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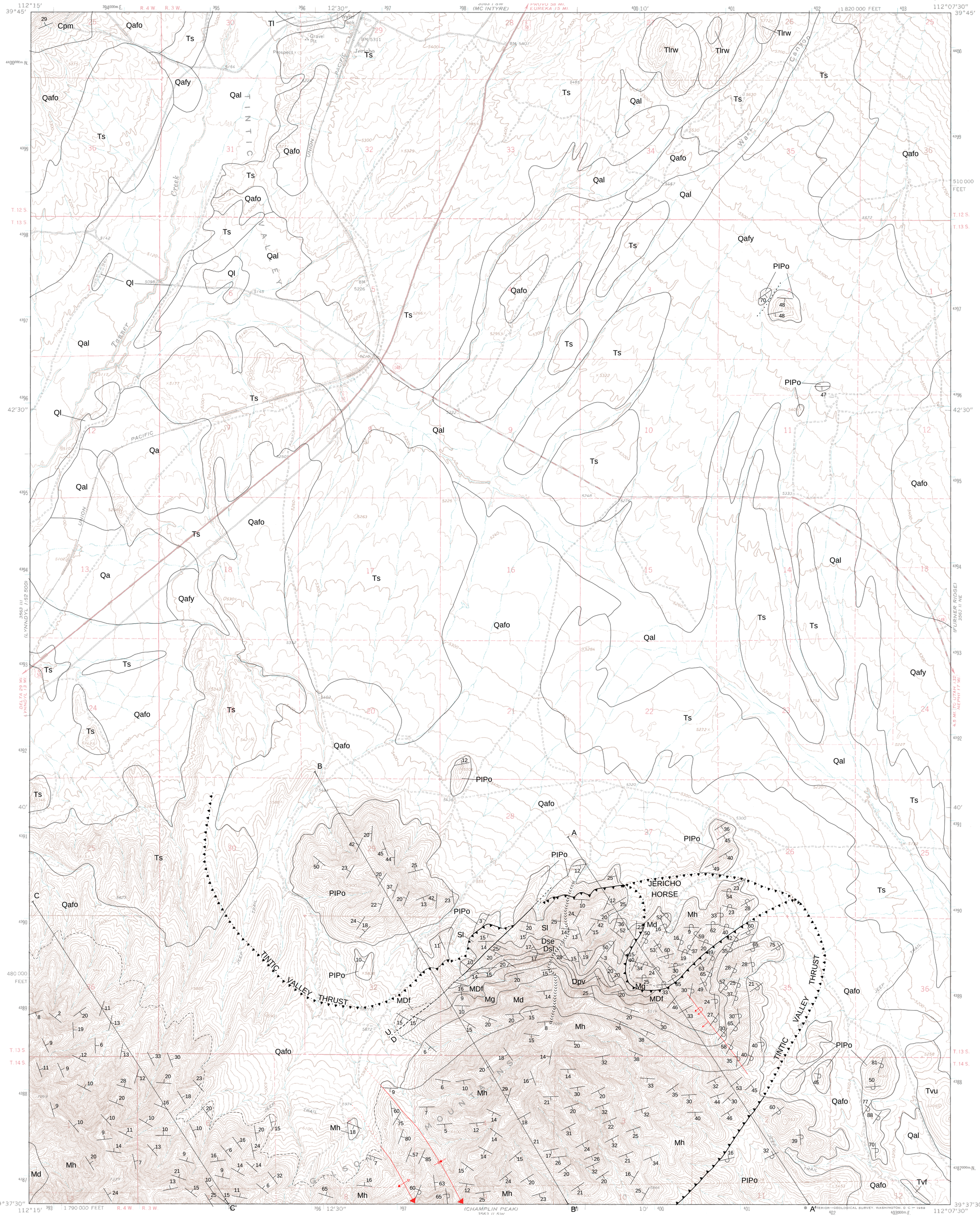

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Field mapping by authors, 2002
Cenozoic Geology from Pampeyan (1989)
Digital map preparation by Darryl Greer.

Provisional Structural Geologic Map of the Jericho Quadrangle, Juab County, Utah

by
Sanghoon Kwon and Gautam Mitra

2005

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Sanghoon Kwon[1] and Gautam Mitra[2]

2005

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MAP SYMBOLS

Contact, dashed where approximately located or gradational, dotted where concealed.

Normal fault, dashed where approximately located, dotted where concealed

Thrust fault, teeth on hanging wall, dashed where approximately located, dotted where concealed.

Antiformal fold-trace, dashed where approximately located, dotted where concealed, arrow shows plunge.

Synformal fold-trace, dashed where approximately located, dotted where concealed, arrow shows plunge.

Reclined fold-trace, dashed where approximately located, dotted where concealed, arrow shows plunge.

20 Strike and Dip of Bedding

80 Strike and Dip of Overturned Bedding

CROSS-SECTION SYMBOLS AND ABBREVIATIONS

Thrust fault, arrow on hanging wall, dashed where approximately located in the subsurface, dotted where eroded out. Arrow indicates relative motion of hanging wall block (with respect to footwall block) along the fault surface.

Normal fault, dashed where approximately located. Arrows indicate relative motion of hanging wall and footwall blocks along the fault surface.

