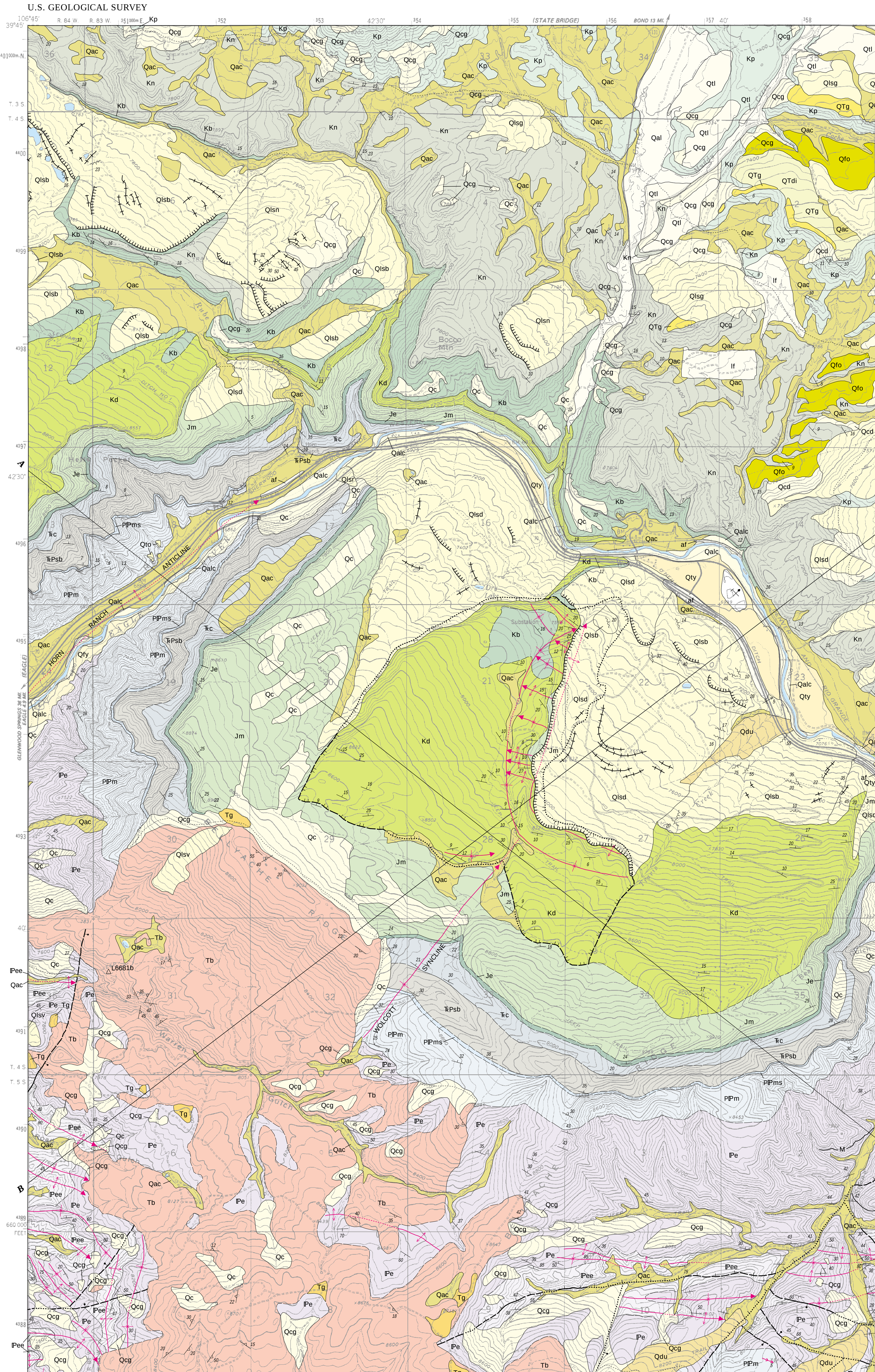


Base from U.S. Geological Survey, 1962
Photorevised 1987
Lambert conformal projection. 10,000-foot grid ticks based on Colorado coordinate system, central zone. 1,000-meter Universal Transverse Mercator grid ticks, zone 13.
1927 North American Datum

