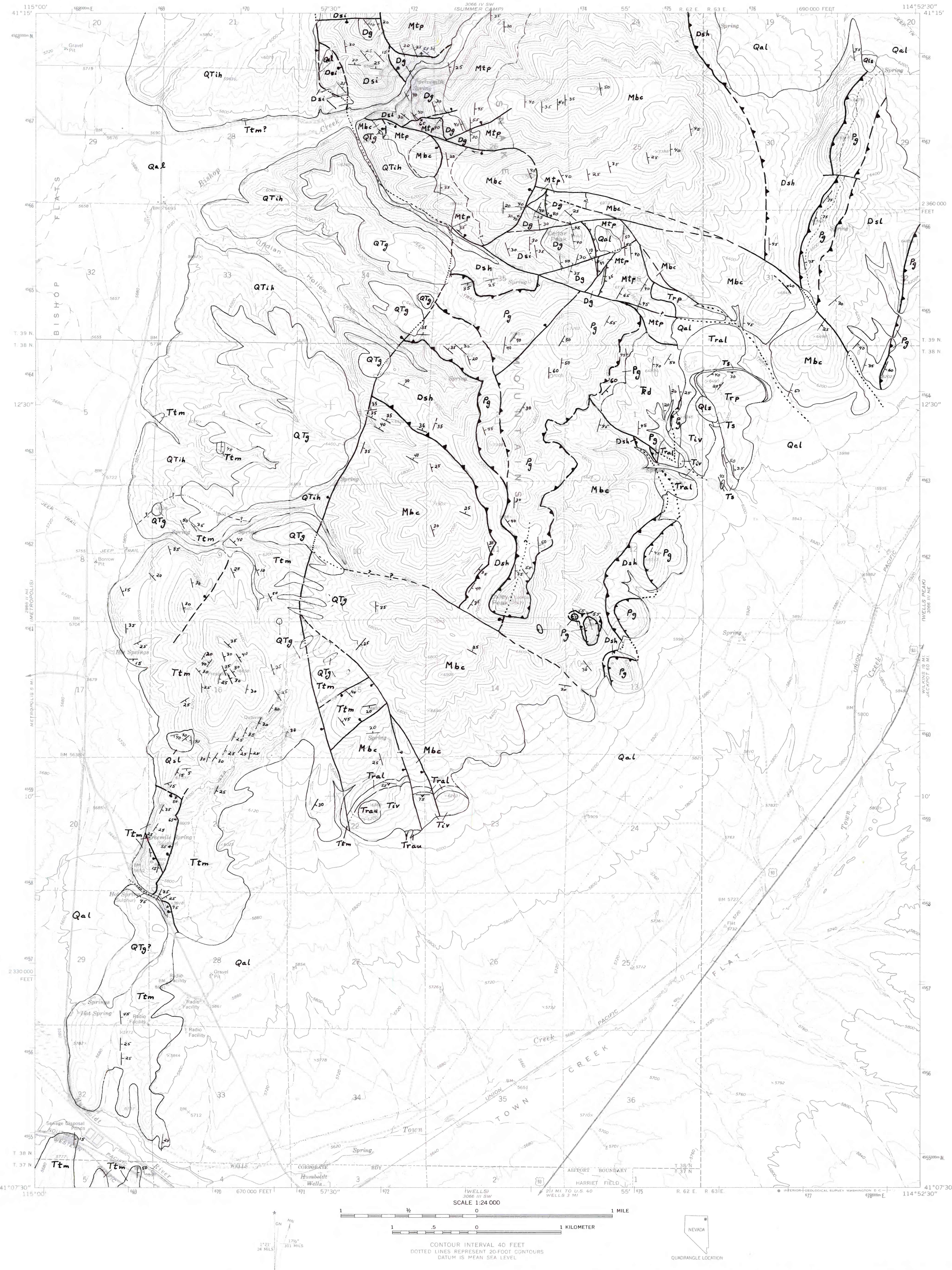
DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY

