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INTERIM GEOLOGIC MAP OF THE JERICHO QUADRANGLE, JUAB COUNTY, UTAH

ABSTRACT

The Jericho 71/2’ quadrangle covers the northern Gilson Mountains in west central Utah. The Gilson Mountains are the first fault-bounded range of the Basin and Range province west of the Wasatch Front. Within the Gilson Mountains, Sevier (Mesozoic)-age shortening structures are preserved; the most prominent are the Tintic Valley (TV) thrust and the Leamington Canyon (LC) fault and their associated structures. The LC fault, exposed along the southern margin of the Gilson Mountains south of the quadrangle, is a thrust fault that is folded by underlying structures and shows top down-to-the-southeast shear. The TV thrust sheet is folded into an anticline-syncline pair by a small-scale horse in the footwall of the TV thrust; this fold pair is partly exposed in the quadrangle. The TV thrust has a leading branch-line with the LC fault in the south-western Gilson Mountains outside the Jericho quadrangle.

In the Jericho quadrangle, both TV hanging wall and footwall rocks and structures and late normal faults are exposed. The small-scale horse and reclined folds associated with emplacement of thrusts are also exposed. These older structures are covered by Tertiary rocks and Quaternary deposits in the northern half of the Jericho quadrangle.

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INTRODUCTION

The Jericho 71/2' quadrangle covers part of the northern Gilson Mountains in west central Utah (figure 1). The town of Jericho is 45 miles northeast of Delta, Utah, and is accessible by U.S. highway 6 and secondary paved roads. The Gilson Mountains are south of the town of Jericho (figure 2) and are accessible via dirt roads and 4-wheel-drive trails. The highest elevation in the Gilson Mountains reaches 2286 m, and is about 732 m above the surrounding valleys. U.S. highway 6 passes between the Gilson Mountains and the Black Mountains to the west. Utah state highway 148 passes between the Gilson Mountains and the East Tintic Mountains that lie to the northeast. Utah State highway 132 passes between the southern Gilson Mountains and the Canyon Mountains to the south.

The Gilson Mountains are the first fault-bounded range of the Basin and Range Province west of the Wasatch Front. Within the Gilson Mountains, shortening structures were formed during the Mesozoic Sevier orogeny (structures shown regionally on figure 1a). The most prominent Sevier-age structures are the Tintic Valley (TV) thrust, the Leamington Canyon (LC) fault, and associated folds (figure 2). Both the TV thrust and the LC fault are folded by underlying structures. In the Jericho quadrangle, erosion through the anticlinal portion of the TV thrust exposes an underlying small-scale horse with overturned beds of upper Paleozoic rocks (Mu in figure 2). The LC fault is south of the Jericho quadrangle.

Costain (1960) was the first to describe the geology of the area; his mapping covered the entire Gilson Mountains and he identified two high-angle reverse faults (north Gilson fault and south Gilson fault); these were later referred to as the Tintic valley thrust by Morris and Kopf (1969), Wang (1970) and Morris (1987 a and b), although there is some controversy regarding the exact exposure of the fault. Higgins (1982) mapped the part of the Gilson Mountains in the Champlin Peak quadrangle, south of the Jericho quadrangle (figure 2). Most recently the overall structural geometry of the Gilson Mountains, including the LC fault and the TV thrust, have been described by Kwon and Mitra (2001). The mapping of the Gilson Mountains was done at a scale of 1:24,000 (or at 1:12,000 where more detail was required), with the aid of black and white aerial photographs. The Cenozoic geology is from Pampeyan (1989).

STRATIGRAPHY

Cambrian in NW
see next ¶

fixed & footwall & TV also added

Map units in this quadrangle belong to three main structural packages: (1) Pennsylvanian and Permian strata that form the footwall of the Tintic Valley (TV) thrust, (2) Silurian to Mississippian strata in the hanging wall of the TV thrust, and (3) Cenozoic sediments and rocks that were deposited on top of the thrust sheets.

Ord?

STRATA OF THE HANGING WALL OF THE SHEEPROCK THRUST

Costain (1960) first mapped the Jericho Ridge as Tintic quartzite, and Morris (1987) reinterpreted it as Prospect Mountain quartzite. We follow ~~the~~ Morris (1987) for describing the lower Cambrian quartzite of Jericho Ridge.

Lower Cambrian Quartzite

Prospect Mountain (Cpm)

The Prospect Mountain quartzite is exposed on Jericho Ridge at the northwestern corner of the Jericho quadrangle. The formation is made up of white to light red, medium-grained, thick- to very thick-bedded quartzites with cross bedding (Costain, 1960; Morris, 1987).

STRATA OF THE HANGING WALL OF THE TINTIC VALLEY THRUST

Costain (1960) established the stratigraphic scheme for the Gilson Mountains and this scheme was largely followed by Wang (1970), Higgins (1982) and Pampeyan (1989). We have largely used the stratigraphic classification of Costain (1960), and have followed the stratigraphic scheme of Pampeyan (1989) for Cenozoic sediments and rocks. ~~The~~ A stratigraphic section in the Gilson Mountains of the TV thrust sheet was also measured by Welsh (1982).

