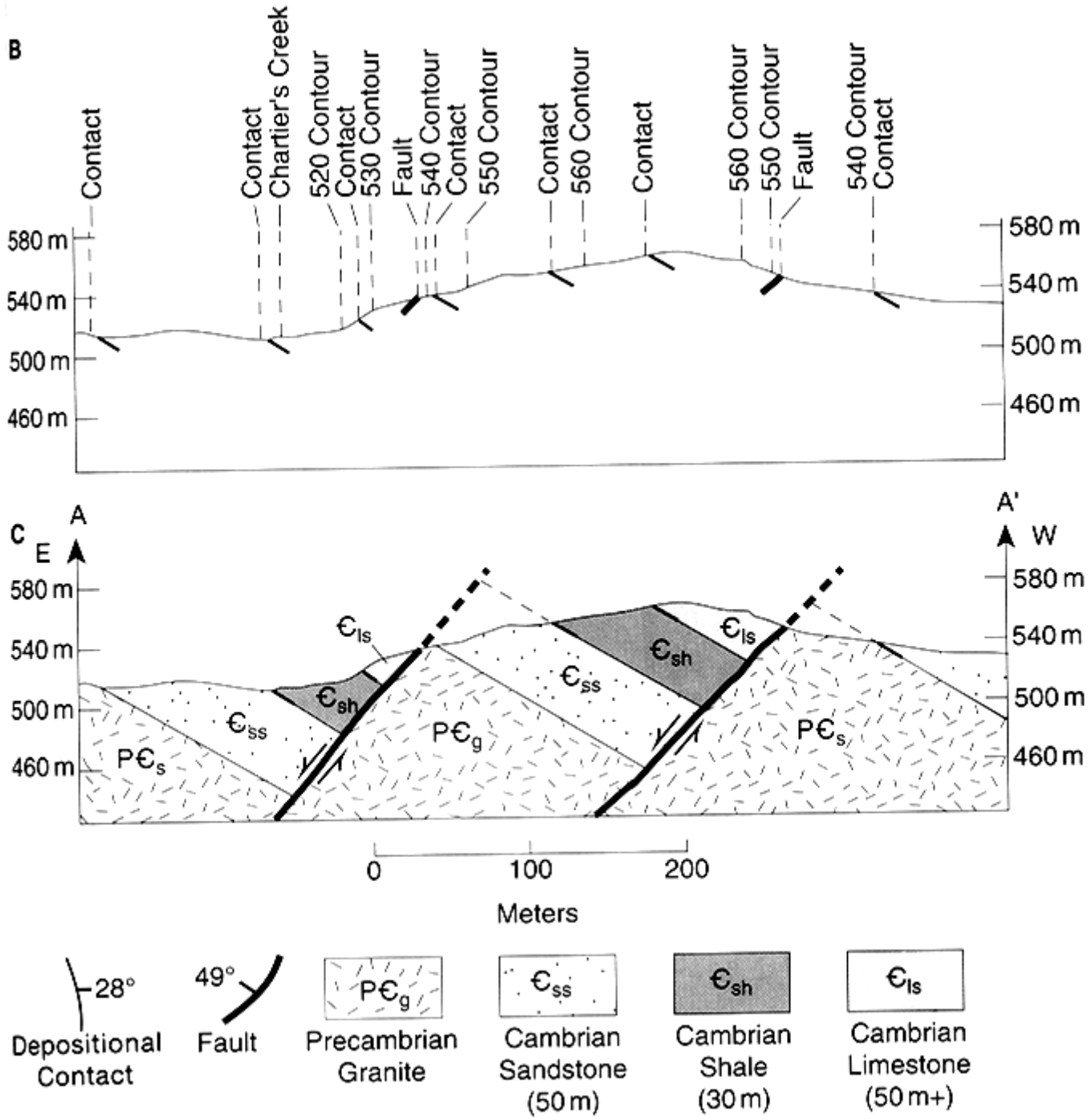




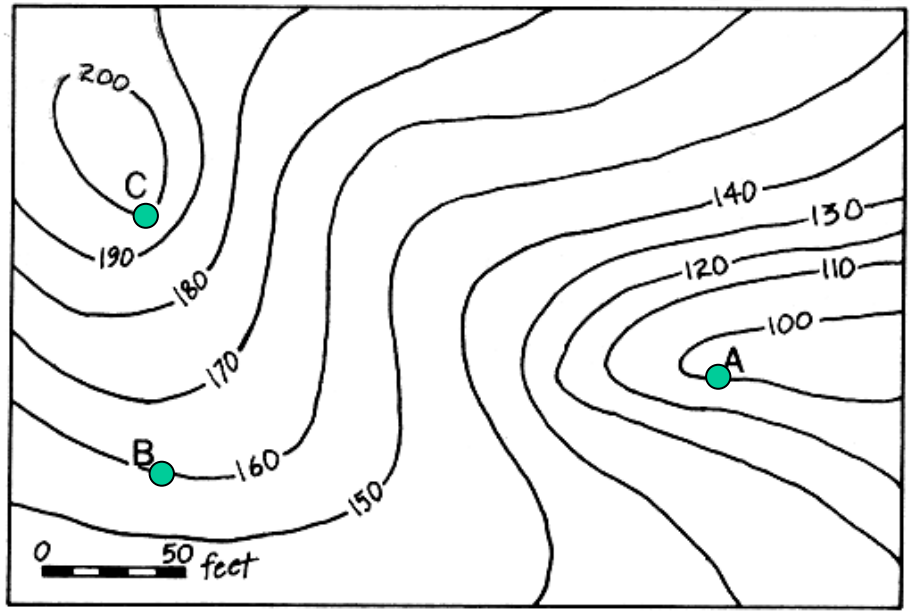

a
b
a
b
a
b
a
b
a
b
a
b


A
A'
€ss
€ls
€ss
€ss
P€s
Creek
Chartier's
30°
49°
32°
31°
27°
32°
540
530
520
550
560
540