APPROXIMATE MEAN DECLINATION, 1998

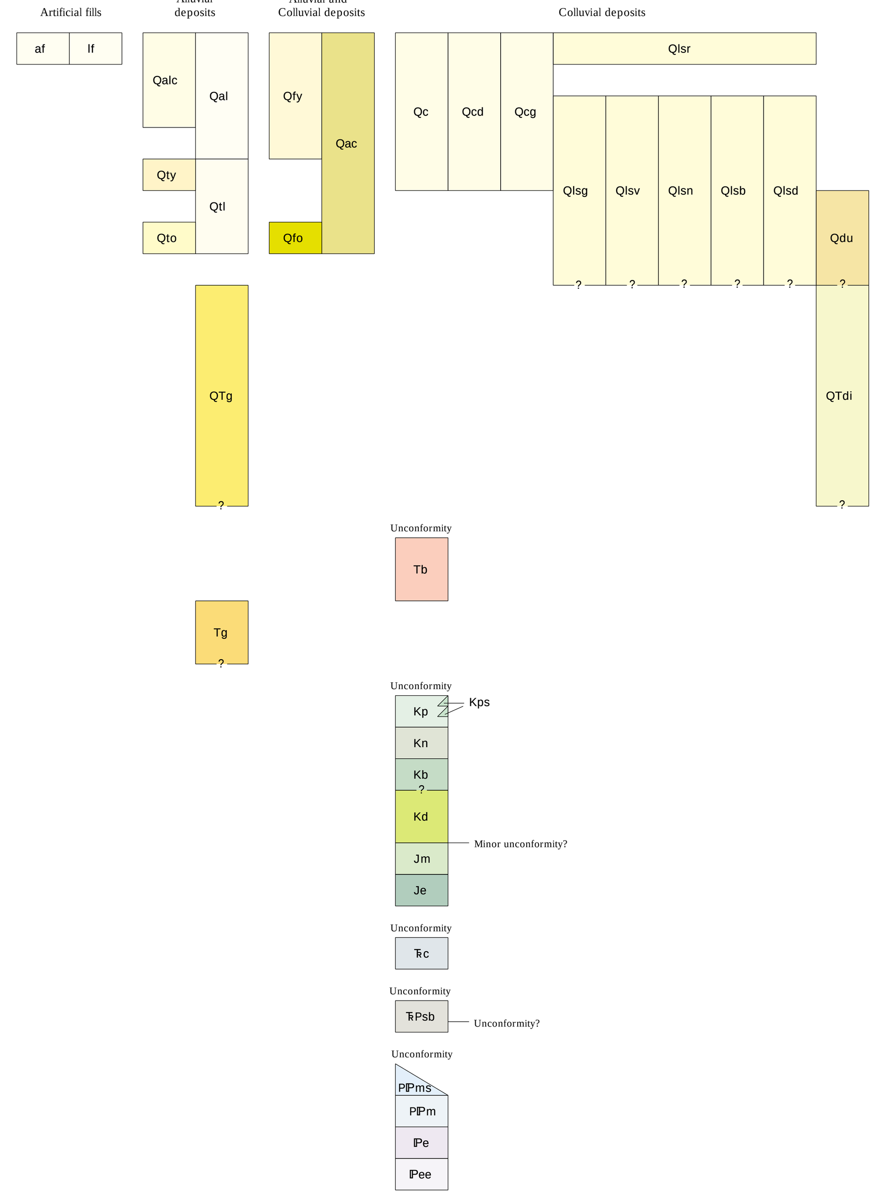
SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
DASHED LINES REPRESENT 20-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