TVT: Tintic Valley thrust

JH: Jericho horse

CORRELATION OF MAP UNITS

Qal	Latest Pleistocene and Holocene alluvium
Qafy	Latest Pleistocene and Holocene alluvial-fan deposits
Ql	Pleistocene deposits of Lake Bonneville
Qao	Pleistocene older alluvium
Qafo	Pleistocene older alluvial-fan deposits
Major unconformity	
Ts	Oligocene to Pliocene Tertiary sedimentary rocks
Tlrw	Oligocene Latite Ridge Latite, welded tuff member
Tw	Oligocene welded tuff unit
Tvu	Oligocene volcanic conglomerate unit undifferentiated
Major unconformity	
PIPo	Lower Permian to Lower Pennsylvanian Oquirrh Group, undivided
Tintic Valley thrust	
Mh	Upper Mississippian Humbug Limestone
Md	Lower and Upper Mississippian Deseret Limestone
Mg	Lower Mississippian Gardison Limestone
MDf	Lower Mississippian and Upper Devonian Fitchville Formation
Dpv	Upper Devonian Pinyon Peak Limestone and Victoria Formation, undivided
Dsi	Middle Devonian Simonson Dolomite
Dse	Lower Devonian Sevy Dolomite
Sl	Silurian Laketown Dolomite
Sheeprock thrust(?)	
Ꞓpm	Lower Cambrian Prospect Mountain Quartzite

ACKNOWLEDGMENTS

This work was supported by U.S. Geological Survey EDMAP award 01HQAG0146 to Gautam Mitra, and by a Nuria Pequera fellowship from the University of Rochester to Sanghoon Kwon. We thank Jon King, Don Clark, and Grant Willis of the UGS for their careful reviews. We extend a special thanks to John Welsh who generously donated many years of unpublished geologic research to the UGS shortly before his untimely death.

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Disclaimer

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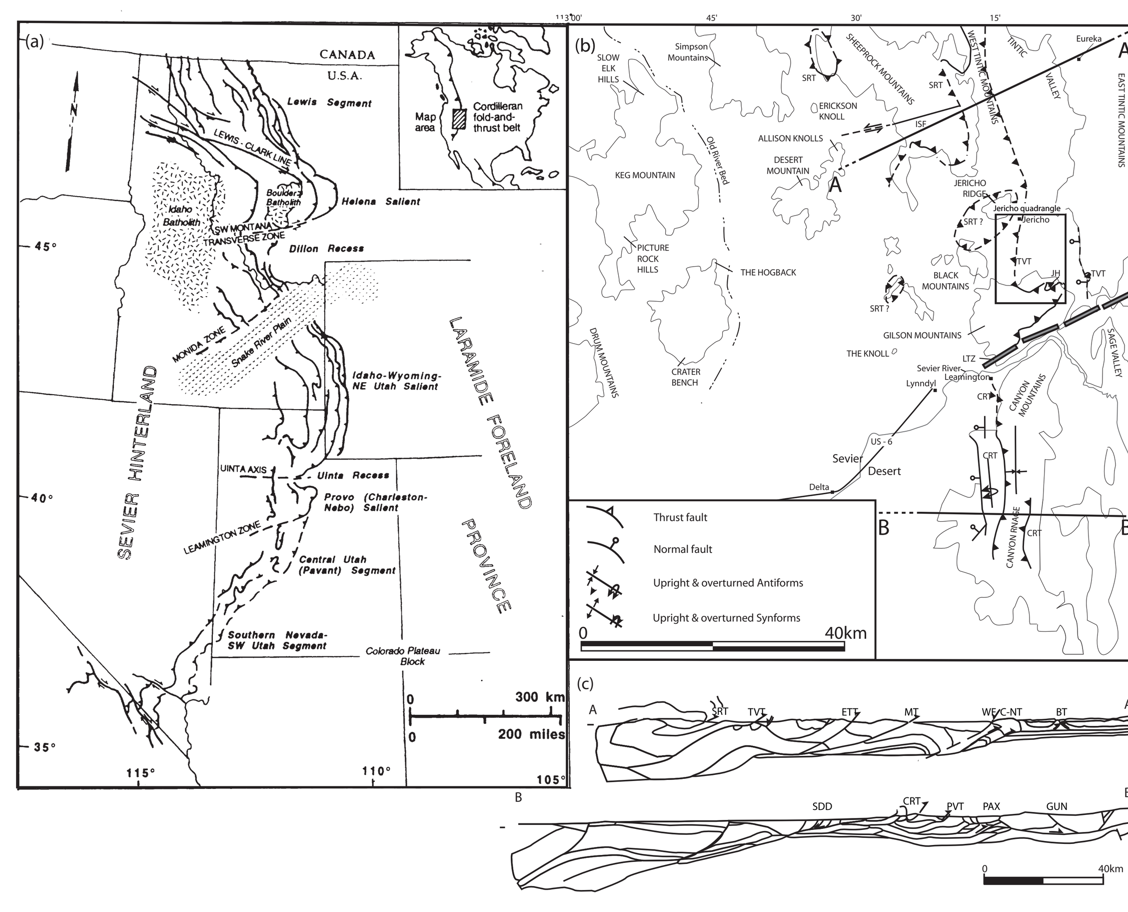


Figure 1: (a) The Sevier FTB of the western USA showing the principal salients and recesses located at prominent transverse zones. (b) Generalized geologic map of central Utah showing the major Sevier-age structures. (c) Regional cross-sections along AA' (Provo salient) and BB' (central Utah segment). Thrusts shown along the Provo salient (AA') are Sheeprock (SRT), Tintic valley (TVT), East Tintic (ETT), Midas (MT), Charleston-Nebo (C-NT) thrusts, 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; JH - Jericho horse.

