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HYDROGEOLOGIC CROSS SECTIONS OF THE MESILLA BOLSON AREA, DONA ANA COUNTY, NEW MEXICO AND EL PASO COUNTY, TEXAS

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APPENDICES A and C

pages 147-157 from

Peterson, D. M., Khaleel, R., and Hawley, J. W., 1984, Quasi three-dimensional modeling of groundwater flow in the Mesilla Bolson, New Mexico and Texas: New Mexico Water Resources Research Institute, Technical Completion Report, Project No. 1345645, WRRI Report No. 178, 185 p.

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The purpose of this phase of research on numerical modeling of groundwater flow in the lower Rio Grande basin of New Mexico (Khaleel et al, 1983; in progress) is to illustrate the hydrogeologic framework of the Mesilla Bolson utilizing all available surface and subsurface information. Emphasis is on physical properties of the intermontane-basin fill related to storage and transmission of ground water, and on the structural and lithologic properties of rock units forming basin boundaries. Information is presented in a combined surface-map and cross-section format (Plates 1 to 16) in order to provide 3-dimensional hydrogeologic models that interface directly with numerical models developed for the hydrologic phase of the study. Basic map scale (1:125,000) and cross-section dimensions (1:1 and 10:1 vertical exaggeration) conform with map and section formats used in ongoing hydrologic and geologic investigations by the U.S. Geological Survey, New Mexico State Engineer, and New Mexico Bureau of Mines and Mineral Resources (Wilson and others, 1981; Seager and others, in press).

Any valid characterization of bolson hydrogeology must be based on the best possible understanding of the local geologic framework, particularly in the context of relatively recent geologic history, since the major water-bearing units are fills of intermontane structural basins of late Cenozoic age. The bulk of these units, and associated confining beds, are components of the Santa Fe Group and include deposits of the ancestral Rio Grande. Recent mapping (summarized by Seager and others, in press) of exposed geologic units and structures is of excellent quality. However, hydrologic investigations focus on basin- and valley-fill units that are rarely well exposed; and in much of the area, subsurface data from drill holes and geophysical surveys are not available. Therefore, portrayals of bolson hydrogeology (e.g. King and others, 1971; King and Hawley, 1975; Wilson and others, 1981), including materials in this report, should be regarded only as reasonable state-of-the-art models that will be subject to testing and revision. The reference list indicates sources of most of the data used in preparation of cross sections. The only unpublished data used were preliminary well logs, mainly from files at the Las Cruces and El Paso offices of the U.S. Geological Survey, and some geophysical information. It must be emphasized, however, the interpretations presented in this study are strictly those of the author.

Plates 1 to 16 illustrate the major hydrogeologic features of the Mesilla Bolson and the format used for presenting hydrogeologic information in this ongoing study. Plate 1 is a topographic map view of the area showing location of 1) major basin-range boundary faults, 2) well-control points, and 3) sixteen cross sections that form the basis for the hydrogeologic model. Plates 2 to 9 and 11 to 14 are preliminary versions of twelve transverse sections (AA', BB', CC', DD', ED', FF', GG', GH', JJ', KK', LL', and MM') across the bolson and adjacent parts of the Jornada and Hueco basins. Plate 10 comprises two longitudinal sections (HH' and II') along the structural uplifts that form the east margin of the Mesilla Bolson; these sections extend from the Dona Ana to the Franklin Mountains. Plate 15 is a longitudinal profile (NN') down the Mesilla Valley from north of Las Cruces to south of Anthony. Plate 16 is a longitudinal section (AN') extending from north to south down the bolson floor west of the Mesilla Valley. The orientation of sections in Plates 15 and 16 is down regional slope and approximately parallel to major ground-water flow lines. The base line of all sections is mean sea level, and geologic information to that depth is given wherever possible. The bulk of hydrogeologic data is from a zone between 2,500 ft elevation and the land surface, with the top of the zone of saturation at about 4,000 ft. However, a few well and geophysical control points extend to or below an elevation of 2,000 ft.