MAP LOCATION

Geology mapped by Dave Lidke in 1996; assisted by Kevin M. Theissen
Map, sections, correlation, and index map digitized by Dave Lidke
Layout design, and digital layout by Denny Welp and F. Craig Brunstein
Manuscript approved for publication August 14, 1998

CORRELATION OF MAP UNITS

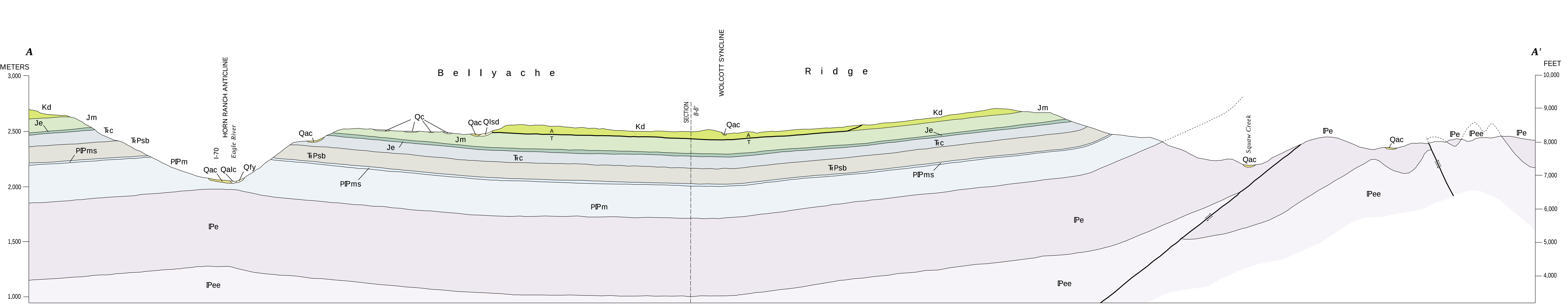


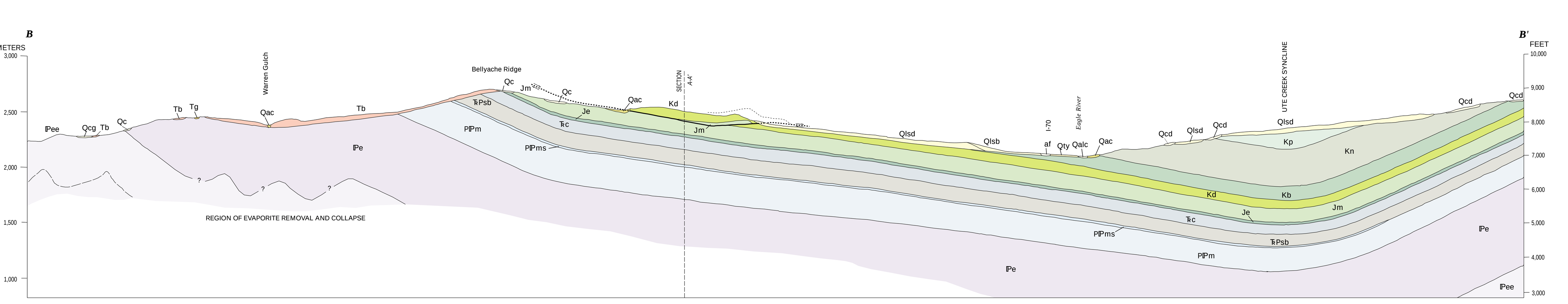
DESCRIPTION OF MAP UNITS

Younger terrace alluvium of Eagle River (late Pleistocene)—Alluvium deposited by Eagle River that underlies terraces about 6–8 m above river. Unit consists of well-sorted, imbricated, rounded and well-rounded pebble-cobble gravel. Clasts consist predominately of white and pink coarse-grained granite, white and gray fine-grained granite and granodiorite, dark gneiss and schist, white, pink, and tan quartzite, fine- to medium-grained red sandstone, and basalt. Some clasts have a thin, white carbonate coat. Matrix consists of pale-brown, silty sand and sand. Gravel is commonly overlain by about 1 m of overbank materials consisting of massive, light-yellowish-brown, silty fine sand and fine sand. Wedges of undivided alluvium and colluvium (Qac) overlie and cover terrace