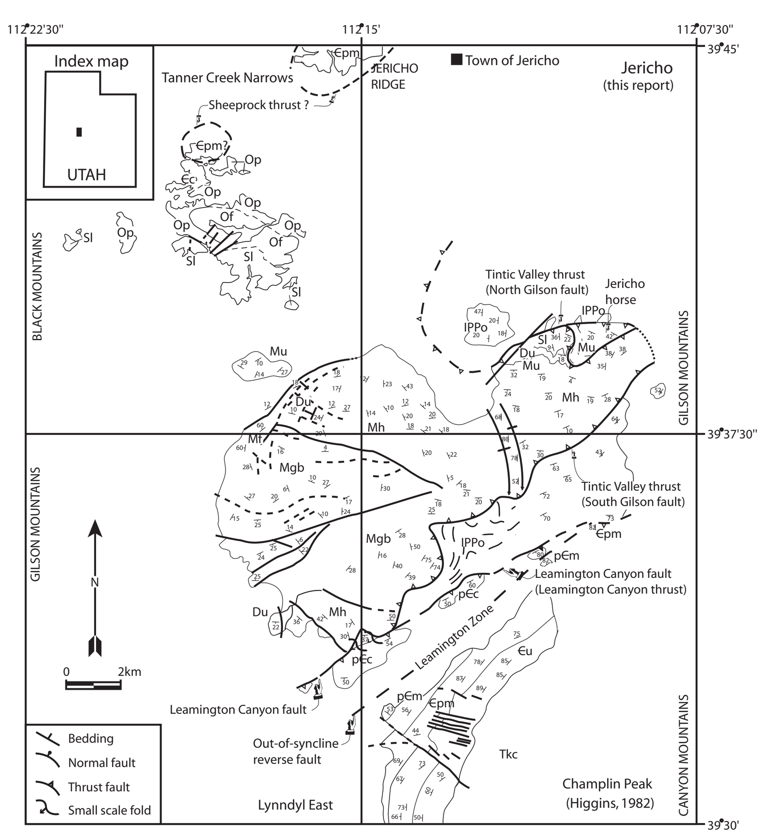


Figure 2: Geologic map of the Gilson Mountains showing the main structures.