OPEN-FILE REPORT
OF 88-755



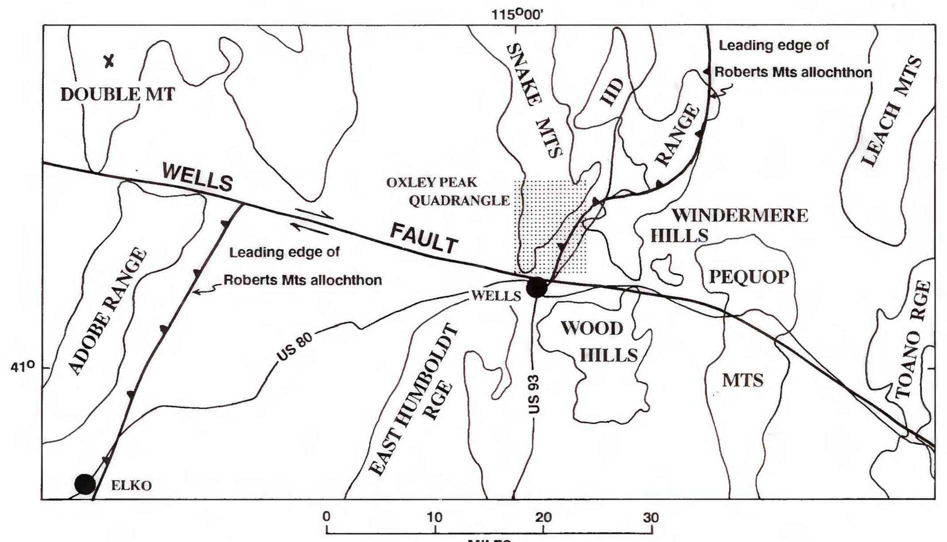


Figure 1. Index map showing the location of the Oxley Peak quadrangle and the trace of the Wells fault and the eastern limit of the Roberts Mountain allochthon.

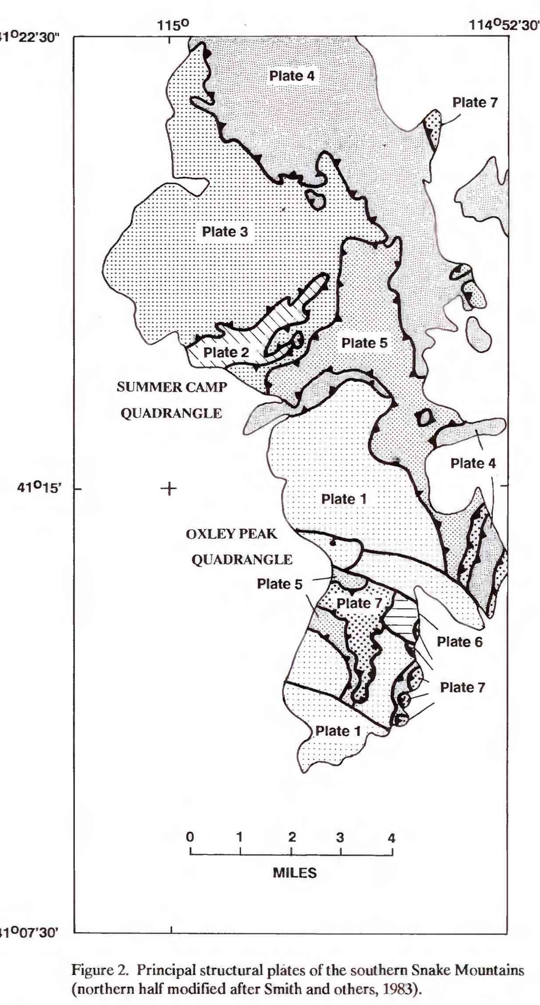
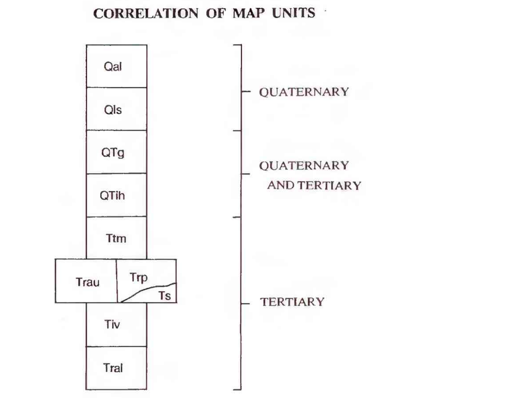
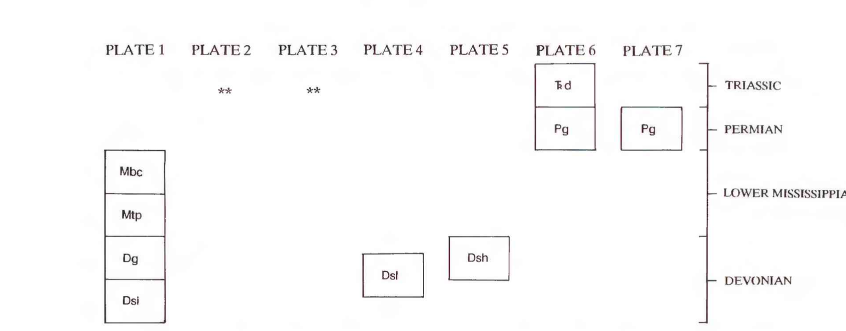