Middle Silurian

Laketown Dolomite (Sl) still mixed English + metric

see previous

The Laketown Dolomite, which was originally defined in the Bear River Range at the Utah-Idaho border, is exposed with a thickness of 369 m (Welsh, 1982) in the northern Gilson Mountains. The base of the Laketown is bounded below by the Tintic Valley (TV) thrust, so that its base is not exposed. The Laketown is an aphanitic to coarse-grained, massively bedded dolomite with abundant a lot of chert layers and intraformational conglomerates in the upper part of the formation. The Laketown appears light gray to dark gray on a fresh surface, and weathers light blue gray to dark blue gray. Stromatolitic horizons are observed within thin-bedded crystalline cherty dolomite with medium to dark gray color. Most of the dolomite is unfossilferous, even though there are orthid brachiopods and rugose corals near the top of the unit, and tabulate corals near the base of the unit (Costain, 1960). The Laketown Dolomite is disconformably overlain by a basal conglomerate horizon of the white-weathering Sevy Dolomite.

Devonian

Sevy Dolomite (Dse)

The Sevy Dolomite is gray to olive gray on fresh surfaces, and weathers a grayish white to almost white. It is a fine-grained dolomite with scattered grains of frosted clear quartz. Individual beds are ~2 m thick and there is a 1.2 m thick bed of light-gray, quartzose sandstone in the upper part of the formation (Costain, 1960). The white-weathering color helps to distinguish the Sevy Dolomite easily from other dolomites in the field. The bottom of the Sevy Dolomite is placed at the base of a poorly exposed conglomerate horizon with small (3 to ~~m~~ 10 mm) Sevy-like pebbles in a gray arenaceous matrix. The upper contact is drawn at the base of the medium-gray weathering Simonson Dolomite. The thickness of the Sevy Dolomite in the northern Gilson Mountains is 97 m (Welsh, 1982).

Simonson Dolomite (Dsi)

The Simonson Dolomite, 75 m (Welsh, 1982) thick in the northern Gilson Mountains, has a conformable contact with the underlying Sevy Dolomite. It conformably underlies the Victoria Formation, but has disconformable contacts with the Fitchville Formation where the Pinyon Peak and Victoria Formations are missing. The Simonson is a fine- to medium-grained, medium gray, color-banded dolomite (Costain, 1960). Individual beds are about 0.7 m thick. The lower portion of the Simonson Dolomite contains a 2 meter thick zone of laminated dolomite with biscuit-shaped structures that correspond to the "Curley limestone" of Proctor and Clark (1956).

Devonian – Lower Mississippian

Pinyon Peak Formation and Victoria Formation (Dpv)

The Victoria Formation consists of a basal unit of dolomitic breccia and dolomites, a middle unit of light-brown, fine- to coarse-grained, thin-bedded quartzose sandstone with cross-bedding, and an upper unit of medium- to dark-gray, fine-grained dolomite (Costain, 1960). The Victoria Formation is unconformably overlain by the Pinyon Peak Limestone ~~in other places~~, ~~but is not~~ Scattered parts of the Victoria Formation are exposed in the northern Gilson Mountains. though not documented in the Jericho Quadrangle The Pinyon Peak Formation is 33 m (Welsh, 1982) thick in the northern Gilson Mountains, and shows a uniform sequence of dark-blue, fine-grained, thin- to medium-bedded, silty limestone. The upper unconformable contact with the Fitchville Formation is placed at the first appearance of thin- to thick-bedded, very silty and very crinoidal limestone (Costain, 1960). The fossils included in this formation are corals, brachiopods, foraminifera, and conodonts.

Mississippian

Fitchville Formation (Mf)

The Fitchiville Formation is ~48 m thick (Welsh, 1982) in the northern Gilson Mountains and consists of medium-bluish to dark-gray, fine- to medium-grained limestone and dolomite. The dolomite unit in the middle of the Fitchville Formation is a steep cliff-former with 60 # cm thick white calcite beds at the base and top. The top of the Fitchville formation has a "Curley limestone" (Proctor and Clark, 1956) that is defined by the presence of biscuit-shaped structures within beds. Fossils taken from the Fitchville Formation in the northern part of the Gilson Mountains are brachiopods, and corals indicating early Mississippian age (Costain, 1960; Wang, 1970).

Gardison Limestone (Mg)

The Gardison Formation, as exposed in the northern part of the Gilson Mountains, conformably overlies the Fitchville Formation in most places, but has unconformable contacts locally. The top of the formation is placed at the base of the first shales and siltstones of the conformably overlying Deseret Limestone. The Gardison Limestone is divided into three distinct units (Costain, 1960). The lower unit is a fine-grained, gray-blue limestone (~70m thick) with abundant silicified horn corals in the lower part; the upper part of this unit has a 90cm thick breccia zone (Costain, 1960), with breccia fragments of dolomite that are lighter-colored than the matrix and that range in size from 6 to 150cm. The middle unit is ~27m thick and consists mostly of medium-gray, massive dolomite with medium to coarse grains. The base of the middle unit has many pockets and lenses of conglomerates, with pebbles of dolomite and chert. Finally, the upper unit, ~12m thick, is medium-bedded, fine-grained, blue-gray limestone, with a thin, black bed of oolites observed in the middle of the unit. The total thickness of the Gardison Formation in the northern Gilson Mountains is ~120 m (Welsh, 1982). The fauna found in the Gardison Limstone in the Gilson Mountains includes brachiopods, gastropods, and tabulate and horn corals.