General distribution patterns of 10 hydrogeologic subclasses of valley and basin fills are shown on Plates 2 to 16 (sections with 10:1 vertical exaggeration). These deposits of late Oligocene to Holocene age (<25 million years) are listed in order of decreasing aquifer potential and include six subdivisions that form important aquifers in the Mesilla Bolson area (Plate 1). Units I to IV form the major aquifers of the region and include deposits of a large fluvial-fan system constructed by the ancestral Rio Grande in Pliocene to middle Pleistocene time (5 to 0.5 million years ago). Clean sand or gravelly sand zones are extensive and thick, and have relatively large hydraulic conductivities. Estimated transmissivities commonly exceed 10,000 ft^2/day and water quality is good (tds usually <1,000 mg/L). Units V and VI form thinner and less extensive aquifers that are locally important water sources, particularly in the southern Jornada del Muerto Basin. These piedmont-slope and basin-floor alluvial deposits include elongate sand and gravel lenses that are in part transitional to more extensive deposits of the ancestral Rio Grande. Transmissivities locally may be as high as 10,000 ft^2/day. Units VII to X rarely form aquifers and include fine-grained basin fill (playa and lake beds) and indurated fan-piedmont deposits. Hydraulic conductivities are very low and water quality is usually poor.

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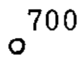
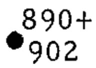
This work is dedicated to the memory of Clyde A. Wilson, who headed the U.S.G.S. office in Las Cruces from 1971 until his untimely death in 1980. This unassuming and highly motivated public servant played the key role in putting ground-water hydrology and hydrogeology of the Mesilla Bolson area on a sound technical and scientific footing. Clyde's expertise and common-sense approach to water resource investigations are greatly missed.

Explanation--Plate 1

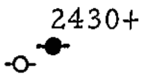
Well-Control Points



Water-well (test or production) with depth indicated; water-level information usually available; sample and/or drillers logs also available for many holes



Water-well (test or production) with geophysical log(s); sample and/or drillers logs commonly available; upper and lower members indicate thickness of basin fill and total depth, respectively.



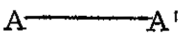
Oil test control point, with thickness of basin fill indicated; geophysical, driller, and sample logs usually available

Boundary Faults

High-angle normal fault; bar and ball on downthrown side

Buried high-angle normal fault

Cross Sections



Location of transverse hydrogeologic cross sections (Plates 2-9, 11-14)

Location of longitudinal hydrogeologic cross sections (Plates 10, 15, 16)

Explanation--Plates 2 to 16

Valley-Fill and Basin-Fill (QTa) Subdivisions

Valley-fill unit

I. Sand and gravel, with local silt-clay lenses. Upper Quaternary Rio Grande Valley fill. Forms upper part of "shallow aquifer" of Leggat et al. (1962) and "flood-plain alluvium of Wilson et al. (1981).

Younger basin-fill units (basin-floor fluvial to deltaic facies)

II. Sand, with pebble gravel, clay-silt, and sandstone lenses; partly cemented with calcite. Plio-Pleistocene ancestral river facies; includes upper Santa Fe Gp-Camp Rice Fm fluvial facies. Unit mainly unsaturated; where saturated forms part of major Mesilla Bolson aquifers.

III. Sand and some fine pebble gravel, interbedded with clay-silt; broadly lenticular to sheet-like strata; partly cemented with calcite (sand $\geq$ clay-silt-sandstone; sand bodies estimated to make up about 50-60% of section). Pliocene-lower Pleistocene transitional facies; fluvial-deltaic deposits of upper Santa Fe Gp, including parts of Camp Rice and Fort Hancock Fms. Includes parts of "medial aquifer" of Leggat et al. (1962).

IIIs. Zones where sand bodies are the major constituent (sand>clay-silt-sandstone; sand bodies estimated to make up about 60-80% of section).

Younger basin-fill units (piedmont-slope and basin-floor facies)

IV. Sand, with discontinuous thin clay layers. Pliocene-upper Miocene? eolian facies; unnamed upper Santa Fe Gp unit. Includes major part of "deep aquifer of Leggat et al. (1962).