Figure 2. Principal structural plates of the southern Snake Mountains (northern half modified after Smith and others, 1983).

CORRELATION OF MAP UNITS





** Plates 2 and 3 are not present in the Oxley Peak quadrangle. See text for discussion of plates and figure 2 for areal distribution of plates.

DESCRIPTION OF MAP UNITS

Qal **Alluvium (Holocene)**-- Gravel, sand, and silt deposits. Includes unsorted and unindurated deposits along watercourses and dry stream beds and sheetwash and alluvial deposits that form thin veneer of cover between stream beds.

Qls **Landslide Deposits (Quaternary)**-- Landslide and slump features of Paleozoic and Tertiary units.

QTg **Gravel (Pleistocene-Pliocene?)**-- Coarse sand, gravel, and boulders of Paleozoic carbonate, sandstone, chert, and shale. Locally the gravels contain abundant clasts of green to buff, crystal-rich tuff and porphyritic volcanic rocks similar to Tertiary units on the south and east sides of the range. Forms ridge-and terrace-capping deposits up to 15-20 ft thick.

QTih **Gravel of Indian Hollow (Pleistocene-Pliocene?)**-- Sand and gravel composed of Paleozoic and Tertiary detritus. Includes sparse lenses of horizontal to subhorizontal, tan, reworked vitric tuffs 3-10 ft thick. Unit is poorly exposed due to its weakly indurated nature and generally is overrun by colluvium from overlying terrace-capping gravels.

Ttm **Sedimentary and Volcanic Rocks of Threemile Spring (Neogene?)**-- Undifferentiated sedimentary and volcanic sequence that includes intercalated, laterally discontinuous fluvial, lacustrine, and tuffaceous units. The lowest unit, present at the south end of the range and in the westernmost railroad cuts, includes yellowish brown to tan fluvial and lacustrine, weakly indurated to locally highly siliceous siltstone to conglomerate. The middle unit includes medium- to fine-grained, pale red to yellowish-brown sandstone and siltstone of fluvial and lacustrine origin; locally contains abundant wood fragments, fish fossils, and ripple marks. The middle unit is best exposed in quarries in the SE corner of section 16, T38N, R62E and in the low hills between the radio facility and the hot springs in SE corner of section 29 and in the NE corner of section 32, T38N, R 62E. Thick-bedded, massive conglomerates with interbedded siltstone and sandstone occur at the transition between the lower and middle units; the conglomerates are typically silicified, commonly have a greenish matrix, and the clasts include rounded to subangular Paleozoic quartzite, chert, and shale and Tertiary volcanic fragments. The upper unit mainly comprises soft weathering white, grey, and greenish airfall vitric tuffs, including fluvially reworked tuffs and local conglomerate interbeds. The upper unit is best exposed in the easternmost railroad cuts. The thickness of the Threemile Spring unit is greater than 3,000 ft.

