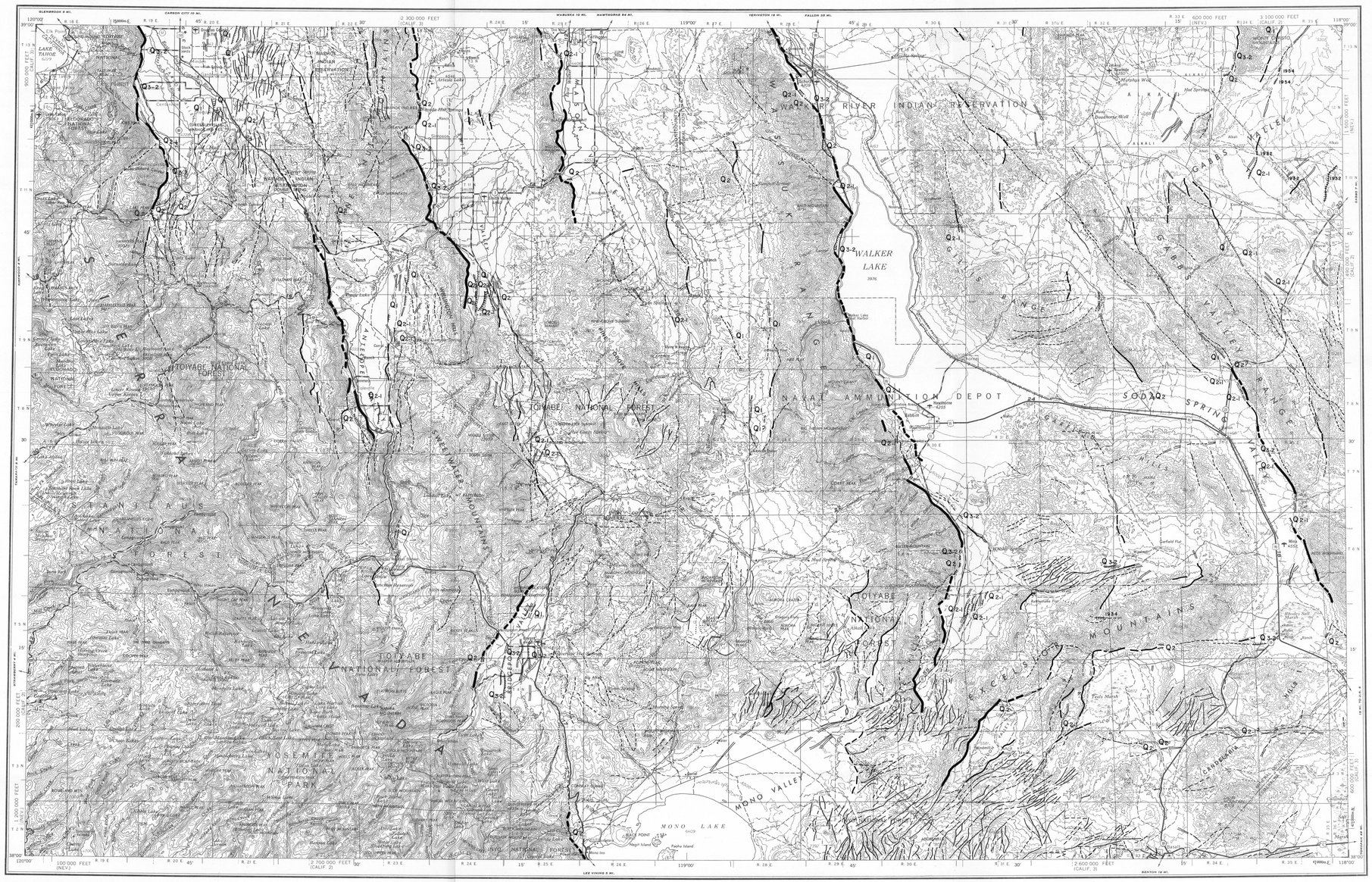
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1382-D