V. Pebbly sand to clay mixtures, interbedded with clean pebbly sand, and clay-silt; broadly lenticular bodies of clean sand and pebble gravel (20-30%). Plio-Pleistocene distal piedmont facies, mainly coalescent fan (bajada) deposits, and local basin-floor alluvium that intertongue with units II to IV and VII. Upper Santa Fe Gp--Camp Rice and Fort Hancock Fms. Includes "NASA well I-J aquifer" of Doty (1963) in southern Jornada Basin.

VI. Coarse gravelly sand to clay mixtures, with thin lenticular bodies of clean sand and gravel (10-20%), and discontinuous zones of calcite cementation. Pleistocene proximal piedmont facies, mainly alluvial fan deposits. Upper Santa Fe Gp-Camp Rice and Fort Hancock Fms.

VII. Clay-silt, with interbedded sand and sandstone lenses; broadly lenticular to sheet-like strata (clay-silt-sandstone>sand; sand lenses less than 10% of section); locally with calcium and sodium sulphates. Pliocene-lower Pleistocene deltaic-lacustrine and playa facies that intertongue with units III, IV, and V. In central basin areas transitional downward with unit X. Upper Santa Fe Gp-Fort Hancock Fm.

Older basin-fill units (piedmont-slope and basin-floor facies)

VIII. Conglomeratic sandstone and mudstone and conglomerate; with discontinuous zones of gravelly sand and clay-silt. Miocene to lower Pleistocene fanglomerate facies; Santa Fe Gp--mainly correlative with Rincon Valley and Hayner Ranch Fms., but also include basal Camp Rice fan deposits.

IX. Fine conglomeratic sandstone and mudstone, interbedded with sandstone to mudstone. Miocene to lower Pleistocene distal piedmont facies, coalescent fan (bajada) deposits that intertongue with units VIII and X). Mainly lower Santa Fe-Rincon Valley Fm.

X. Clay-silt, mudstone, and shale, with local sandstone and conglomeratic lenses; locally with calcium and sodium sulphates. Miocene to lower Pliocene playa-lake facies; mainly lower Santa Fe Group-Rincon Valley Fm.

Bedrock Units*

Qb	Basaltic volcanics, mostly flows, with local cinder-cone and conduit material. Quaternary
Tb	Basaltic plugs. Miocene and Pliocene
Tr	Rhyolitic volcanics, with some interbedded sandstone and conglomerate mostly ash-flow tuff and lava. Oligocene
Tri	Rhyolitic intrusive complexes; mostly sills, plugs and associated lava domes. Oligocene
Ti	Silicic to intermediate plutonic rocks. Oligocene and Eocene
Tv	Andesitic and other intermediate volcanic and volcaniclastic rocks, including lavas and laharic breccias. Oligocene and Eocene
Trv	Undivided Tr and Tv
Tl	Mudstone, sandstone, and conglomerate with local gypsum beds. Lower tertiary, mainly Eocene
Tvl	Undivided Tv and Tl
M	Mesozoic rocks--undivided; includes limestone, sandstone, shale and marine limestone. Cretaceous
TM	Undivided Ti, Tv, Tl, M
Pu	Upper Paleozoic rocks; includes limestone, shale, sandstone and mudstone, with local gypsum beds.
MP	Undivided M and Pu
Pl	Lower Paleozoic rocks--undivided; includes limestone, shale, and minor sandstone.
P	Undivided Pu and Pl
P€	Precambrian metasedimentary rocks, metavolcanics, and granite.
PP€	Undivided Pu, Pl, and P€

* Primarily hydrogeologic boundary units with very low transmissivities. However, limestones may locally be highly transmissive in zones with solution-enlarged joints and fractures; and sandstone, conglomerate, and fractured tuffs and lavas may also form aquifers in a few areas.