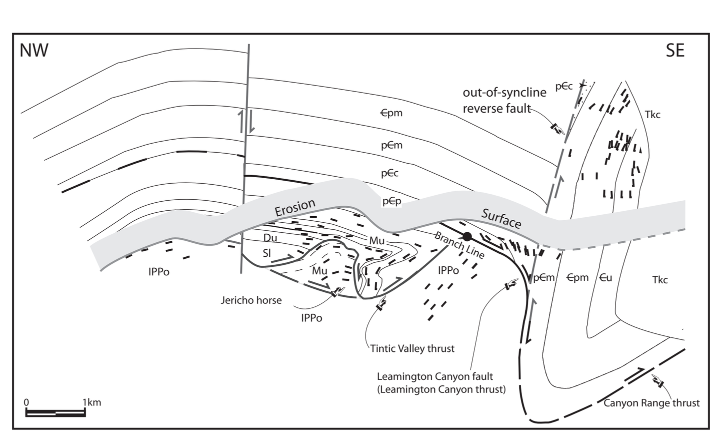
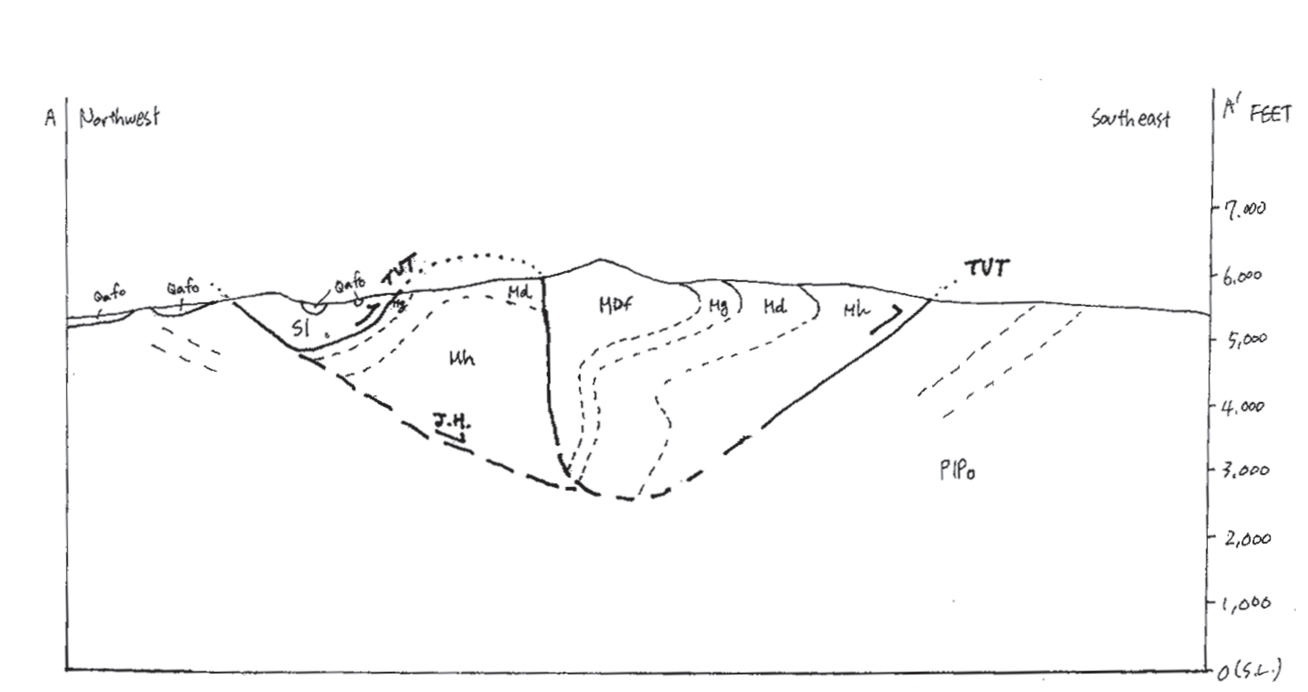
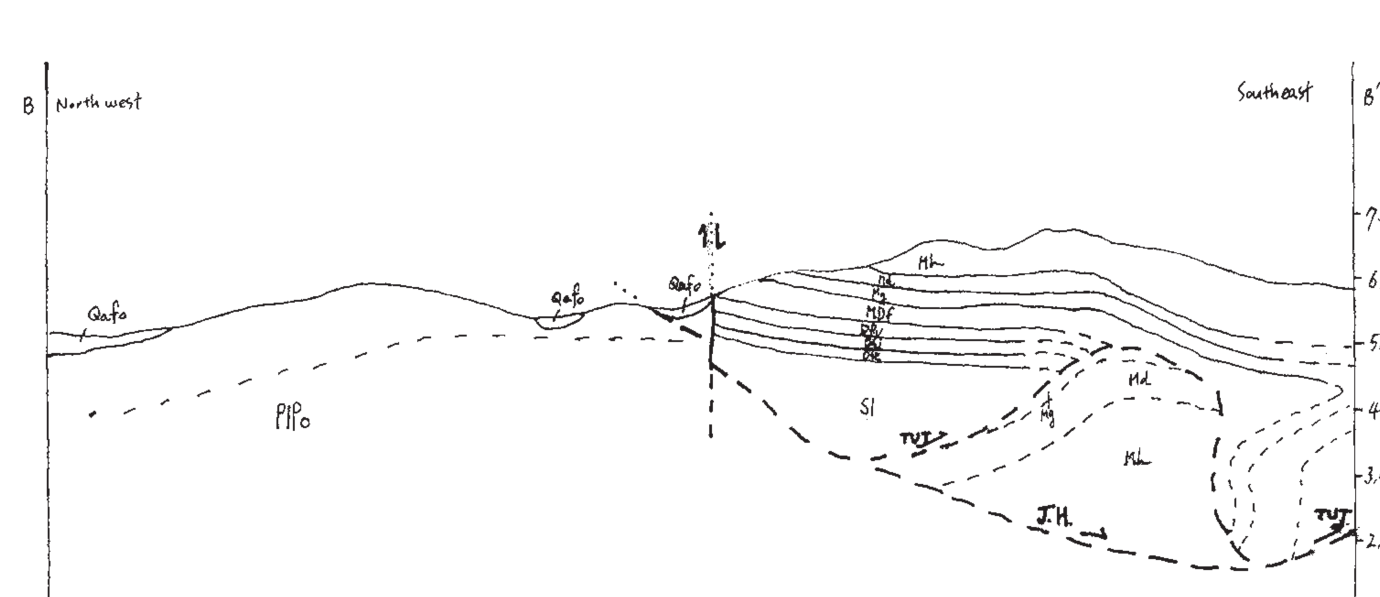
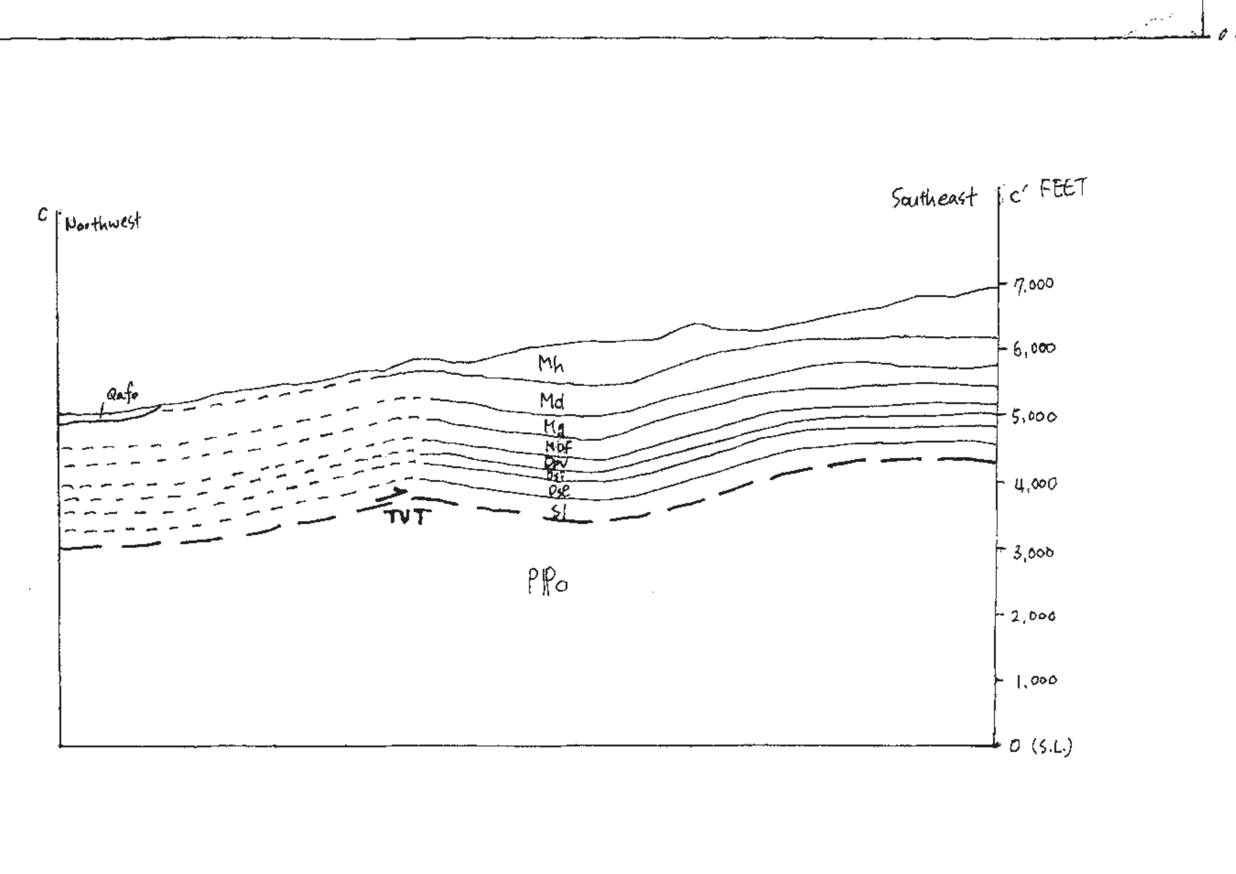