Base from U. S. Geological Survey, 1957

Geology mapped by J.C. Dohrenwend 1980-81

Scale 1:250,000

5 0 5 10 15 20 Statute Miles
5 0 5 10 15 20 25 30 Kilometers
5 0 5 10 15 Nautical Miles

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS

16½°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1980

NEVADA
QUADRANGLE LOCATION

MAP SHOWING LATE CENOZOIC FAULTS IN THE WALKER LAKE 1° BY 2° QUADRANGLE, NEVADA – CALIFORNIA

By

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1982

MAP SHOWING LATE CENOZOIC FAULTS IN THE WALKER LAKE 1° BY 2° QUADRANGLE, NEVADA-CALIFORNIA

PATTERNS OF LATE CENOZOIC FAULTING

The Walker Lake 1° by 2° quadrangle lies athwart the transitional boundary between the Sierra Nevada and Basin and Range physiographic provinces. Six distinct topographic domains are identified within the quadrangle (fig. 1). These domains are clearly defined by contrasting orientations, densities, and styles of late Neogene faulting as follows:

(1) The Sierra Nevada--The Sierra Nevada occupies the southeastern part of the quadrangle. With the exception of the several Basin and Range fault systems that extend into the Sierra Nevada along its northeast flank, this region contains few demonstrable Quaternary faults. The basin-range-related faults are generally north to north-northwest-trending high-angle dip-slip faults.

(2) Western region of Basin and Range topography--A region of Basin and Range topography extends across the northwestern and north-central parts of the quadrangle in a zone from Carson Valley on the northwest to Walker Lake on the east. Five major range-front fault systems dominate the topography and late Cenozoic structure of this region. These high-angle dip-slip fault systems trend generally north to north-northwest along the eastern flanks of the ranges they form. The overall lengths of these fault systems range from 35 to 110 km and vertical offsets range up to at least 2300 m. Fault traces along the range fronts are irregular, bifurcating, and discontinuous. Associated intrarange and intrabasin faulting is common and typically occurs as generally north-trending swarms of short closely spaced subparallel faults. The topographic expression of these fault swarms is subdued relative to the major range-front fault systems and vertical offsets along individual faults rarely exceed 100 m.

(3) Walker Lane--East of the Wassuk Range, the Gillis Range and the Gabbs Valley Range lie within the Walker Lane, a northwest-trending belt of dextral strike-slip faulting and orofluxural warping that is generally considered to extend approximately 650 km from the vicinity of Las Vegas, Nev., to the Honey Lake region of northeastern California. In the quadrangle, five major strike-slip fault systems dominate late Cenozoic faulting along the Walker Lane. These faults are characterized by relatively straight continuous traces up to 20 km long. Subsidiary faults commonly branch and splay from these main fault traces. Where the extension of one of these faults forms a major range front scarp along the west flank of the Gabbs Valley Range east of Soda Spring Valley, the faulting becomes irregular and discontinuous, similar to the style of the major range-front fault systems in the region of basin-range topography to the west. There is little evidence for Quaternary strike-slip displacement along these major strike-slip faults.

(4) Eastern region of Basin and Range topography--Northeast of the Walker Lane and north of Gabbs Valley in the extreme northeastern part of the quadrangle, is a region characterized by a north-northeast orientation of topography and late Cenozoic faulting. All of the late Cenozoic faults mapped in this small area of the quadrangle display evidence of Quaternary movement, including all surface ruptures within the quadrangle associated with the Cedar Mountain earthquake of 1932 and the Dixie Valley-Fairview Peak earthquakes of 1954 (Gianella and Callaghan, 1934; Ekren and Byers, 1978; Slemmons, 1957).

(5) Pine Grove Hills and Bodie Hills--A region of variably trending high-angle dip-slip faults extends throughout the Pine Grove Hills and Bodie Hills in the south-central part of the quadrangle and forms an elongate north-trending embayment into the western region of Basin and Range topography. Faults within this region are relatively short (less than 10 km long) and are characterized by relatively small displacements (generally less than 200 m). Compared with most of the late Cenozoic faulting in other regions of the quadrangle, the topographic expression of this faulting is relatively subdued.