Trau **Upper Rhyolitic Welded Ash-flow Tuff (Paleogene)**-- Densely welded, silicified, gray ash-flow tuff with eutaxitic pumice. Contains 10-15% phenocrysts, including sanidine (0.5-2.0 mm), resorbed quartz (0.5-1.0 mm), and partially oxidized biotite (0.5 mm). Groundmass is devitrified and granophyric with trace amounts of zircon and opaque minerals. Lithic fragments are sparse, ranging up to 6-7 mm in size.

Trp **Porphyritic Rhyolite Flow (Paleogene)**-- Reddish black, porphyritic devitrified flow rock with local black basal vitrophyre. Phenocrysts, up to 5 mm in size, include resorbed quartz, sanidine, and plagioclase; plagioclase occurs as glomerocrysts with or without sanidine. Spherulitic groundmass contains microlites of phenocryst mineralogy plus trace amounts of zircon, subhedral 0.3-0.5 mm embayed opaques, and lithic fragments.

Ts **Lake Sediments (Paleogene)**-- Gray to white, tuffaceous, thin-bedded, fine-grained lacustrine siltstone and shale. Unit is soft weathering and poorly exposed. Fragments of silicified wood, up to 0.3 m across, occur locally. Unit ranges from a few meters to more than 100 m in thickness; appears to be concordant with underlying volcanic unit, though the mutual contact is an irregular erosional surface.

Tiv **Intermediate Volcanic Rocks (Paleogene)**-- Includes andesitic to dacitic flows and agglomerates. Rocks are dark-green to reddish-gray, fine grained, some with medium-grained phenocrysts. Individual units are laterally discontinuous and irregular in thickness, ranging up to 30 ft. Phenocrysts include plagioclase, hornblende, and possibly clinopyroxene. Groundmass in most rocks is pilotaxitic with plagioclase microlites and is spotted with euhedral opaque minerals. All of the rocks observed in thin section show signs of alteration, which is interpreted to be deuteric. Plagioclase is weakly to strongly altered to white mica and epidote? and mafic minerals are altered to biotite? and unidentified fine-grained, in part opaque, minerals. Phenocrysts are typically weakly to strongly iron stained. Some rocks have quartz veinlets. The upper contact is an irregular erosion surface and the unit ranges from about 10 ft to more than 300 ft in thickness.

Tral **Lower Rhyolitic Welded Ash-flow Tuff (Paleogene)**-- Moderately welded, tan to white, crystal-poor ash-flow tuffs; individual tuff beds are laterally discontinuous and range up to 30-45 ft in thickness. Typical rock contains 10% phenocrysts (sanidine, resorbed quartz, biotite) that are 0.5-1.5 mm in diameter in a shard-rich axiolitic groundmass with lithic fragments and trace zircon. The lower tuff units are commonly altered to bright green. The base of the unit on the east side of the range (SE sec. 1 and NE sec. 12, T38N, R62E) is marked by a basal oolitic limestone about 3 ft thick and an overlying thin biotite-bearing, altered rhyodacitic flow. The unit ranges from about 10 ft to more than 600 ft in thickness.

Trd **Dinwoody? Formation (Triassic)**-- Shale and limestone. Interbedded greenish, grey, and "chocolate brown" thin-bedded to fissle shale with subordinate brownish, thin-bedded to platy, fine-grained limestone to shaly limestone; locally contains thin lenses of limestone-pebble conglomerate with clasts of Permian limestone, chert, and dolomite and productid fragments. Thickness unknown, but probably greater than 500 ft; upper and lower contacts are faulted. Lithologically this unit is essentially identical to Triassic rocks in the northern Adobe Range, approximately 35 miles to the west (Ketner and Ross, 1983) and resembles the Dinwoody Formation of southeastern Idaho and northeastern Utah, except for the presence of the limestone-pebble conglomerates.