Deseret Limestone (Md)

The Deseret Limestone is ~180m thick in the northern Gilson Mountains (Welsh, 1982) and consists dominantly of fine-grained, thin-bedded limestone with chert nodules and fine-grained, fissile siltstone (Costain, 1960). The limestone appears medium dark gray to black, and the siltstone is medium gray blue on fresh surfaces. The conformable upper contact with the overlying Humbug Formation is ~~recognized~~ placed where sandstone is abundant. The base of the Deseret Limestone is drawn at the contact of the Gardison Limestone with the siltstone of the Deseret Limestone. The only fossils that are observed in the Deseret Limestone are brachiopods.

good

still problem in the Humbug

Humbug Limestone (Mh)

The Humbug Limestone, ~190 m thick in the northern Gilson Mountains (Welsh, 1982), is one of the most extensively exposed formations in the Gilson Mountains. The Humbug Limestone has conformable contacts with the overlying Great Blue Limestone and the underlying Deseret Limestone. The base of the formation is drawn at the first sandstone or siltstone bed above the Deseret Limestone. The Humbug Limestone in the southern

Gilson Mountains is in fault contact with the Oquirrh Group along the TV thrust. The Humbug Limestone consists mainly of silty to arenaceous limestone and quartzose sandstone (Costain, 1960). The limestone is fine grained and appears black on fresh surfaces. The sandstone has fine to medium grain-size and appears gray to brown gray to sometimes black, with light tan to brown weathering.

STRATA IN THE FOOTWALL OF THE TINTIC VALLEY THRUST

The Oquirrh Group, in the footwall of the TV thrust, is exposed in the northern part of the Gilson Mountains. It is also exposed along the southern margin of the Gilson Mountains but is not exposed in the Canyon Mountains to the south of the Leamington Canyon fault.

Pennsylvanian - Permian

Oquirrh Group (PPo)

The lower Oquirrh Group is not exposed in the Gilson Mountains because the Tintic Valley (TV) thrust cuts off the lower beds and places the Silurian Laketown Dolomite and Mississippian Humbug and/or Great Blue Formations against the Pennsylvanian-Permian Oquirrh Group. The upper contact of the Oquirrh with the overlying Diamond Creek Sandstone is not present in the Jericho quadrangle and is not well exposed to the south. The thickness of the Oquirrh Group as exposed in the Gilson Mountains is ~1,700m, and the unit is characterized by medium-to dark-gray, thin- to thick-bedded, cherty limestone with thin- to thick-bedded, calcareous sandstone interbeds (Costain, 1960). The upper part of the Oquirrh Group consists mainly of light olive-gray to dark-gray, medium-bedded, arenaceous dolomite with interbedded sandstone units that are similar to those in the lower exposed part (Costain, 1960). Many of the dolomite beds contain numerous chert nodules. Fusulinids, brachiopods, corals, and bryozoan fragments are commom in this unit in the Gilson Mountains (Costain, 1960; Wang, 1970).

CENOZOIC UNITS

North of the Gilson Mountains, there are a variety of Tertiary Formations and Quaternary sedimentary deposits; on our map, these deposits are included following the work of Pampeyan (1989).

Oligocene

Fernow Quartz Latite (Tf) not its likely Copperopolis Latite middle mbr

Light- to medium-gray medium-grained welded tuff containing phenocrysts of quartz, sanidine, andesine, and biotite and black obsidian in a matrix of partly to wholly welded glass shards (Morris, 1975a). Locally includes thin patches of airfall tuff at base. Middle Oligocene in age. Varies from 0-457 m in thickness.

Latite Ridge Latite (Tlr)

Latite Ridge Latite consists of a welded tuff member and an underlying airfall tuff member (Morris, 1975b). The welded tuff member is reddish-brown, medium grained porphyry containing broken phenocrysts of calcic albite, sanidine and biotite, and fragments of fine-grained latite, in a matrix of opaque brown glass that is marked by narrow veinlets of chalcedony. Varies from 0-305 m in thickness. The airfall tuff member is white to gray fine-grained non-welded tuff; 0-183 m thick.

Oligocene to Pliocene

Tertiary sedimentary rocks (Ts)

Regionally this unit is predominantly reddish-brown to grayish-orange, semi-consolidated siltstone and calcareous clay, with lesser amounts of green and red tuffaceous bentonitic claystone, light-gray to white marly limestone, and thin pebble to cobble conglomeratic lenses (Pampeyan, 1989). Thickness exceeds 600m. note on age

Pleistocene

Older Fan Deposits (Qafo)

Semi-consolidated, poorly sorted, crudely stratified sand and gravel in large alluvial fans that border upland areas. Locally includes colluvium, stream alluvium, and younger alluvial fan deposits. Typically deeply dissected (Pampeyan, 1989). Several tens of meters in thickness.

Older Alluvium (Qao)

Mostly stream, and channel deposits consisting of clay- to small boulder-size detrital material. Locally includes alluvial-fan and stream terrace deposits. Poorly sorted, crudely stratified, and moderately to deeply dissected (Pampeyan, 1989). Thickness ranges from a few to tens of meters.

Deposits of Lake Bonneville (Ql)

Lake sediments which consist of interlayered white, light-gray, brown, tan, and yellowish-gray clay, silt, sand, marl, and gravel (Pampeyan, 1989). Several meters to tens of meters in thickness.

Latest Pleistocene and Holocene need note on shoreline

Alluvium Fan Deposits (Qafy)

Unconsolidated, poorly sorted alluvial fan deposits of sand and gravel that are largely derived from older alluvial (Qao) and older fan deposits (Qafo) (Pampeyan, 1989). Commonly overlie the older alluvial deposits. Thickness is usually less than 5m but may be thicker locally.

Alluvium (Qal)

Stream channel deposits consisting of clay- to cobble-size, poorly sorted, crudely stratified, and generally undissected detrital material. Locally includes alluvial-fan and stream-terrace deposits (Pampeyan, 1989). Commonly less than a few meters in thickness.