(6) Mono Lake basin-Excelsior Mountains trend--A broad zone of northeast- to east-trending topography and late Cenozoic faulting extends eastward from Mono Lake basin, across the Adobe and Anchorite Hills and along the Excelsior Mountains and Candelaria Hills to the Walker Lane. The trends of topography and faulting within this zone are approximately orthogonal to and in marked contrast with the topographic and faulting trends of the Walker Lane and the major range-front fault systems in the northern part of the quadrangle. Late Cenozoic faulting within this zone is dominated by two distinct and contrasting styles: swarms of north- to northeast-trending, short, closely spaced, subparallel to bifurcating, high-angle, dip-slip faults in late Tertiary and Quaternary volcanic rocks, and widely separated but approximately evenly spaced east-trending, high-angle faults, several of which have undergone left-oblique displacement (Speed and Cogbill, 1979). Fault scarps and lineaments in Quaternary surficial deposits occur at a number of locations along several of these left-oblique faults.

EXPLANATION OF MAP SYMBOLS

1932 HISTORIC SURFACE FAULTING--Surface ruptures associated with historic earthquakes. Number indicates the year of the earthquake:

1932--The December 20, 1932 Cedar Mountains earthquake, M=7.2 (Gianella and Callaghan, 1934)

1934--The January 30, 1934 Excelsior Mountains earthquake, M=6.3 (Callaghan and Gianella, 1935)

1954--The December 16, 1954 Dixie Valley - Fairview Peak earthquakes, M=6.9 to 7.2 (Slemmons, 1957; Ekren and Byers, 1978)

Q3 FAULT SCARPS IN QUATERNARY SURFICIAL DEPOSITS--Surface offsets of Quaternary surficial deposits other than those displacements associated with known historic earthquakes. Nachures indicate the downslope direction of the scarp. Symbol indicates the approximate age of the offset Quaternary deposit: Q_{h}, Holocene deposits; Q_{h-p}, Holocene and (or) late Pleistocene deposits; Q_{p}, late Pleistocene deposits; Q_{p-}, Pleistocene deposits; Q_{m} middle to early Pleistocene deposits. Symbols correspond with the unit symbols used on the surficial geologic map of the Walker Lake 1° by 2° quadrangle (Dohrenwend, 1982).

Fault scarps in Quaternary surficial deposits are scattered throughout that part of the quadrangle east of the Sierra Nevada. These scarps are associated with: (1) all but one of the major range-front fault systems in the quadrangle, (2) four of the major strike-slip faults of the Walker Lane domain (fig. 1) in the northeastern part of the quadrangle, (3) three approximately east-trending fault zones immediately north and south of the Excelsior Mountains and within the Candelaria Hills in the southeastern part of the quadrangle, and (4) six small fault swarms along the southeast flanks and at the south ends of several of the quadrangle's major basins--Carson Valley, Antelope Valley, Smith Valley, Bridgeport Valley, and Whiskey Flat. Scarp heights range from 0.5 m to approximately 10 m, and scarp declivities range from less than 5° to approximately 31°. Scarp lengths range up to approximately 3,500 m. Quaternary fault scarps in alluvium along the major range-front fault systems are typically more steeply sloping than Quaternary fault scarps in alluvium associated with sid-e-basin and strike-slip fault systems

FAULT-RELATED LINEAMENTS IN QUATERNARY SURFICIAL DEPOSITS--Alinements in Quaternary surficial deposits of one or more of the following features: linear drainage channel segments, shallow linear swales, springs, and vegetation contrasts. Commonly alined or associated with Quaternary fault scarps. Lengths of fault related lineaments in surficial deposits range up to approximately 6,000 m

MAJOR RANGE-FRONT FAULTS--Faults bounding the tectonically active fronts of major mountain ranges. Major range fronts in the Walker Lake quadrangle are characterized by: juxtaposition of Quaternary alluvium against bedrock, an absence of pediments, sharp piedmont angles, steep bedrock slopes, faceted spurs, and subparallel systems of high-gradient, short, narrow, steep-walled canyons orthogonal to the range front. Commonly form fault scarps and lineaments in Quaternary surficial deposits along or immediately adjacent to the range front. Solid lines indicate locations where the range-front scarp is abrupt, steep, and sharply defined. Dashed lines indicate locations where the range-front scarp is relatively subdued.