Pg **Gerster? Formation (Permian)**-- Limestone, chert, and siltstone. Grey, medium-to thick-bedded, medium- to coarse-grained bioclastic limestone to dolomitic limestone; brachiopod valves and spines are common. Thin interbeds of yellowish-brown, argillaceous and calcareous siltstone. Dark grey, reddish-brown, and yellowish-brown chert, commonly with sponge spicules, that occurs as irregular nodules or as thin-bedded units up to several feet thick. Thickness unknown, but probably greater than 500 ft.

Mbc **Sandstone of Bishop Creek (Lower Mississippian)**-- Sandstone, conglomerate, and shale. Brown to reddish-brown, medium-to thick-bedded, medium-to coarse-grained to gritty chert-quartz sandstone. The sandstone beds are typically massive, with no visible internal layering; locally where they are thinner bedded, graded bedding is present. Medium-bedded chert-pebble conglomerate occurs locally in the upper part of the unit. Black fissle shale occurs locally. The unit has a minimum thickness of approximately 5,000 ft. The basal contact is gradational with the Lower Mississippian Tripon Pass Limestone and the upper contact is a low-angle fault. A Devonian-Lower Mississippian assemblage of condonts (personal communication, Bruce Wardlaw) occurs about 1,000 ft. above the base in a thin limestone bed. Lower Mississippian conodonts have been collected from a black shale in the upper part of the unit just north of the map boundary and south of Bishop Creek by Keith Ketner (personal communication, 1988). This is the same unit that Smith and others (1983) refer to as map unit Mss in their structural Plate I in the Summer Camp quadrangle, immediately to the north of this quadrangle. A similar, and probably correlative unit occurs in the Adobe Range (Ketner and Ross, 1983) in the same stratigraphic and structural position and is referred to as map unit Ms.

Mtp **Tripon Pass Limestone (Lower Mississippian)**-- Gray, medium- to thin-bedded, fine- to medium-grained limestone with graded bedding. Locally becomes sandy, the grains being quartz and chert. Contains interbeds of fissle to platy brown calcareous shale. Contact with underlying Guilmette Formation is normal in the Bishop Creek area, but is a bedding fault at Cedar Peak. Basal unit is poorly exposed as a grassy slope littered with small chips of fissle shale and platy limestone. Upper contact with sandstone of Bishop Creek is gradational and is placed where limestone/sandstone ratio is approximately 1:1. The Tripon Pass Limestone is Lower Mississippian in age (Oversby, 1973).

Dsh **Shale, Limestone, and Chert (Lower Upper Devonian)**-- Dominant lithology is black to dark brownish gray, fissle to thin-bedded, locally weakly phyllitic shale. Contains interbedded medium gray, thin- to medium-bedded, medium-grained, in part bioclastic limestone; locally beds contain well-rounded, frosted, medium-grained quartz. Black, thin-bedded chert is present locally as thin interbeds. Thickness of unit exceeds 800 ft. Upper and lower contacts are low-angle faults. Contains four lower Upper Devonian conodont assemblages (personal communication, Bruce Wardlaw, 1988). This unit is map unit Dt of Smith and others (1983) in the Summer Camp quadrangle, where it ranges from Lower to Upper Devonian in age.

Dsl **Shale, Limestone, and Chert (Devonian)**-- Contains irregular though more or less equal amounts of fissle black shale, yellowish thin-bedded to platy, argillaceous, siliceous, fine-grained limestone, and black, thin-bedded, platy chert. Thickness is unknown, but probably exceeds 400-500 ft. The lower and upper contacts are low-angle faults. Two conodont assemblages are middle Middle Devonian and Devonian to Early Mississippian in age (personal communication, Bruce Wardlaw, 1988). This is map unit DSOw of Smith and others (1983), which they determined to range in age from Ordovician to Devonian.