STRUCTURAL GEOLOGY

Introduction

The Sevier fold-thrust belt (FTB) is an east-verging belt that defines the eastern margin of thin-skinned crustal shortening in the Cordilleran orogen of western North America (Armstrong, 1968; Burchfiel and Davis, 1975; Allmendinger, 1992; Miller and others et al., 1992) (figure 1a). Within this belt, thrusting displaced the Proterozoic, Paleozoic, and Mesozoic miogeoclinal rocks eastward during the late Cretaceous (55-140 Ma) Sevier orogeny (Armstrong, 1968; Burchfiel and Davis, 1975; Schwartz and DeCelles, 1988). The Sevier FTB is broken up into a series of salients, or segments, and these salients are typically decoupled from one another along east-west trending transverse zones (Lawton and others et al., 1994; Mitra, 1997) (figure 1a).

The Gilson Mountains are located at the southern end of the Provo salient, which has a prominent arcuate shape in map view with thrust traces strongly convex toward the foreland (figure 1a); the major thrusts are the Sheeprock thrust (SRT), the Tintic Valley thrust (TVT), the East Tintic-Stockton thrust system (ETT-ST), the Midas thrust (MT), the Charleston-Nebo thrust system (C-NT), and frontal blind thrusts (BT) that form a triangle zone adjacent to the undeformed foreland of the Wasatch Plateau (Morris and Shepard, 1964; Black, 1965; Mabey and Morris, 1967; Morris and Lovering, 1979; Christie-Blick, 1983; Morris, 1983; Tooker, 1983; Smith and Bruhn, 1984; Lawton, 1985; Bruhn and others ~~et al.~~, 1986; Mitra,1997; Mukul and Mitra, 1998) (cross-section A-A' of figure 1c). The Provo salient is separated from the adjoining central Utah segment along the Leamington transverse zone, a prominent ENE-WSW oblique transverse zone that includes the Leamington Canyon fault, associated folds and an out-of-syncline reverse fault (Kwon and Mitra, submitted) (figure 1 and 3).

The geologic setting of the Gilson Mountains and surrounding area has to be interpreted in the context of its regional geological setting (figure 1b). The Tintic Valley (TV) thrust is exposed in the northern and southern Gilson Mountains. Morris (1983) suggests(ed) that part of the TV thrust is also exposed at the south end of the East Tintic Mountains which lie E (east) and NE (northeast) of the Gilson Mountains. The Sheeprock (SR) thrust is exposed in the West Tintic and Sheeprock Mountains that lie to the northwest of the Gilson

Mountains. Across the Leamington transverse zone to the south, in the central Utah segment of the Sevier FTB (figure 1a), the Canyon range (CR) thrust is exposed in the Canyon Mountains (figure 1b and c). The CR thrust sheet and associated hanging wall rocks are folded into a large syncline that is exposed in the middle and eastern part of the Canyon Mountains (Christiansen, 1952).

The Gilson Mountains expose parts of the Tintic Valley (TV) thrust and the Leamington Canyon (LC) fault (figure 2). The TV thrust sheet is mainly composed of upper Paleozoic limestone and sandstone, and is folded into an anticline-syncline pair. The LC fault is also folded by underlying structures including the TV thrust sheet (figure 3). The initial emplacement of the TV thrust sheet and the LC fault, and their subsequent folding occurred during the Sevier orogeny. The Sevier-age structures are truncated by later Tertiary normal faults.

The LC fault separates the CR thrust in the Canyon Mountains to the south from the TV thrust in the Gilson Mountains (Costain, 1960; Wang, 1970; Higgins, 1982). Kwon and Mitra (2001) have reinterpreted the relationship between the LC fault and the CR thrust and suggest that the two are essentially the same fault. The TV thrust joins with the LC fault (LC thrust hereafter) at a branch-line near the town of Leamington. The Jericho quadrangle exposes an anticline-syncline pair of the folded TV thrust sheet, a small-scale horse which caused the folding of the TV thrust sheet, and Tertiary normal fault that offset the Sevier age structures.

Sevier Thrusts and Folds

The TV thrust is well exposed in the eastern half of the Gilson Mountains and its position under the Tintic Valley in the Jericho quadrangle is variously interpreted (Costain, 1960; Wang, 1970; Higgins, 1982; Pampeyan, 1989). Costain (1960) first mapped two high-angle reverse faults in the Gilson Mountains (the North Gilson and the South Gilson faults). These faults were later interpreted as a synclinally folded thrust fault that represents the southern end of the TV thrust (Morris and Kopf, 1969; Wang, 1970; Higgins, 1982; Pampeyan 1989). However, the position of the trace of the TV thrust in the Gilson Mountains is controversial (Costain, 1960; Wang, 1970; Higgins, 1982; Pampeyan, 1989). Wang (1970) suggested that the Gilson thrust (North Gilson fault of Costain, 1960) swings to the south at the eastern end of the Gilson Mountains and ends at the Leamington Canyon fault. He further interpreted the Champlin thrust (South Gilson fault of Costain, 1960) as a separate thrust fault that swings northward at the eastern end of the Gilson Mountains and lies above the Gilson thrust. In the northern Gilson Mountains he placed the fault where the Devonian Dolomites and Lower Mississippian Formations are in contact with the Silurian Laketown Dolomite and Lower Mississippian Formations (see also Pampeyan, 1989); this thrust trace is problematic because it places younger Devonian Dolomites over older Silurian Laketown

Dolomite. Other geologists (Morris and Kopf, 1969; Higgins, 1982) have suggested that the TV thrust has a leading branch-line with the LC thrust at the western end of the Gilson Mountains (near the town of Leamington).