Faults

High-angle normal faults, dashed where inferred; direction of relative displacement shown

Well Control

3918'
704

Well on or near line of section; land-surface elevation and total depth shown

4355'
640+
850

Well location projected to line of section; surface elevation, basin-fill thickness, and total depth shown

22.2.15.143 — Well location shown by township south, range east, section, and 40-acre quarter

Other Control (see Wilson et al, 1981)

X — Location of USGS vertical electrical sounding

Indication of electrical basement

<1000 Mg/L tds — Estimated dissolved solid content of ground water

Water table

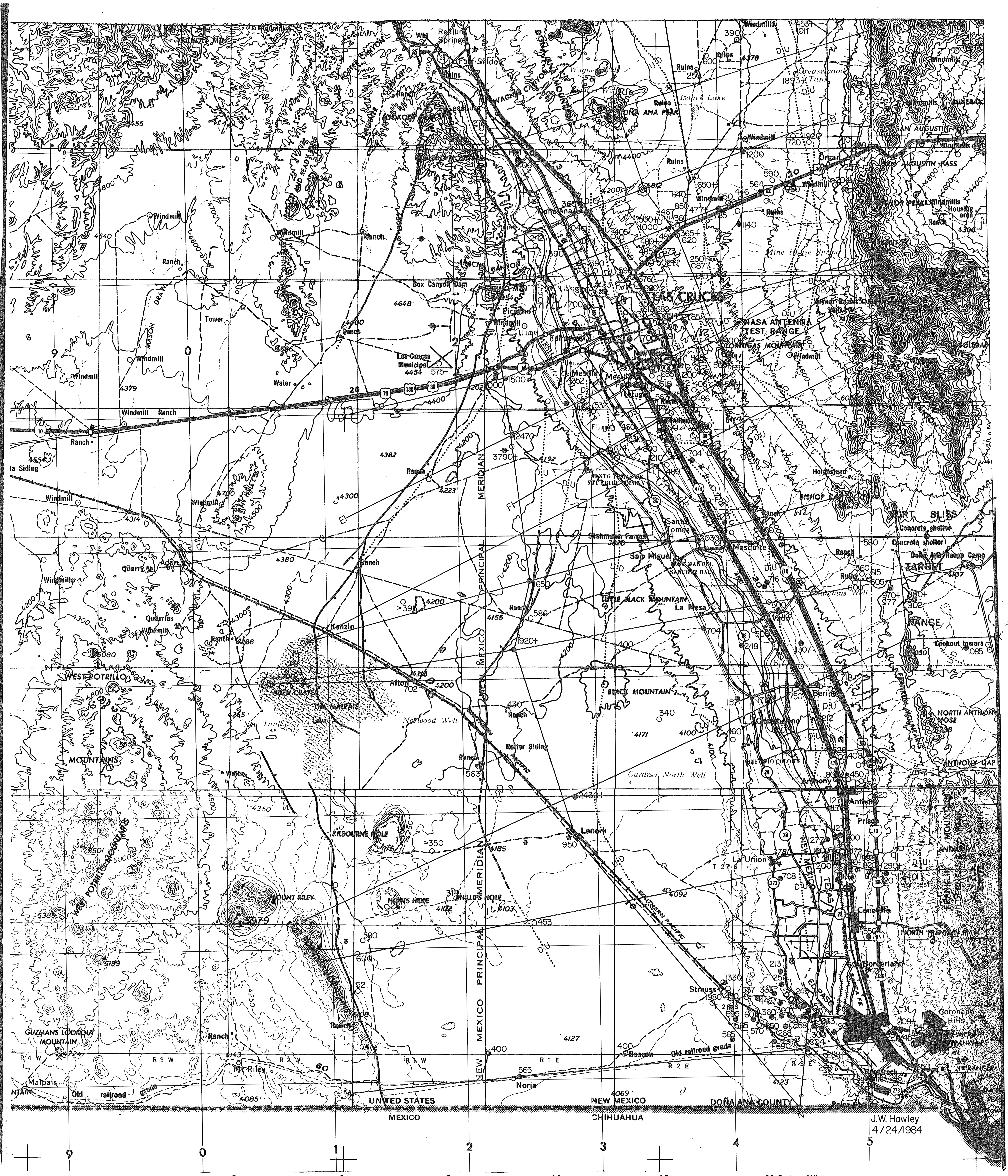


PLATE I. Index map showing location of well-control points, hydrogeologic sections, and major boundary faults.