CONVERSION FACTORS

Multiply	By	To obtain
centimeters (cm)	0.3937	inches (in.)
meters (m)	3.281	feet (ft)
kilometers (km)	0.6214	miles (mi)





DISCUSSION OF STRUCTURAL FEATURES

Structural features in the map area include faults and folds of differing ages and origin (fig. 1). Most faults and folds appear to be related to deep-seated, regional tectonism. Some folds and a large sag in the southwestern part of the map area, however, probably are local features related to gravity block-glide landsliding, and to collapse or upheaval of rock units due to dissolution and diapiric movement of evaporitic rocks of the Eagle Valley Evaporite (IPee). The north and central parts of the quadrangle contain gently north-dipping Pennsylvanian to Late Cretaceous strata that are deformed by three north- to northeast-trending folds. From west to east they are the Horn Ranch Anticline and the Wolcott and Ute Creek Synclines. Rock units of the Middle Pennsylvanian Eagle Valley Formation and the Eagle Valley Evaporite are exposed in the southern part of the quadrangle; these strata are complexly deformed by tight, closely-spaced folds that are cut by normal and reverse faults. In the southwestern part of the quadrangle, early Miocene basaltic flows unconformably overlie previously folded rocks of the lower part of the Eagle Valley Formation and the Eagle Valley Evaporite. These basaltic flows apparently have collapsed as much as 430 m due to dissolution and removal of underlying evaporitic rocks. In the central part of the quadrangle, a crescent-shaped anticline and syncline pair and smaller cross folds formed in a large, block-glide landslide that consists mainly of the Dakota Sandstone. These structural features are labeled on figure 1 and described, from oldest to youngest, in greater detail below.

SOUTHERN FOLD AND FAULT ZONE

Complexly deformed strata of the Eagle Valley Formation and Eagle Valley Evaporite in the southern part of the map area comprise a structural domain referred to here as the "southern zone of folds and faults" (fig. 1). Folds in this zone are tight and have variable to sinuous trends, and in places are cut by steep to moderately dipping normal and reverse faults. Fold axes trend east-southeast to east-west in the western and central part of the zone, but they are bent and refolded into a northerly configuration in the eastern part of the zone where they wrap around the east limb of the Wolcott syncline. Folds in the eastern part of the zone are cut by north- to northeast-striking reverse faults. Early Miocene basaltic rocks are unaffected by the folds and many of the faults that deform the underlying Pennsylvanian rocks. This indicates that the folding and faulting in the southern zone is Pennsylvanian or younger but older than the early Miocene basaltic rocks that truncate these structures.

Folds and many of the faults in the southern zone are the oldest structures identified in the map area, because they are deformed by younger structures like the Wolcott syncline. Folds in the southern zone may have initially developed during (1) Pennsylvanian to early Permian deformation related to formation of the ancestral Rocky Mountains, (2) Laramide deformation (Late Cretaceous to Eocene) that initiated the formation of the present Rocky Mountains, or (3) flowage and diapiric activity of evaporitic rocks in the Eagle Valley Evaporite at sometime during Pennsylvanian to pre late Laramide time. The folds in the southern zone are principally confined to the lower part of the Eagle Valley Formation and the underlying Eagle Valley Evaporite, and they appear to have

[...]

depositional voids or soluble minerals such as evaporitic minerals (J.M., Soule, Colorado Geological Survey, oral commun., 1998) (table 1). The Eagle Valley Evaporite (IPee) and the Eagle Valley Formation (IPe) are respectively the principal evaporite-rich and evaporite-bearing rock units in the map area. These two units are widely exposed in the southern part of the map area.