Dg **Guilmette Formation (Upper Devonian)**-- Grey, medium- to thick-bedded, medium-grained limestone. Contains medium-to thin-bedded dolomite as interbeds in lower 100-200 ft. Basal unit is thin-bedded, argillaceous, *Atrypa*-bearing limestone that forms a smooth slope. Formation is approximately 1,000 ft. thick.

Dsi **Simonson Dolomite (Middle Devonian)**-- Grey, medium- to thick-bedded, fine-to medium-grained, laminated dolomite with minor interbeds of limestone. Base is not exposed. Thickness probably exceeds 1,500 ft.

CONTACT -- Dotted where concealed

FAULT -- Showing dip (arrow); dashed where inferred; dotted where concealed; queried where uncertain

Normal fault -- Bar and ball on downthrown side; dashed where inferred; dotted where concealed; queried where uncertain

Thrust fault -- Solid sawteeth on upper plate; dashed where inferred; dotted where concealed; queried where uncertain

Subordinate thrust fault -- Hollow sawteeth on upper plate

Strike-slip fault -- Arrows show relative or apparent movement

STRIKE AND DIP OF INCLINED BEDS

STRIKE AND DIP OF INCLINED FLOW LAYERING

SOME PRELIMINARY INTERPRETATIONS ON THE STRUCTURAL GEOLOGY OF THE OXLEY PEAK AND ADJACENT QUADRANGLES

The Oxley Peak quadrangle is located in the southern Snake Mountains at the juncture of two major structural features, the eastern or leading edge of the allochthonous lower Paleozoic western or siliceous facies, commonly referred to as the leading edge of the Roberts Mountain allochthon or Roberts thrust, and the WNW-trending Wells fault, which is interpreted to be a major strike-slip fault of late Mesozoic to early Tertiary age (fig. 1). The prevalent, or generally accepted, interpretation for the structural development of this region is as follows: (1) late Devonian to earliest Mississippian large-scale eastward thrusting of the western or siliceous deep-water facies over the transitional and shelf carbonate or eastern facies (the Antler Orogeny); (2) relative quiescence until middle Mesozoic time; (3) Late Jurassic through early Tertiary large-scale eastward thrusting and regional metamorphism that involved both the earlier deformed Antler belt and the miogeocline between the Antler belt and the Wasatch Front; (4) early to middle Tertiary volcanism and sedimentation; (5) extensional faulting and metamorphism from about 30-20 Ma; and (6) late Tertiary to Holocene basin-and-range faulting and coeval sedimentation and volcanism that formed the present Basin-and-Range Province setting. Structures in the Oxley Peak quadrangle can definitely be attributed to two or three of the above listed events, namely Late Jurassic to early Tertiary compressive tectonics and 30-20 Ma extensional faulting and/or late Tertiary to Holocene basin-and-range faulting. Antler Orogenic structures are not present, or at least, can not be documented, and the use of the term Roberts Mountains thrust in this area is ambiguous.

Late Jurassic to early Tertiary deformation: Structures in the Oxley Peak quadrangle formed during this event include low-angle, in part bedding-parallel, younger-over-older and older-over-younger thrust faults and WNW-trending high-angle faults interpreted to be strike-slip or tear faults genetically related to the thrust faults. These thrust faults bound seven distinct sedimentary sequences or thrust plates. The present geometry of these plates was attained by compressive deformation during the Late Jurassic-early Tertiary time span, but no data are yet available that indicate the exact timing of the deformation within this interval. Some of the high-angle faults were subsequently reactivated during Tertiary time but at least one was not, for it is overlain by basal Tertiary volcanic and sedimentary rocks (SE corner of sec. 1, R62E, T38N).

The thrust faults, which juxtapose the seven plates, are major structures that extend to the north into the Summer Camp quadrangle (fig. 2). The following discussion and assignment of plate numbers includes the geology of the Summer Camp quadrangle and adjacent areas mapped by Smith and others (1983).

Plate 1 includes Middle Devonian through Lower Mississippian carbonate and clastic rocks of the miogeoclinal setting. These rocks are interpreted to represent the easternmost assemblage prior to Mesozoic compressive tectonics and to be the lowest structural unit. However, based on regional structural considerations, Plate 1 is considered to be allochthonous even though the base is not exposed.