550
530
520
530
540
550
560
560
550
540

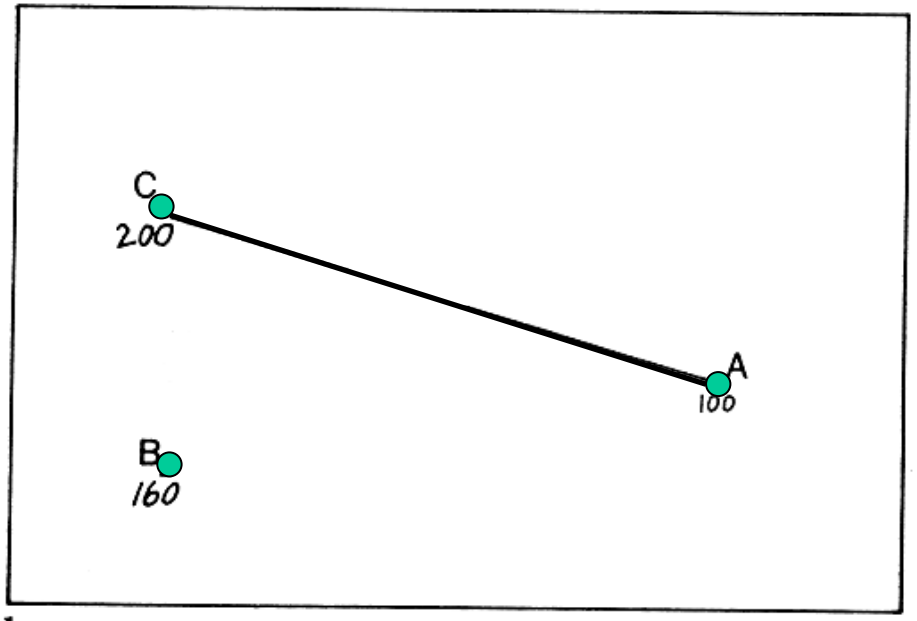

A
A'
€ss
€ls
€sh
PCs
540
530
520
550
560
30°
49°
32°
31°
27°
Creek
Chartier's
~30°
~30°
~30°
Fault
49° W
Fault
49° W