FIgure 3: Down-plunge projection parallel to the transport direction of major structures, showing major faults, bedding rakes and lithologic contacts in the Gilson Mountains.







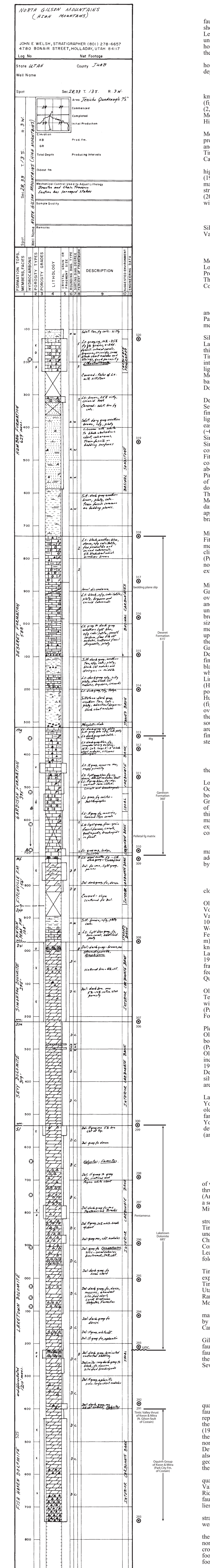


Figure 4. Stratigraphic section in the northern Gilson Mountains by John E. Welsh in 1982. Located in sections 28 and 33, T. 13 S., R. 3 W., Juab County, Utah (Jericho 7.5' quadrangle). John E. Welsh provided this unpublished data to the Utah Geological Survey for unrestricted use in 1998. Annotations were added by UGS staff based on a revised version of this stratigraphic section by Welsh, and interpretations of Kwon and Mitra.

ABSTRACT

The Jericho 7.5-minute quadrangle covers the northern Gilson Mountains in central Utah. The Gilson Mountains are one of the first fault-bounded ranges of the Basin and Range province west of the Wasatch Front. Within the Gilson Mountains, Sevier (Late Cretaceous to Eocene)-age shortening structures are preserved; the most prominent are the Tintic Valley thrust and the Leamington Canyon fault and their associated structures. The Leamington Canyon 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 Tintic Valley thrust sheet is folded into an anticline-syncline pair by a Jericho horse in the footwall of the Tintic Valley thrust; this fold pair is partly exposed in the quadrangle. The Tintic Valley thrust has a leading branch-line with the Leamington Canyon fault in the southwestern Gilson Mountains outside the Jericho quadrangle.

In the Jericho quadrangle, both Tintic Valley hanging wall and footwall rocks and structures and late normal faults are exposed. The Jericho 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.