Extensive range-front fault systems bound seven mountain ranges in the quadrangle: the ranges west of Carson Valley and Antelope Valley, the Pine Nut Mountains-Wellington Hills, the Sweetwater Mountains, the Sierra Nevada (south of Conway summit), the Singatse Range, and the Wassuk Range. All of these ranges trend north to north-northwest and all tilt generally westward away from east-facing range-front scarps. East of the Sierra Nevada, these ranges vary in size from the Singatse Range, 35 km long with a present topographic relief of approximately 700 m, to the Wassuk Range, 110 km long with a present topographic relief of approximately 2,300 m

FAULTS JUXTAPOSING QUATERNARY ALLUVIUM AGAINST BEDROCK, OTHER THAN MAJOR RANGE-FRONT FAULTS--Morphologically similar to major range-front faults except that the associated fault systems are significantly less extensive and the fault scarps are substantially lower, shorter, and less continuous. Solid lines indicate locations where fault scarps are abrupt, steep, and well defined. Dashed lines indicate locations where fault scarps are relatively subdued

FAULTS FORMING FAULT SCARPS IN QUATERNARY AND (OR) TERTIARY ROCKS--Faults forming fault scarps in early Quaternary and (or) Tertiary alluvium or Quaternary and (or) latest Tertiary volcanic rocks. Fault scarps are typically moderately steep to steep and moderately dissected to undissected. Lengths of individual fault scarps range from a few tens of meters to as much as 5500 m. Scarp heights range from less then 5 m to as much as 180 m. The large majority of these faults occur in eight distinct swarms of short closely spaced bifurcating to subparallel faults. One of these swarms occurs in Quaternary and (or) Tertiary tertigenous sediments on the west flank of the Pine Nut Mountains in the northwestern part of the quadrangle. The other seven swarms occur in Quaternary and (or) latest Tertiary volcanic rocks ranging in age, where known, from 1.0 to 4.7 million years (m.y) (Silbert and Reynolds, 1973; Gilbert and others, 1968; Kleinhampl and others, 1975; Marvin and Cole, 1978). These seven swarms are scattered across the central and southeastern parts of the quadrangle from the eastern flank of the Sweetwater Mountains to the northwestern flank of the Candelaria Hills

FAULTS ASSOCIATED WITH PROMINENT TOPOGRAPHIC LINEAMENTS--Faults associated with prominent alinements of one or more of the following landforms: abrupt scarps, linear ridges, hillside benches and trenches, linear segments of stream channels and stream valleys, ridge-crest saddles and cols, linear depressions, and small closed basins. Typically associated with or expressions of fault systems along range fronts, in early Quaternary and (or) Tertiary alluvium, or in Quaternary and (or) latest Tertiary volcanic rocks

DISTINCT TOPOGRAPHIC LINEAMENTS IN BEDROCK--Probable faults in bedrock associated with alinements of one or more of the following landforms: abrupt scarps, linear ridges, hillside benches, linear segments of stream channels and valleys, and ridge-crest saddles and cols. Morphologically similar to and typically related to faults associated with prominent topographic lineaments, although not as clearly defined as these latter features

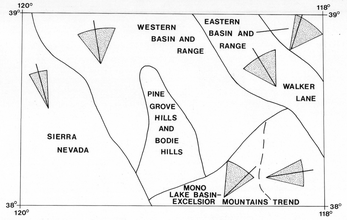

Figure 1. Topographic and late Cenozoic faulting domains within the Walker Lake 1° by 2° quadrangle. Within each domain, shaded angle and line indicate the general range and approximate average, respectively, of fault trends within that domain.

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