Considerable recent study in the Gilson Mountains (Kwon and Mitra, 2001) and careful mapping of the Jericho 71/2’ quadrangle (presented in this report) suggest that both the North and South Gilson faults (Costain, 1960) are essentially the same fault, namely the TV thrust that is folded into a syncline (figure 2 and 3). The TV thrust is also exposed at the south end of the East Tintic Mountains (Furner Ridge quadrangle) ~~which~~ where it is also folded into a syncline. Considering the map patterns (Costain, 1960; Morris, 1987) of the synclinally folded thrust fault (wider in Gilson Mountains and narrower in East Tintic Mountains), we can surmise that the TV thrust exposed in the Gilson Mountains lies on the down-thrown side of the range-front normal fault bounding the East Tintic Mountains (figure 1b).

The stratigraphic position of the hanging wall of the TV thrust shows that it climbs up-section from north to south, and the stratigraphic separation of the TV thrust increases gradually away from the leading branch-line with the LC thrust at the western end of the Gilson Mountains, in the Champlin Peak quadrangle (figure 2 and 3).

Down plunge projections of most of the Gilson Mountains show that the TV thrust sheet is folded into an anticline-syncline pair by an underlying small-scale horse (figure 3; cross-sections A-A’ and B-B’). The small-scale horse underlying the TV thrust is exposed in the northern part of the Gilson Mountains (112°10′, 39°39′) and the entire stratigraphic package observed within the horse is overturned Figure 2. (plate 1; cross-section A-A’ and B-B’). Kwon and Mitra (2001) explained this overturning as the result of plucking of the horse from the overturned limb of the footwall syncline of the TV thrust, a mechanism similar to that suggested by McNaught and Mitra (1993). The remaining portion of the footwall syncline is not exposed anywhere, but presumably lies in the subsurface north of the Gilson Mountains.

The reclined folding, observed in the northeastern part of the Gilson Mountains (cross-section A-A’), is probably associated with refolding of a steep limb of the fault-bend fold that is associated with TV-thrust emplacement (Kwon and Mitra, 2001). The reclined folding has a fold-axis with low plunge and southeasterly trend (cross-section A-A’). The gentle, long horizontal back-limb of the fault-bend fold is also broadly folded (cross-section C-C’).

The TV thrust footwall rocks are exposed along the northern and southern margins of the Gilson Mountains in the Jericho and Champlin Peak quadrangles and are broadly folded. The folding observed in the footwall of the TV thrust (figures 2 and 3; plate 1) indicates the possible existence of unexposed blind thrusts underlying the TV thrust sheet. This overall structural geometry of the Gilson Mountains is consistent with structures observed in the Canyon Mountains, where the CR thrust is also folded by underlying duplexes (Mitra and Sussman, 1997).

Fig 1c?

The down-plunge projection of the Gilson Mountains looking NE also demonstrates the relationships between the TV thrust and the LC thrust (figure 3). The LC thrust is dipping to the southeast with top down-to-the-southeast shear (Kwon and Mitra, 2001). The LC thrust itself is also folded into an anticline. Based on a variety of lines of evidence the LC thrust has recently been correlated with the CR thrust to the south (Kwon and Mitra, 2001). As we described earlier, the TV thrust has a leading branch-line with the LC thrust in the south-western part of the Gilson Mountains (figure 2). Parts of the LC thrust were reactivated as an out-of-syncline reverse fault (figure 3) and this is probably related with tightening of the CR syncline by underlying structures during the Cretaceous Sevier orogeny.

Normal faults

Steeply dipping later Tertiary normal faults truncate the Sevier age structures in most of the Gilson Mountains. The older structures are commonly dissected by normal faults and these faults are topographically conspicuous. In particular, the TV thrust shows offset by later normal fault in the Jericho portion of the northern Gilson Mountains (figure 2 and 3; cross-section B-B').

REFERENCES

Allmendinger, R.W., 1992, Fold and thrust tectonics of the western United States exclusive of the accreted terranes, *in* Burchfiel, B.C., Lipman, P.W. and Zoback, M.L. editors, The Cordilleran Orogen, the conterminous U.S.: Geological Society of America, The Geology of North America, G-3, p. 583-608.

Armstrong, R.L., 1968, Sevier orogenic belt in Nevada and Utah: Geological Society of America Bulletin **79**, 429-458.

could omit

Black, B.A, 1965, Nebo overthrust, southern Wasatch Mountains, Utah: Brigham Young University Geologic Studies **12**, 55-89.

Bruhn, R.L., Picard, M.D. and Isby, J.S., 1986, Tectonics and sedimentology of the Uinta Arch, western Uinta Mountains, and Uinta Basin, *in* Peterson, J. A. editor, Paleotectonics and sedimentation in the Rocky Mountain region, United States: American Association of Petroleum Geology Memoir **41**, 119-141

Burchfiel, B.C. ~~&~~ and Davis, G.A., 1975, Nature and controls of Cordilleran orogenesis, western United States - extensions of an earlier synthesis: American Journal of Science **275A**, 363-396.

Christiansen, R.F., 1952, Structure and stratigraphy of the Canyon Range, Utah: Geological Society of America Bulletin **63**, 717-740.

Christie-Blick, N. H., 1983, Structural geology of the southern Sheeprock Mountains, Utah: Regional significance, *in* Miller, D. M., Todd, R. and Howard, K. A. editors, Tectonics and Stratigraphic studies in the Eastern Great Basin: Geological Society of America Memoir **157**, 101-124.

Costain, J.K., 1960, Geology of the Gilson Mountains and vicinity, Juab County, Utah: *Ph. D. dissertation*, University of Utah, Salt Lake City, 178 p.