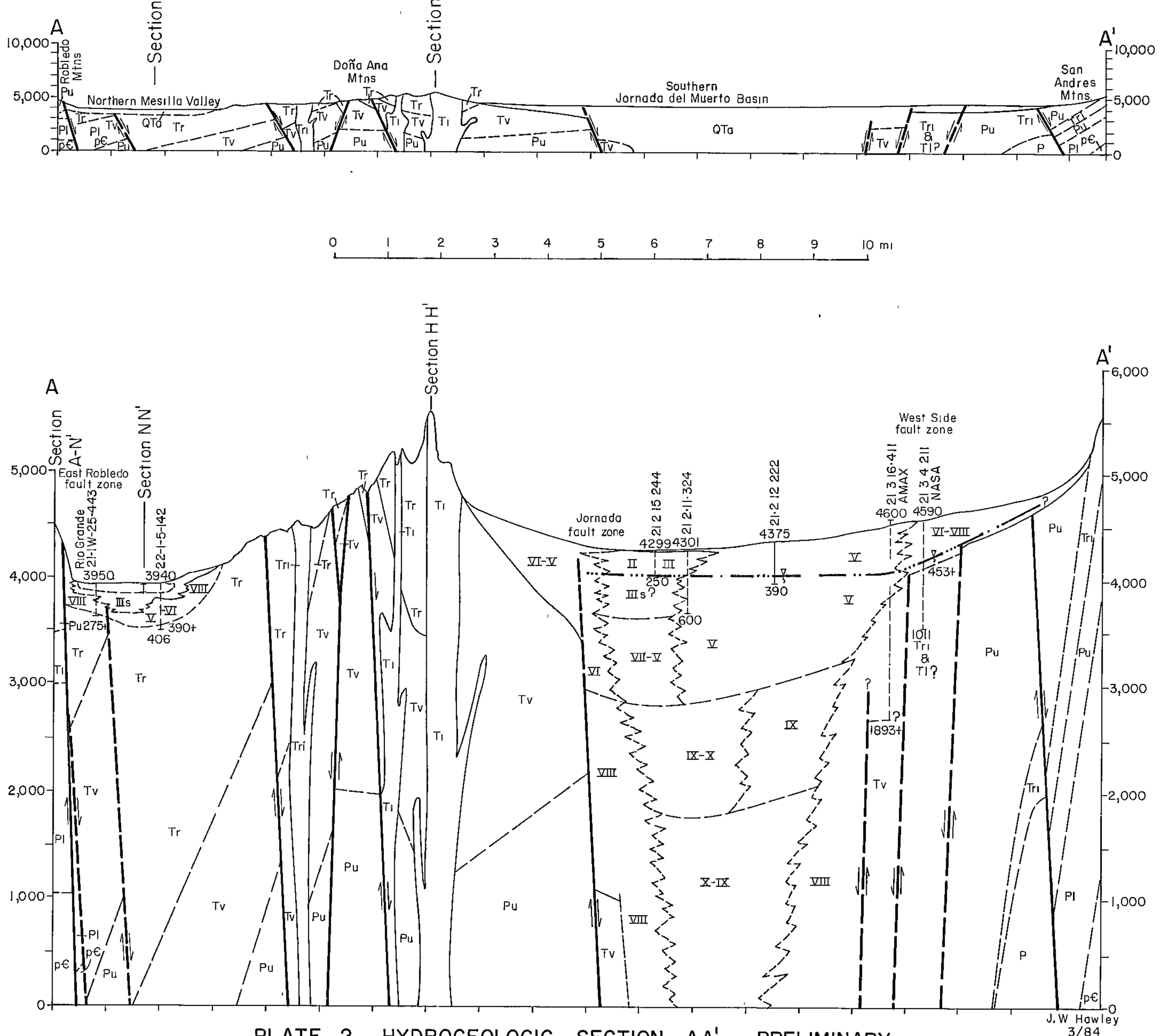


PLATE 2. HYDROGEOLOGIC SECTION AA' — PRELIMINARY