In Eagle and Garfield Counties, evaporite-related collapse features range in scale from local, relatively small and widely scattered sinkholes, to relatively large regional collapse centers (Kirkham and others, 1997; Scott and others, 1998). The sinkholes commonly are a few meters to tens of meters in length and width, and show surface collapse of about one to several meters; many of these have formed relatively recently, a few within the last several years. In contrast, the regional collapse centers are a few to many kilometers in length and width and appear to have collapsed as much as a thousand meters. The regional collapse centers apparently have collapsed slowly, and perhaps continually, during the last few to several million years. Much of the evidence for the presence of these collapse centers comes from deformation and sagging of 24 to 8 Ma basaltic flows where they overlie evaporitic rocks. The basaltic flows (Tb) in the southwestern part of the map area overlie the Eagle Valley Evaporite (IPee) and Eagle Valley Formation (IPe), and these basaltic rocks appear to have collapsed or sagged (Hubert, 1954) as much as 430 m during some period of time after about 22 m.y. ago when they were initially deposited. This area of regional collapse in the map area is considered part of the recently identified, but incompletely defined, Eagle collapse center (Kirkham and others, 1997; Scott and others, 1998).

Areas underlain by evaporitic rocks have some potential for diapiric upwelling (rising ground) related to differential loading, or perhaps, hydration of evaporitic material. Diapiric upwelling, however, also appears to be principally a slowly evolving, regional-scale process, most notable in some river valleys where rapid downcutting by rivers in the last several million years has decreased the overlying load above evaporitic rocks at depth and thereby triggered the anticlinal upwelling, or rise, of the evaporitic rocks beneath the river valley (Kirkham and others, 1997; Kirkham and Widmann, 1997). The Horn Ranch anticline, in the west-central part of the map area, may reflect diapiric upwelling of evaporitic rocks at depth beneath the steep canyon of the Eagle River (Scott and others, 1998).

Areas underlain by and near evaporitic rocks also have potential for high-salinity surface and ground water from dissolution of the evaporitic rocks and surficial deposits derived from them. The Eagle and Colorado Rivers are known to have high salinities downstream from the map area, and a large percentage of that salinity is probably derived from dissolution of evaporitic rocks and evaporitic surficial deposits (Kirkham and others, 1997; Kirkham, 1997; Scott and others, 1998).

EXPANSIVE AND CORROSIVE SOILS

Soils that tend to swell or shrink due to changes in moisture content are commonly known as expansive soils. Expansive soils are common in those areas underlain by sedimentary rock containing expansive clay minerals, or in areas underlain by colluvial and alluvial deposits derived from those rocks. Expansion and contraction of these soils can cause structural damage to rigid materials, such as foundations, pipes, and septic systems sitting on or buried in these expansive soils. In the map area the Benton Shale (Kb) and Pierre Shale (Kp) are known to contain bentonite, which

[...]