Plate 2 includes carbonate rocks of Devonian age that may be part of the transitional facies deposited west of Plate 1 rocks.

Plate 3 comprises a Lower Ordovician through Devonian suite of primarily carbonate rocks that represents a more westerly facies than the Plate 1 suite. The base of Plate 1 is not exposed and Plates 1 and 3 are not juxtaposed, but the relationship of Plate 3 on Plate 2 and the greater structural deformation in Plate 3 than in Plate 1 is additional support to the interpretation of their relative structural positions.

Plate 4 includes an Ordovician through Devonian suite of clastic, siliceous, and carbonate rocks of the western siliceous facies. This plate, which would generally be considered part of the Roberts Mountain allochthon, is structurally involved with late Paleozoic and Triassic rocks. Plate 4 rests on Plates 1, 3, and 7.

Plate 5 comprises a Devonian black shale-chert-limestone sequence assigned to the facies transitional between the western siliceous and eastern carbonate facies. It rests on Plates 1, 3, and 4.

Plate 6 consists of Triassic shales and limestones similar to rocks in SE Idaho and NW Utah and Middle Permian carbonates and chert and is in fault contact above Plate 5 (removal of the late Tertiary east tilt of the range would flatten the dip of the fault and indicate a younger-over-older low-angle fault relation).

Plate 7 includes Middle Permian carbonates and chert that rest on Plates 1, 4, 5, and 6. Plate 7 truncates and overlies a north-trending high-angle fault at Oxley Peak that is down to the west; this high-angle fault repeats plates 1, 5, and 6.

WNW-trending high-angle faults cut the plates, and plate geometry on opposite sides of them is markedly different. This structural style indicates that these faults were active during the formation of the thrust faults and they are therefore considered to be high-angle strike-slip or tear faults that formed coincident with the thrust faults. We are not certain at this time if some of these high-angle faults are the upturned or ramp edges of thrust faults that bound the plates or if they are only tear faults with nominal strike slip that terminate upward and downward against low-angle thrust faults.

The WNW-trending faults are interpreted to be second order faults to the Wells fault, a WNW-trending strike-slip fault that passes along the southern edge of the map area and has 40-50 miles of right slip (Thorman and Ketner, 1979). Similarly trending high-angle faults occur immediately to the east in the Windermere Hills and northern Pequop Mountains (unpublished mapping, Thorman; personal communication, Karl Mueller, 1988).

Middle to late Tertiary to Holocene deformation: Three sets of faults were active in Tertiary to Holocene time. The oldest faulting involved reactivation along some of the WNW-trending faults. Subsequent deformation formed scoop-shaped west-dipping listric faults on the west side of the range. Both of these fault sets are cut by north-trending west-dipping normal faults on the west side of the range.

WNW-trending high-angle faults were in part reactivated subsequent to Tertiary volcanism. The faults that bound the Cedar Mountain block (secs. 25, 26, 35, and 36, R62E, T39N) cut the Tertiary volcanic rocks on the east side of the range; whether or not the northernmost of these faults, which juxtaposes the sandstone of Bishop Creek on the south with various units on the north (sec. 31, R63E, T39N), was reactivated can not be proven at this time. The two high-angle faults that bound the Triassic rocks on the east side of the range did not have post-Tertiary volcanic movement because they terminate at the basal Tertiary unconformity.

Spoon-shaped west-dipping listric faults south of Bishop Creek cut, and in part, follow the WNW-trending faults that bound Cedar Peak. Three listric faults are present, nested within a master west-facing fault that dips 30°-40°W at its head and 60°-80° along its northern and southern traces.

North-trending, west-dipping normal faults extend the length of the range and are the cause of the general east dip of all rocks within the range. The fault that cuts through the range from the mouth of Bishop Creek juxtaposes Tertiary strata on the west with Paleozoic strata on the east; the fault bifurcates at its' southern terminus and two second order cross faults formed between the north-south bifurcations. A range-front fault covered by alluvium immediately west of the Tertiary rocks along the foot of the range is postulated based on: 1) small-scale offsets in QTg with slickensides indicating dip-slip movement observed at several localities at the foot of the range; 2) the presence of hot springs along the range front; and 3) the abrupt nature of the range front.