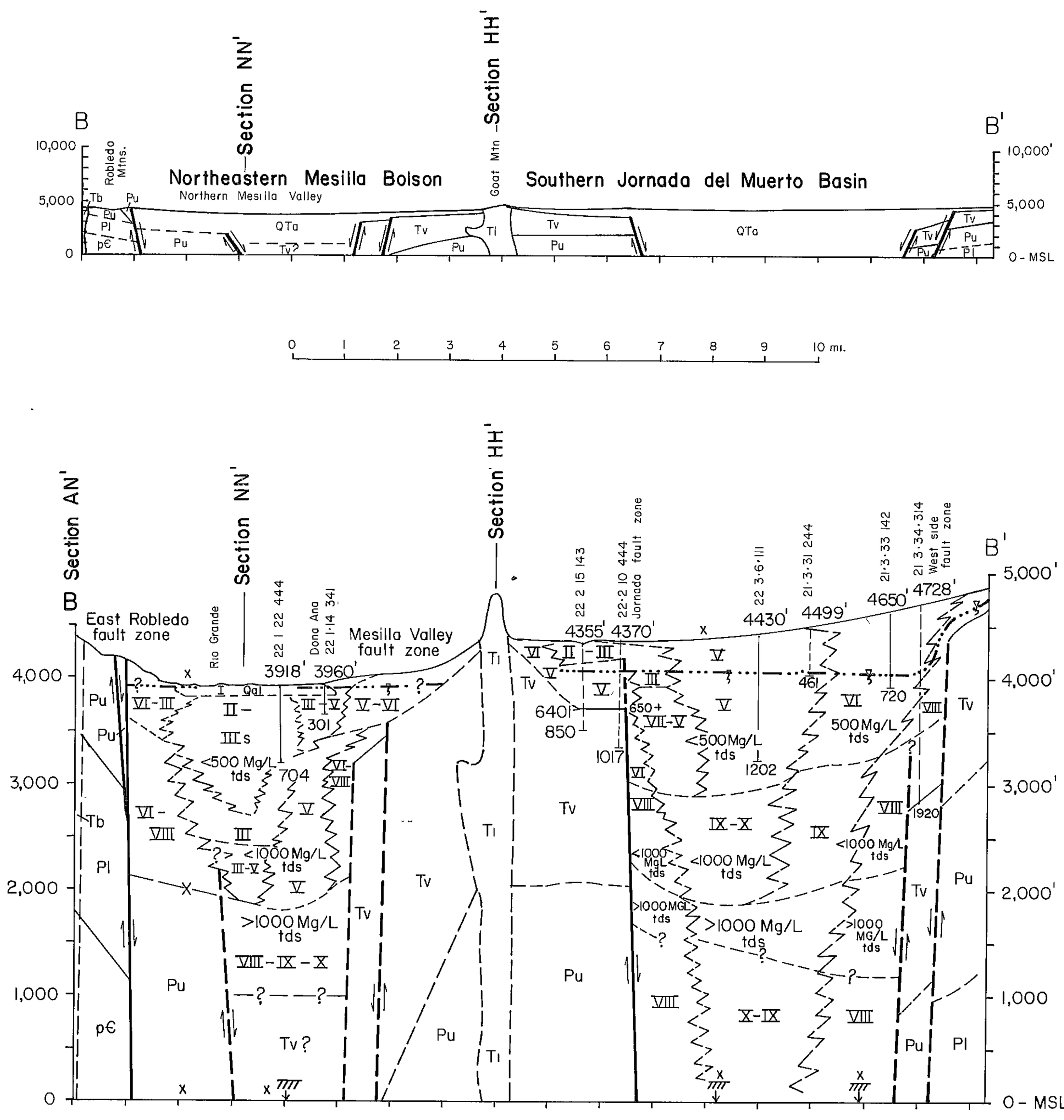


PLATE 3. HYDROGEOLOGIC SECTION BB' — PRELIMINARY