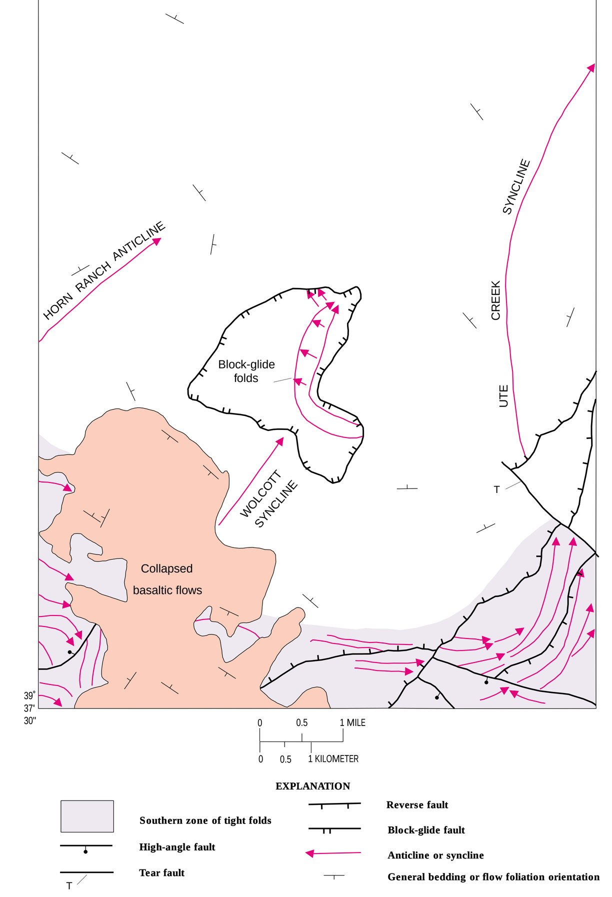


Figure 1. Sketch map of structural features in the Wolcott quadrangle, Colorado

[...]

Near the crest of Bellyache Ridge, the Dakota Sandstone (Kd) and the uppermost part of the Morrison Formation (Jm) have also failed as a large, essentially intact, block-glide mass that slid northward down slope. The toe of this large block-glide appears to have been folded above its underlying block-glide fault as it slid (see map, cross section B-B', and discussion of structural features). Braddock (1978) has discussed and described similar large block-glide masses that involve the Dakota Sandstone and Morrison Formation in several locations along the Colorado Front Range. The Bellyache Ridge block glide formed before formation of the landslide deposits (Qlsd) that cover its northern edge; therefore, movement of the block-glide mass probably occurred in the early Pleistocene or earlier.

The potential for rock-fall hazards exist along nearly all of the steep cliffy slopes in the map area, particularly those containing sandstone ledges. The Dakota Sandstone cliffs appear to be particularly susceptible to rock falls as is evident from the abundant large sandstone boulders on slopes and at the base of slopes beneath cliffs of the Dakota Sandstone.

FLOODING

The flood plain of the Eagle River is very narrow throughout most of the map area, as defined by the stream channel and flood-plain deposits (Qalc) along the Eagle River. The Eagle River floodplain has potential for flood hazard during prolonged or high precipitation and runoff events (table 1). Other areas of possible flood hazard during such events include low-lying areas along Squaw Creek and it's tributaries and low-lying areas along Alkali, Muddy, and Red Canyon Creeks. In addition to these locations, low-lying areas near the mouths of Rube, Milk, and Alkali Creeks may also be prone to rare floods and debris-flow events caused by intense thunderstorms in their headward regions. Numerous relatively low-lying locations in the map area underlain by undivided alluvium and colluvium (Qac), particularly fine-grained deposits in the northern part of the quadrangle, may be susceptible to local flooding accompanied by rapid erosion and gullying during cloudburst or prolonged thunderstorm conditions.

GROUND SUBSIDENCE

Nearby the map area and in localities elsewhere in Eagle and Garfield counties, significant property losses have resulted from ground subsidence related to solution voids in evaporitic rocks, and from subsidence related to hydrocompaction of soils and low-density, surficial materials containing

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[...]
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Table 1.—*Map units associated with potential geologic hazards in the Wolcott quadrangle*

Erosion: Mass wasting[1]			Erosion: Gullying	Ground subsidence		Expansive and corrosive soils		Flooding
QTg	Qlsg	QTdi	Qac	Qac	IPee	Qac	Kb	Qalc
Tg	Qlsv	Tb	Qfy	Qc	IPe	Qc	Kp	Qal
Qc	Qlsn	Kn					IPee	Qac
Qcd	Qlsb	Kb					IPe	Qfy
Qcg	Qlsd	Kd						Qty?
Qlsr	Qdu							

[1]Includes landslides, debris flows, rockfalls and rock topples.

GEOLOGIC MAP OF THE WOLCOTT QUADRANGLE, EAGLE COUNTY, COLORADO

By

David J. Lidke

1998