INTRODUCTION

The Jericho 7.5-minute quadrangle covers part of the northern Gilson Mountains in central Utah (figure 1). The town of Jericho is 45 miles (72 km) 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 (Champlin Peak) reaches 7,504 feet (2,288 m), and is about 2,400 feet (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 one of the first fault-bounded ranges of the Basin and Range Province west of the Wasatch Front. Within the Gilson Mountains, shortening structures were formed during the Late Cretaceous to Eocene Sevier orogeny (structures shown regionally on figure 1a). The most prominent Sevier-age structures are the Tintic Valley thrust, the Leamington Canyon fault, and associated folds (figure 2). Both the Tintic Valley thrust and the Leamington Canyon fault are folded by underlying structures (figure 3). In the Jericho quadrangle, erosion through the anticlinal portion of the Tintic Valley thrust exposes an underlying Jericho horse with overturned beds of upper Paleozoic rocks (Mu in figure 2, figure 3). The Leamington Canyon 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 faults were later referred to as the Tintic Valley thrust by Morris and Kopf (1969), Wang (1970), and Morris (1987a, 1987 b), although there is some controversy regarding the exact exposure of the fault(s). 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 Leamington Canyon fault and the Tintic Valley thrust, were described by Kwon and Mitra (2001, 2002) and Kwon (2004). The mapping of the Gilson Mountains was done at a scale of 1:24,000 (at 1:12,000 where more detail was required), with the aid of black and white aerial photographs. The Cenozoic geology is modified slightly from Pampeyan (1989). Refer to plates 1 and 2.

STRATIGRAPHY

Map units in this quadrangle belong to four main structural packages: (1) Cambrian strata in the hanging wall of the Sheeprock thrust, (2) Silurian to Mississippian strata in the hanging wall of the Tintic Valley thrust, (3) Pennsylvanian and Permian strata that form the footwall of the Tintic Valley thrust, and (4) Cenozoic rocks and sediments that were deposited on top of the thrust sheets.

Strata of the Hanging Wall of the Sheeprock Thrust

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

Lower Cambrian

Prospect Mountain Quartzite (Ꞓpm): 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 quartzite with cross-bedding (Costain, 1960; Morris, 1987a). Costain (1960) estimated a thickness of about 2,000 feet (610 m) at Jericho Ridge.

Strata of the Hanging Wall of the Tintic Valley Thrust

Costain (1960) established the stratigraphic scheme for the Gilson Mountains, which was largely followed by Wang (1970), Higgins (1982), and Pampeyan (1989). We have largely used the stratigraphic classification of Costain (1960), and have closely followed the stratigraphic scheme of Pampeyan (1989) for Cenozoic sediments and rocks. The stratigraphic section of the Tintic Valley thrust sheet in the Gilson Mountains was also measured by John Welsh (figure 4).

Silurian

Laketown Dolomite (Sl): The Laketown Dolomite was originally defined in the Bear River Range at the Utah-Idaho border. Welsh probably measured a thickness of about 865 feet (264 m) of Laketown in the northern Gilson Mountains, but did not recognize that the Laketown is bounded below by the Tintic Valley thrust, so that its base is not exposed. The Laketown is a fine- to coarse-grained, massively bedded dolomite with many 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 unfossiliferous, 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 (lower Devonian) 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 about 7 feet (2 m) thick and there is a 4-foot-thick (1.2 m) 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 (~0.1 - 0.4 inches [0.04-0.2 cm]) 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 320 feet (98 m) (figure 4).

Simonson Dolomite (Dsi): The Simonson Dolomite (middle Devonian), 245 feet (75 m) (figure 4) 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 2 feet (0.6 m) thick. The lower portion of the Simonson Dolomite contains a zone, about 7 feet (2 m) thick, of laminated dolomite with biscuit-shaped structures that correspond to the "Curley limestone" of Proctor and Clark (1956).

Pinyon Peak Limestone 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). Parts of the Victoria Formation are likely exposed in the Gilson Mountains, but are not documented in the Jericho quadrangle. The Victoria Formation is unconformably overlain by the Pinyon Peak Limestone in other places, but the Victoria is not exposed in the northern Gilson Mountains. The Pinyon Peak Limestone is 108 feet (33 m) thick (figure 4) 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. These two units are considered upper Devonian (Hintze, 1988).

Mississippian - Devonian

Fitchville Formation (MDf): The Fitchville Formation is about 160 feet (49 m) thick (figure 4) 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 about 24-inch-thick (9.4 cm) 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 that indicate an early Mississippian age (Costain, 1960; Wang, 1970). The formation extends from the upper Devonian to lower Mississippian (Hintze, 1988).

Mississippian

Gardison Limestone (Mg): The Gardison Limestone (lower Mississippian), 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 (~230 feet [70 m] thick) with abundant silicified horn corals in the lower part; the upper part of this unit has a breccia zone about 35 inches (14 cm) thick (Costain, 1960) with breccia fragments of dolomite that are lighter-colored than the matrix and that range in size from 2 to 6 inches (1-2.4 cm). The middle unit is about 90 feet (27 m) thick and consists mostly of medium-gray, massively bedded 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, about 40 feet (12 m) 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 about 360 feet (110 m) (figure 4). The fauna found in the Gardison Limestone in the Gilson Mountains includes brachiopods, gastropods, and tabulate and horn corals (Costain, 1960; Wang, 1970).

Deseret Limestone (Md): The Deseret Limestone is about 620 feet (189 m) thick in the northern Gilson Mountains (figure 4) 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 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. The Deseret extends from lower to upper Mississippian (Hintze, 1988). Additional reconnaissance mapping by UGS geologists suggests that additional Deseret Limestone may be present in the south-central portion of the Jericho quadrangle.

Humbug Formation (Mh): The Humbug Formation (upper Mississippian), more than about 630 feet (192 m) thick in the northern Gilson Mountains (figure 4), is one of the most extensively exposed formations in the Gilson Mountains. The Humbug Formation 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 upper contact of the Humbug is gradational with the overlying Great Blue to the south. The Humbug Formation in the southern Gilson Mountains is in fault contact with the Oquirrh Group along the Tintic Valley thrust. The Humbug Formation 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. Fossils include foraminifera, crinoid stems, horn corals, and brachiopod fragments (Costain, 1960; Wang, 1970).