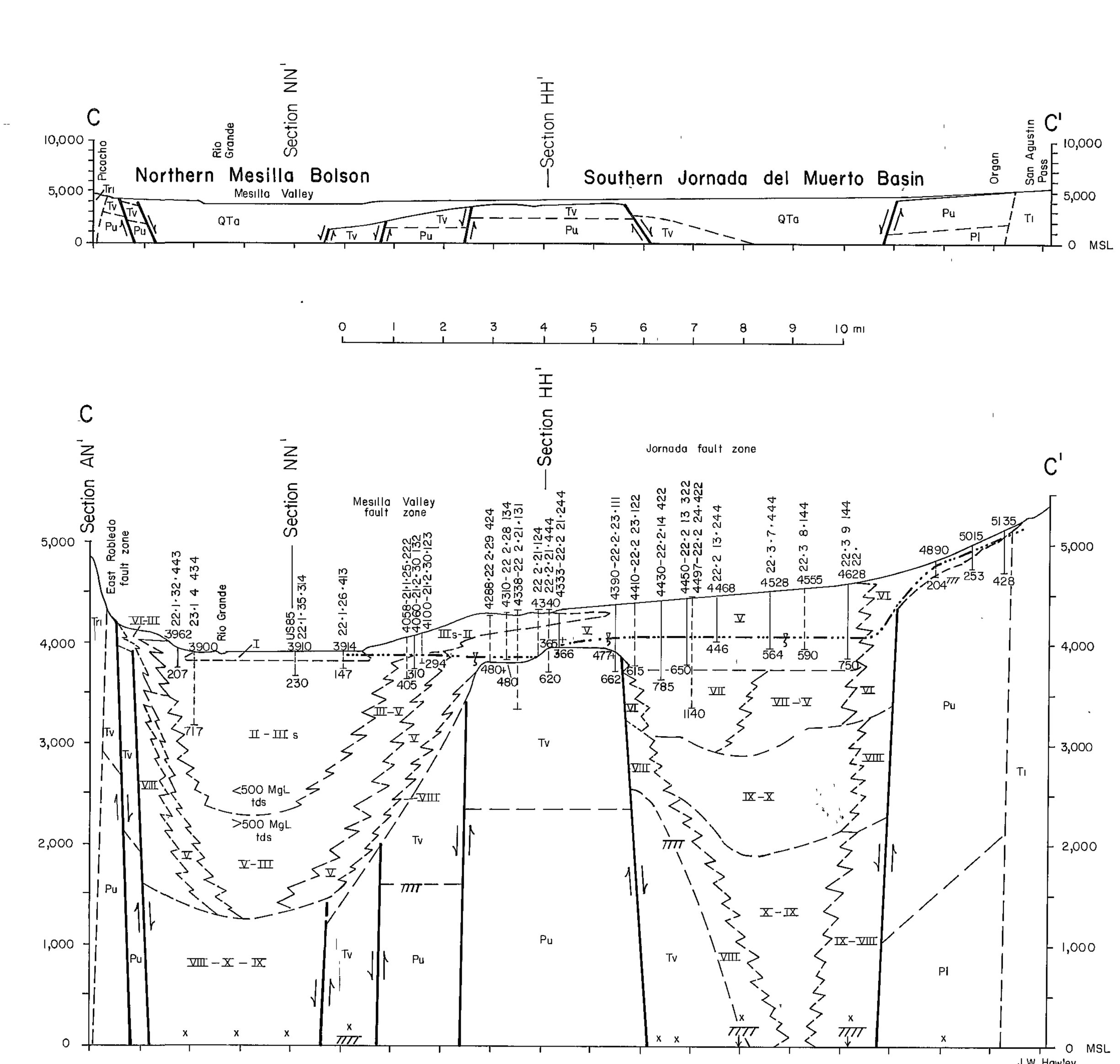


PLATE 4. HYDROGEOLOGIC SECTION CC' — PRELIMINARY