B
Contact
Contact
Chartier's Creek
520 Contour
Contact
530 Contour
Fault
540 Contour
Contact
550 Contour
Contact
560 Contour
Contact
560 Contour
550 Contour
Fault
540 Contour
Contact
580 m
540 m
500 m
460 m
580 m
540 m
500 m
460 m
C
A
E
A'
W
580 m
540 m
500 m
460 m
€ls
€sh
€ss
P€g
P€s
€ls
€sh
€ss
P€s
580 m
540 m
500 m
460 m
0
100
200
Meters
28°
Depositional Contact
49°
Fault
P€g
Precambrian Granite
€ss
Cambrian Sandstone (50 m)
€sh
Cambrian Shale (30 m)
€ls
Cambrian Limestone (50 m+)

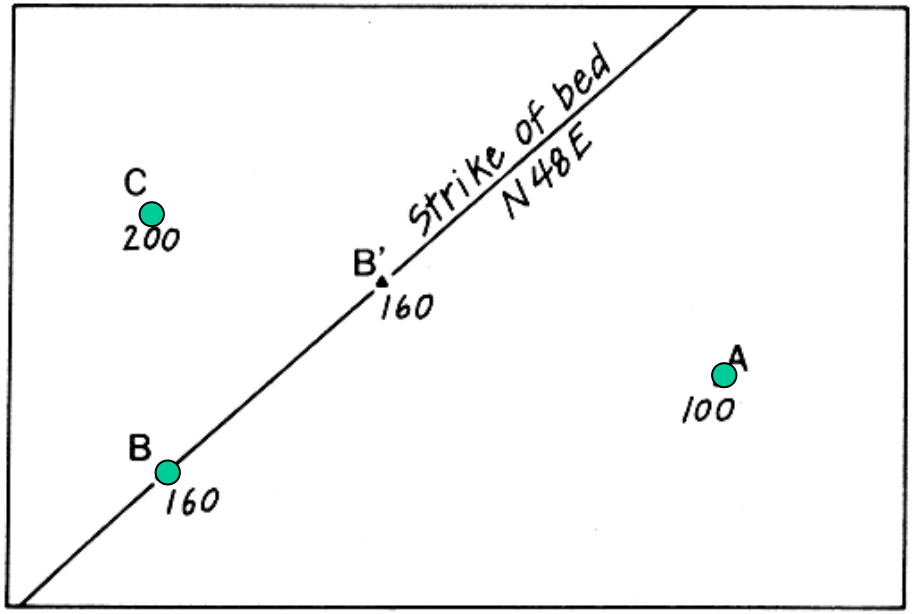
Three-Point Problem



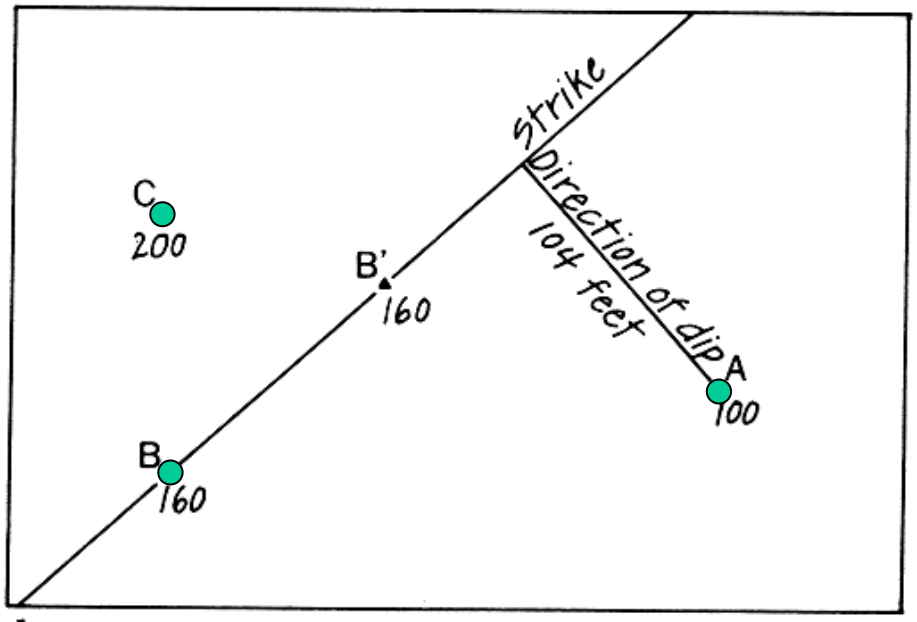
a



b

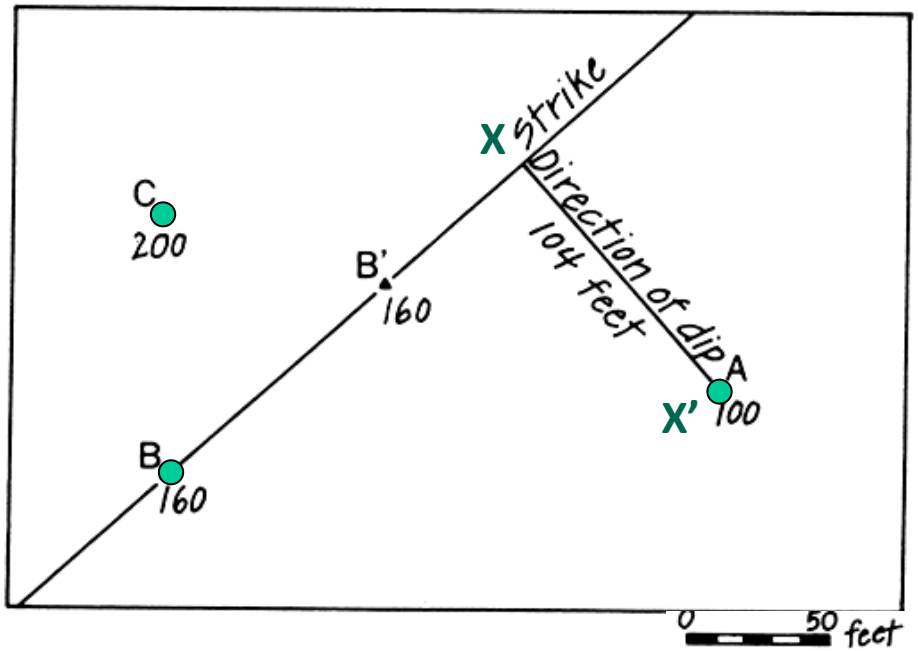


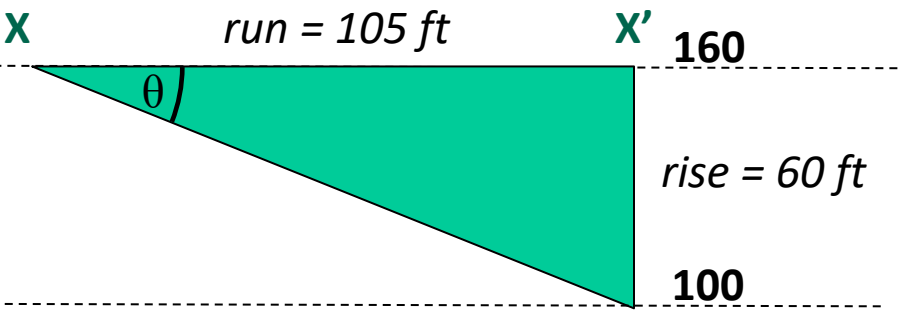
c



d

Three-Point Problem





$$\tan\theta = (\frac{opp}{adj})$$

$$\tan^{-1}(\frac{60ft}{105ft}) = \theta = 30^o$$