Strata in the Footwall of the Tintic Valley Thrust

The Oquirrh Group, in the footwall of the Tintic Valley 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.

Lower Permian – Lower Pennsylvanian

Oquirrh Group undivided (PIPo): The lower Oquirrh Group is not exposed in the Gilson Mountains because the Tintic Valley thrust cuts off the lower beds and places the Silurian Laketown Dolomite and Mississippian Humbug and/or Great Blue Formations against the Permian-Pennsylvanian Oquirrh Group. We have not mapped any units overlying the Oquirrh Group in the footwall of the Tintic Valley thrust in the Jericho quadrangle. The thickness of the Oquirrh Group as exposed in the Gilson Mountains is about 5,600 feet (1,707 m), 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 common in this unit in the Gilson Mountains (Costain, 1960; Wang, 1970).

The authors lumped all Tintic Valley thrust footwall rocks in the Jericho quadrangle as Oquirrh Group undivided. Additional reconnaissance mapping by UGS geologists completed after the mapping by Kwon and Mitra further clarified some stratigraphic relationships in the quadrangle. This additional mapping suggests the presence of an overturned section of Oquirrh Group, Diamond Creek Sandstone, and Park City Formation rocks overlain by early Tertiary-Cretaceous and Oligocene conglomerate formations in the southeast corner of the quadrangle.

Cenozoic Units

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

Oligocene

Volcanic conglomerate unit undifferentiated (Tvu): Volcanic conglomerate and agglomerate similar to that extensively mapped by Clark (2003) in Sage Valley is present in one exposure. The unit consists of boulders of dark gray latite in a matrix of tuff and volcanic gravel (Morris, 1975,1977). Roughly 100 feet (30 m) is exposed.

Welded tuff unit (Tw): One outcrop of welded tuff is present in the southeast corner of the quadrangle. Although quite similar in appearance to the Fernow Quarz Latite, UGS found a different geochemical signature. UGS is conducting further evaluation of this welded tuff unit. Only about 20 feet (6 m) of the welded tuff is exposed in the quadrangle. The tuff unit is likely Oligocene, but its age relations to other volcanic units mapped is not presently known.

Latite Ridge Latite, welded tuff member (Tlrw): Latite Ridge Latite consists of a welded tuff member and an underlying airfall tuff member (Morris, 1977). 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. This map unit varies from 0 to 1,000 feet (0-305 m) in thickness. The air-fall tuff member is not exposed in the Jericho quadrangle. Some exposures mapped by Pampeyan (1989) as Fernow Quartz Latite in the northern portion of the Jericho quadrangle have been included here with the Latite Ridge Latite.

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 conglomerate lenses (Pampeyan, 1989). The age of this unit is not known. The unit may be as old as Oligocene, so the designation of Pampeyan (1989) as Salt Lake Formation is not used. The thickness of this map unit exceeds about 2,000 feet (610 m).

Pleistocene

Older Alluvial-Fan Deposits (Qafo): These deposits are semi-consolidated, poorly sorted, crudely stratified sand and gravel in large alluvial fans that border upland areas. The deposits locally include colluvium, stream alluvium, and younger alluvial-fan deposits. The fans are typically deeply dissected (Pampeyan, 1989). These deposits are several tens of feet (and meters) in thickness.

Older Alluvium (Qao): This unit is mostly stream and channel deposits consisting of clay- to small boulder-size detrital material. The unit locally includes alluvial-fan and stream terrace deposits. The deposits are poorly sorted, crudely stratified, and moderately to deeply dissected (Pampeyan, 1989). The alluvium thickness ranges from a few to tens of feet (and meters).

Deposits of Lake Bonneville (Ql): These undifferentiated lake sediments consist of interlayered white, light-gray, brown, tan, and yellowish-gray clay, silt, sand, marl, and gravel (Pampeyan, 1989). The Bonneville shoreline of Lake Bonneville, which is vaguely visible in the northwest corner of the map area, is present at an elevation of about 5,180 feet. The deposits are several feet to tens of feet (and meters) in thickness.

Latest Pleistocene and Holocene

Younger Alluvial-Fan Deposits (Qafy): These deposits consist of unconsolidated, poorly sorted alluvial-fan sand and gravel that are largely derived from older alluvial (Qao) and older fan deposits (Qafo) (Pampeyan, 1989). These fans commonly overlie the older alluvial deposits. The thickness of these fans is typically less than 20 feet (6 m), but may be thicker locally.

Younger Alluvium (Qal): These stream channel deposits consist of clay- to cobble-size, poorly sorted, crudely stratified and generally undissected detrital material. This unit locally includes alluvial-fan and stream-terrace deposits (Pampeyan, 1989). This alluvium is commonly less than a few feet (and meters) in thickness.