Higgins, J.M., 1982, Geology of the Champlin Peak quadrangle, Juab and Millard counties, Utah: Brigham Young University Geology Studies **29**, 40-58.

Kwon, S., & Mitra, G., 2001, The geometry, kinemtics and deformation characteristics of the Leamington Canyon transverse zone, central Utah: Geological Society of America Annual Meeting Abstract, **33**, 6, A149-A150.

Kwon & Mitra submitted

Lawton, T.F., 1985, Style and timing of the frontal structures, Sevier thrust belt, central Utah: American Association of Petroleum Geology Bulletin **69**, 1145-1159.

Lawton, T.F., Boyer, S.E., & Schmitt, J.G. 1994, Influence of inherited taper on structural variability and conglomerate distribution, Cordilleran fold and thrust belt, western United States: Geology **22**, 339-342.

Mabey D.R. and Morris, H.T., 1967, Geologic interpretation of gravity and aeromagnetic maps of Tintic Valley and adjacent areas, Toole and Juab countries, Utah: U.S. Geological Survey Professional Paper **516-D**, 1-10.

McNaught, M.A. and Mitra, G., 1993, A kinematic model for the origin of footwall synclines: Journal of Structural Geology **15**, 805-808.

Miller, D.M., Nilsen, T.H. and Bilodeau, W.L., 1992. Late Cretaceous to early Eocene geologic evolution of the U.S. Cordillera, *in* Burchfiel, B. C., Lipman, P. W. and Zoback, M. L. editors, The Cordilleran Orogen, the Conterminous U.S.: Geological Society of America, The Geology of North America **G-3**, 205-260.

Mitra, G. 1997, Evolution of salients in a fold-and-thrust belt: the effects of sedimentary basin geometry, strain distribution and critical taper, *in* S. Sengupta editor, Evolution of Geological Structures from Macro- to Micro- scales: Chapman and Hall, London, p. 59-90.

Mitra, G. & Sussman, A.J., 1997, Structural evolution of connecting splay duplexes and their implications for critical taper: an example based on geometry and kinematics of the Canyon Range culmination, Sevier Belt, central Utah: Journal of Structural Geology **19**, 503-521.

Morris, H.T., 1975a, Geologic map and sections of the Furner Ridge quadrangle, Juab County, Utah: U.S. Geological Survey Miscellaneous Investigation Map I-1045, scale 1:24,000.

Morris, H.T., 1975b, Geologic map and sections of the Tintic Mountain quadrangle and adjacent part of the McIntyre quadrangle, Juab and Utah Counties, Utah: U.S. Geological Survey Miscellaneous Investigation Map I-883, scale 1:24,000.

Morris, H.T., 1987a, Preliminary geologic map of the Delta 2 degree quadrangle, Toole, Juab, Millard, and Utah Counties, Utah: U.S. Geological Survey Open-File Report 87-185, scale 1:250,000.

Morris, H.T., 1987b, Preliminary geologic structure map of the Delta 2 degree quadrangle and adjacent areas, west-central Utah: U.S. Geological Survey Open-File Report 87-187, scale 1:250,000.

Morris, H.T., 1983, Interrelations of thrust and transcurrent faults in the central Sevier orogenic belt near Leamington, Utah: Geological Society of America Memoir **157**, 75-81.

Morris, H.T. and Kopf, R.W., 1969, Tintic Valley thrust and associated low-angle faults, central Utah: Geological Society of Annual Meeting Abstracts, 55-56.

Morris, H.T. and Lovering, T.S., 1979, General geology and mines of the East Tintic mining district, Utah and Juab Counties, Utah: U.S. Geological Survey Professional Paper **1024**, 203p.

Morris, H.T. and Shepard, W.M., 1964, Evidence for a concealed tear fault with large displacement in the central East Tintic Mountains, Utah: new interpretations based on structural analysis: Geological Society of America Rocky Mountain Section Meeting Abstracts **26**, 55.

√Mukul, M. & Mitra, G., 1998, Stratigraphy and structural geology of the southern Sheeprock and the adjacent West Tintic Mountains (Utah): A review and new interpretations based on structural analysis: Utah Geological Survey Miscellaneous Publications **98-1**, 17-56.

√Pampeyan, E.H., 1989, Geologic map of the Lynndyl 30- by 60-minute quadrangle, west central Utah: Miscellaneous investigation series Map I-1830, Department of interior U.S. geological survey.

√Proctor, P.D. and Clark, D.L., 1956, "The Curley Limestone-an Unusual Biostrome in Central Utah": Journal of sedimentary petrology **26**, 313-321.

√ Schwartz, R.K. and DeCelles, P.G., 1988. Cordilleran foreland-basin evolution and synorogenic sedimentation in response to interactive Cretaceous thrusting and reactivated foreland partitioning, *in* Schmidt, C.J. and Perry, W.J. editors, Interaction of the Rocky Mountain Foreland & Cordilleran Thrust Belt: Geological Society of America Memoir **171**, 489-514.

√Smith, R.B. and Bruhn, R.L., 1984, Intraplate extensional tectonics of the eastern Basin-Range: inferences on structural style from seismic reflection data, regional tectonics, and thermal-mechanical models of brittle-ductile deformation: Journal of Geophysical Research **89**, 5733-5762.

√Tooker, E.W., 1983, Variations in structural style and correlation of thrust plates in Sevier foreland thrust belt, Great Salt Lake area, Utah, *in* Miller, D. M., Todd, R. and Howard, K. A. editors, Tectonic and Stratigraphic Studies in the Eastern Great Basin: Geological Society of America Memoir **157**, 61-74.