Some regional structural considerations: Stratigraphic and structural relations in the southern Snake Mountains, including both stratigraphic facies and the superposition of the various facies upon each other, are almost identical to those mapped by Ketner and Ross (1983) in the northern Adobe Range. Such unusual features as lenses of Permian limestone-pebble conglomerates in the Triassic, the thick Lower Mississippian chert-quartz sandstone of Bishop Creek and the Permian (plate 7) thrust over older units such as the Mississippian sandstone (plate 1), constitute a rather unique geologic setting. These unique features suggest the likelihood that the two areas were once joined and were subsequently offset by faulting. These two ranges, the northern Adobe Range and southern Snake Mountains, terminate to the north and south, respectively, against the Wells fault (fig. 1), as shown by Thorman and Ketner (1979). If the ranges were originally one structural element, they have been separated by 40 miles of right slip, as would be expected from other lines of evidence. Therefore, we correlate the northern Adobe Range with the southern Snake Mountains and consider this to be additional evidence in support of the existence of the Wells fault. In addition, the use of the term "Roberts Mountain allochthon" is used (fig. 1) with reference to allochthonous western facies rocks, but the age of observed deformation can only be attributed to post-Triassic events and not to middle Paleozoic orogeny.

PRELIMINARY OBSERVATIONS REGARDING MINERALIZATION

Silicified rock and jasperoid occur along faults of each fault set. At many localities the rocks are only slightly silicified, but at others the rocks are intensely silicified and altered. Special note is made of the following occurrences:

* Silicified rock, and local iron staining, are very prominent in a brecciated zone just above the thrust fault that juxtaposes Permian (plate 7) on Devonian (plate 5) in the Oxley Peak area. It extends continuously along the fault to the north and along the same structure at the eastern foot of the range. Similar, but less intense, silicification occurred at the same structural position in the northeastern part of the quadrangle.
* Rocks are weak to strongly silicified and iron stained along the Guilmette-Tripon Pass contact at Cedar Peak. This contact is interpreted to be a bedding fault with minor displacement.
* Altered rocks, weakly silicified, are present along the northern east-west trace of the master listric fault and the small second order fault north of this fault that juxtaposes Tripon Pass with Simonson and Guilmette. Similar relationships are present at the head of the master listric fault where the fault cuts the Guilmette and Simonson, as well as along some of the faults cut by the listric fault.
* Tertiary rocks are strongly to moderately silicified and weakly iron stained along the west foot of the range, especially close to the hot springs. The north-trending high-angle fault in sec. 21, R62E, T38N is intensely silicified and forms a rib 3-6 ft wide and up to 6 ft in height.

REFERENCES CITED

Ketner, K.B., and Ross, R.J., 1983, Preliminary geologic map of the northern Adobe Range, Elko County, Nevada: U.S. Geological Survey Open-File Map 83-290.
Oversby, Brian, 1973, New Mississippian formation in northeastern Nevada and its possible significance: American Association of Petroleum Geologists Bulletin, v. 57, p. 1779-1783.
Smith, J.F.r., Ketner, K.B., Hernandez, G.X., Harris, A.G., and Smith, M.C., 1983, Preliminary geologic map of the southern Snake Mountains, Elko County, Nevada: U.S. Geological Survey Open-File Map 83-303.
Thorman, C.H., and Ketner, K.B., 1979, West-northwest strike-slip faults and other structures in allochthonous rocks in central and eastern Nevada and western Utah: Rocky Mountain Association of Geologists, 1979, Basin and Range Symposium, p. 123-133.

PRELIMINARY GEOLOGIC MAP OF THE OXLEY PEAK QUADRANGLE, ELKO COUNTY, NEVADA

By
C. H. Thorman and W. E. Brooks

1988