STRUCTURAL GEOLOGY

Introduction

The Sevier fold-thrust belt is an east-verging zone 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, 1992) (figure 1a). Within this belt, thrusting displaced Proterozoic, Paleozoic, and Mesozoic miogeoclinal rocks eastward during the late Cretaceous to Eocene (140-40 Ma) Sevier orogeny (Armstrong, 1968; Burchfiel and Davis, 1975; Schwartz and DeCelles, 1988; Constenius and others, 2003). The Sevier fold-thrust belt is broken up into a series of salients, or segments, which are typically decoupled from one another along east-west trending transverse zones (Lawton and others, 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 in the Provo salient are the Sheeprock thrust, the Tintic Valley thrust, the East Tintic-Stockton thrust system, the Midas thrust, the Charleston-Nebo thrust system, and frontal blind thrusts 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, 1986; Mitra,1997; Mukul and Mitra, 1998; Constenius and others, 2003) (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 east-northeast to west-southwest oblique transverse zone that includes the Leamington Canyon fault, associated folds, and an out-of-syncline reverse fault (Kwon and Mitra, 2001) (figure 1 and 3).

The geologic setting of the Gilson Mountains and surrounding area has to be interpreted in the context of its regional setting (figure 1b). The Tintic Valley thrust is exposed in the northern and southern Gilson Mountains. Morris (1983) suggested that part of the Tintic Valley thrust is also exposed at the south end of the East Tintic Mountains, which lie east and northeast of the Gilson Mountains. The Sheeprock 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 fold-thrust belt (figure 1a), the Canyon Range thrust is exposed in the Canyon Mountains (figure 1b and c). The Canyon Range 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 thrust and the Leamington Canyon fault (figure 2). The Tintic Valley thrust sheet is mainly composed of upper Paleozoic limestone and sandstone, and is folded into an anticline-syncline pair. The Leamington Canyon fault is also folded by underlying structures including the Tintic Valley thrust sheet (figure 3). The initial emplacement of the Tintic Valley thrust sheet and the Leamington Canyon fault, and their subsequent folding occurred during the Sevier orogeny. The Sevier-age structures are truncated by later Tertiary normal faults.

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

Sevier Thrusts and Folds

The Tintic Valley thrust is well exposed in the eastern half of the Gilson Mountains, whereas 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 Tintic Valley thrust (Morris and Kopf, 1969; Wang, 1970; Higgins, 1982; Pampeyan 1989). However, the position of the trace of the Tintic Valley 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 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) suggested that the Tintic Valley thrust has a leading branch-line with the Leamington Canyon 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, 2002; Kwon, 2004) and mapping of the Jericho 7.5-minute quadrangle (presented in this report) suggest that both the north and south Gilson faults (Costain, 1960) are essentially the same fault, namely the Tintic Valley thrust that is folded into a syncline (figure 2 and 3). The Tintic Valley thrust is also exposed at the south end of the East Tintic Mountains (Furner Ridge quadrangle) where it is also folded into a syncline. Considering the map patterns (Costain, 1960; Morris, 1987a) of the synclinally folded thrust fault (wider in Gilson Mountains and narrower in East Tintic Mountains), we can surmise that the Tintic Valley 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 Tintic Valley thrust shows that it climbs up-section from north to south, and the stratigraphic separation of the Tintic Valley thrust increases gradually away from the leading branch-line with the Leamington Canyon thrust at the western end of the Gilson Mountains, in the Champlin Peak quadrangle (figures 2 and 3).

A down-plunge projection of most of the Gilson Mountains shows that the Tintic Valley thrust sheet is folded into an anticline-syncline pair by the underlying Jericho horse (figure 3; plate 2 cross-sections A-A' and B-B'). The Jericho horse underlying the Tintic Valley thrust is exposed in the northern part of the Gilson Mountains (112º 10'W, 39º 39'?) and the entire stratigraphic package observed within the horse is overturned (plate 1; plate 2 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 Tintic Valley 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 folds, observed in the northeastern part of the Gilson Mountains (plate 2 cross-section A-A'), are probably associated with refolding of a steep limb of the fault-bend fold that is associated with Tintic Valley-thrust emplacement (Kwon and Mitra, 2001). The reclined folds have fold-axes with low plunges and southeasterly trends (plate 2 cross-section A-A'). The gentle, long horizontal back-limb of the fault-bend fold is also broadly folded (plate 2 cross-section C-C').

The Tintic Valley 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 folds observed in the footwall of the Tintic Valley thrust (figures 2 and 3; plate 1) indicate the possible existence of unexposed blind thrusts underlying the Tintic Valley thrust sheet. This overall structural geometry of the Gilson Mountains is consistent with structures observed in the Canyon Mountains, where the Canyon Range thrust is also folded by underlying duplexes (Mitra and Sussman, 1997).

The down-plunge projection of the Gilson Mountains looking northeast also demonstrates the relationships between the Tintic Valley thrust and the Leamington Canyon thrust (figure 3). The Leamington Canyon thrust is dipping to the southeast with top down-to-the-southeast shear (Kwon and Mitra, 2001). The Leamington Canyon thrust itself is also folded into an anticline. Based on a variety of lines of evidence the Leamington Canyon thrust has recently been correlated with the Canyon Range thrust to the south (Kwon and Mitra, 2001). As we described earlier, the Tintic Valley thrust has a leading branch-line with the Leamington Canyon thrust in the southwestern part of the Gilson Mountains (figure 2). Parts of the Leamington Canyon thrust were reactivated as an out-of-syncline reverse fault (figure 3) and this is probably related with tightening of the Canyon Range syncline by underlying structures during the 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 Tintic Valley thrust shows offset by a later normal fault in the Jericho portion of the northern Gilson Mountains (figure 2 and 3; plate 2 cross-section B-B').