√Wang, Y.F., 1970, Geological and geophysical studies of the Gilson Mountains and vicinity, Juab county, Utah: *Ph. D. dissertation*, University of Utah, Salt Lake City, 196 p.

√Welsh, J.E., 1982, Stratigraphic measured section of the North Gilson Mountains: Unpublished data from Utah Geological Survey.

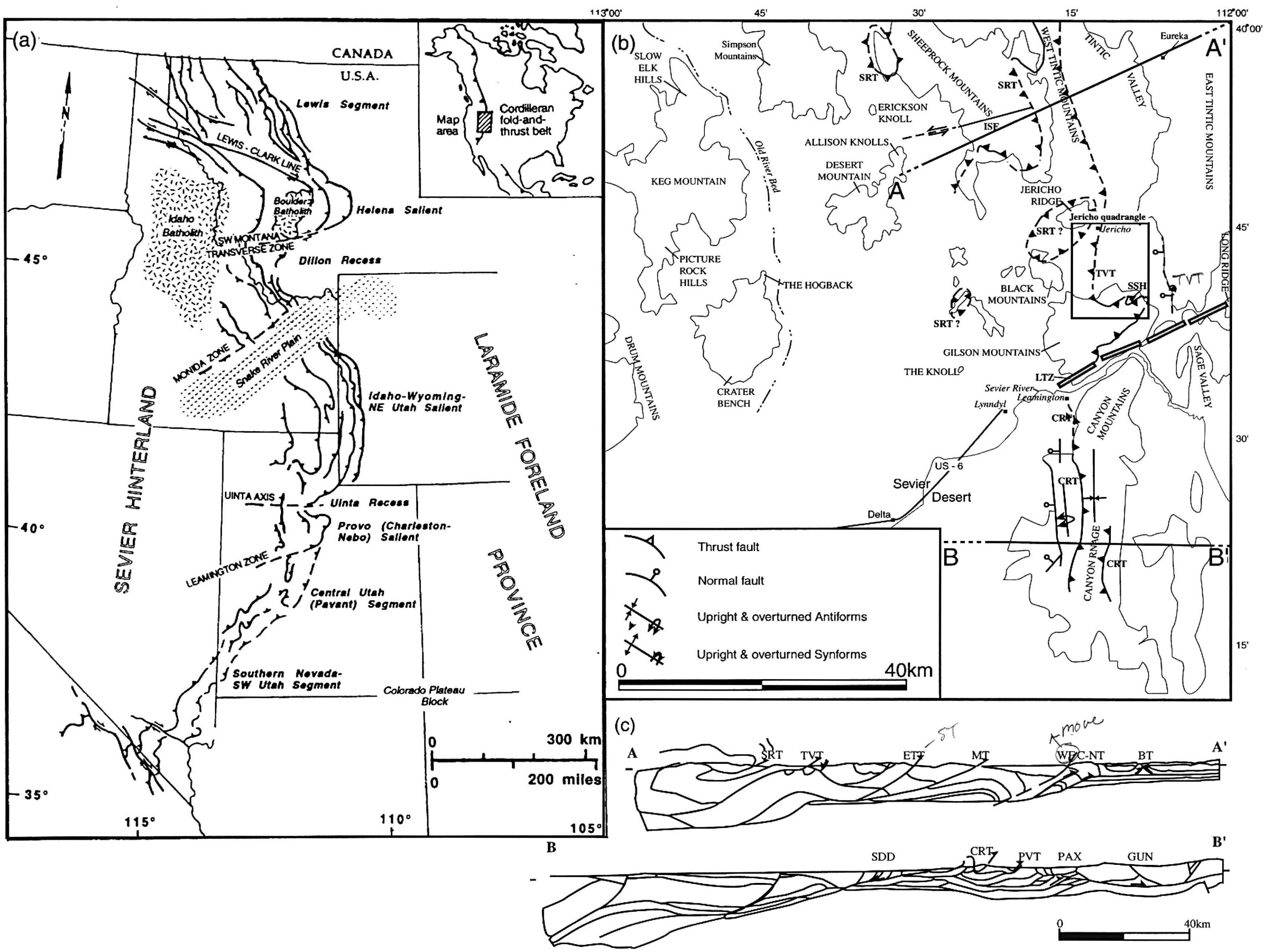

Figure 1: (a) The Sevier FTB of the western USA showing the principal salients and recesses located at prominent transverse zones. (b) Generalized geologic map of central Utah showing the major Sevier-age structures. (c) Regional cross-sections along AA' (Provo salent) and BB' (central Utah segment). Thrusts shown along the Provo salient (AA') are Sheeprock (SRT), Tintic valley (TVT), East Tintic (ETT), Midas (MT), Charleston-Nebo (C-NT) thursts, and a blind triangle zone (BT). Along the central Utah segment (BB') are Canyon Range thrust (CRT), Pavant thrust (PVT), Paxton thrust (PAX), Gunnison thrust (GUN), also shown are the Wasatch normal fault (WF) and Sevier Desert detachment (SDD). ISF - Indian Springs fault; LTZ - Leamington transverse zone; SSH - Small-Scale horse.

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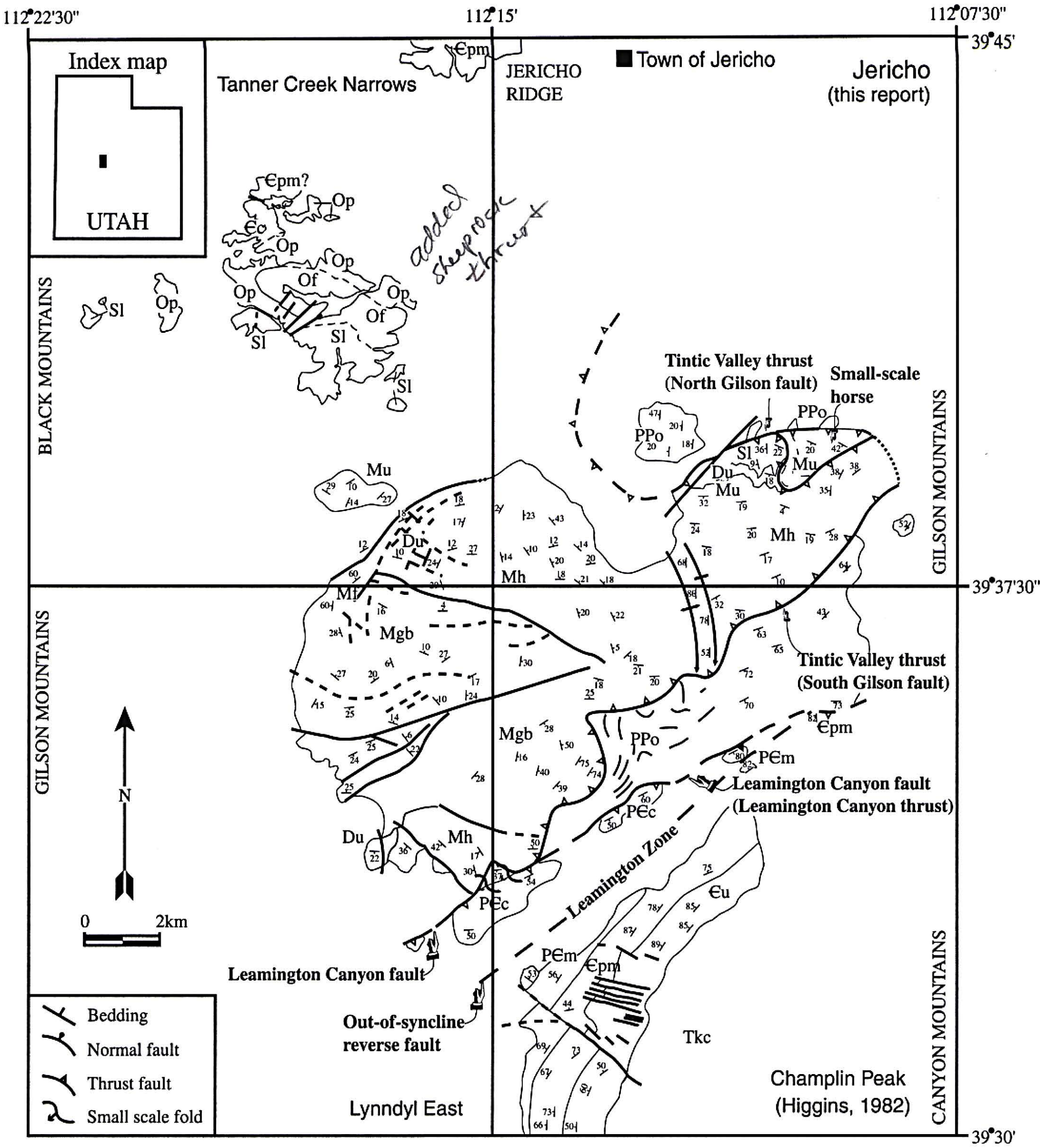

Figure 2: Geologic map of the Gilson Mountains showing the main structures.

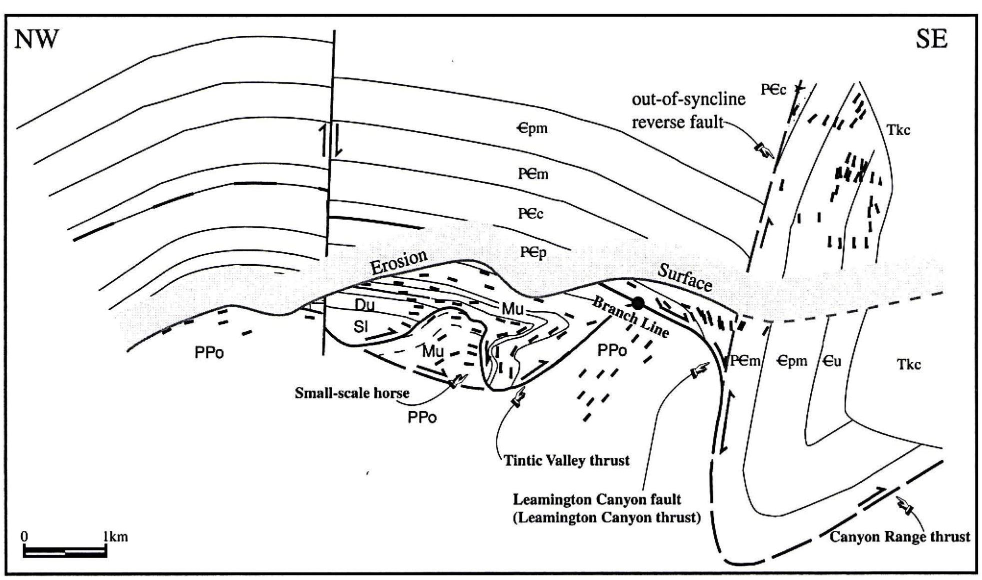

FIgure 3: Down-plunge projection parallel to the transport direction of major structures, showing major faults, bedding rakes and lithologic contacts in the Gilson Mountains.