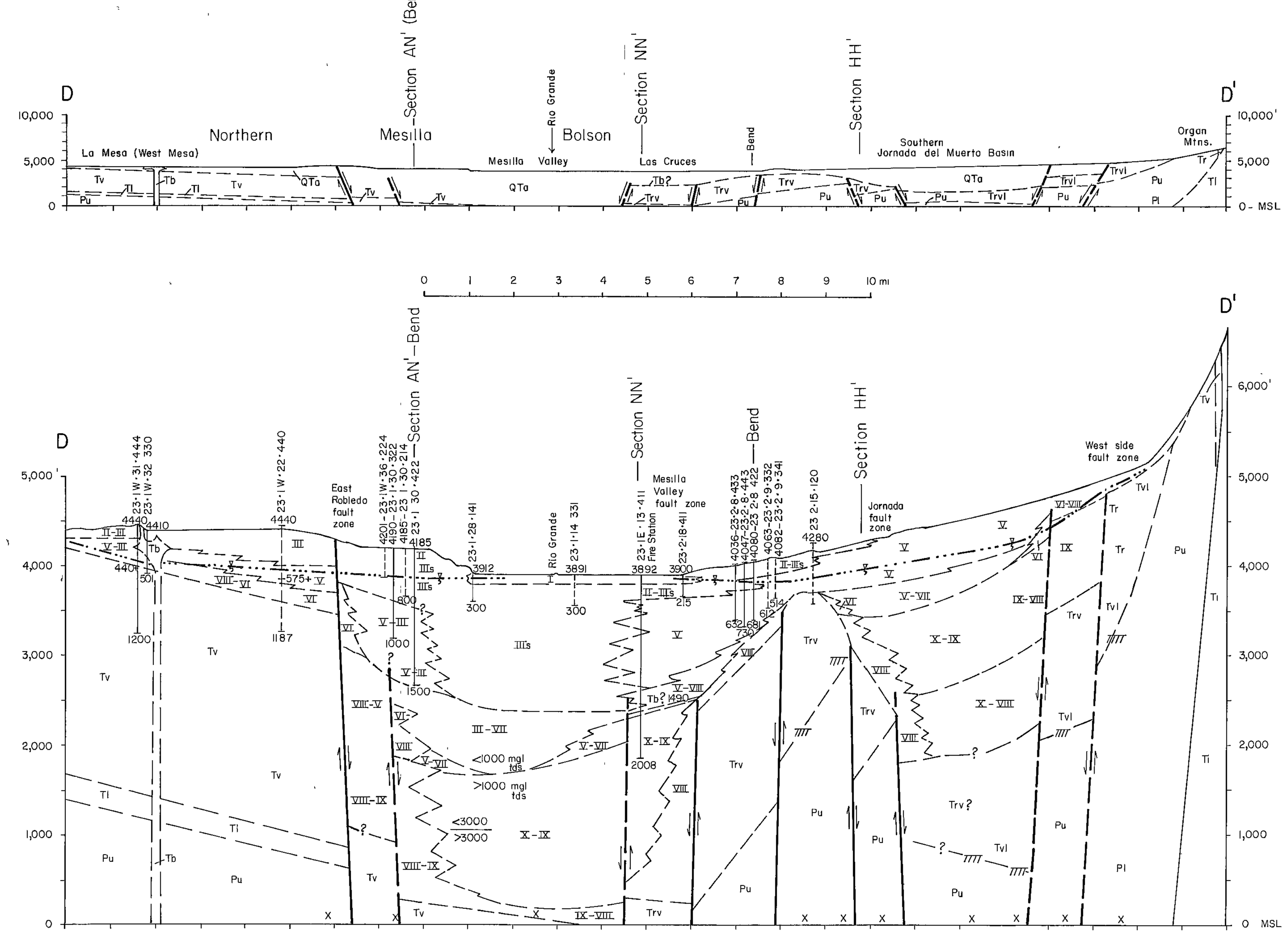


PLATE 5. HYDROGEOLOGIC SECTION DD' — PRELIMINARY

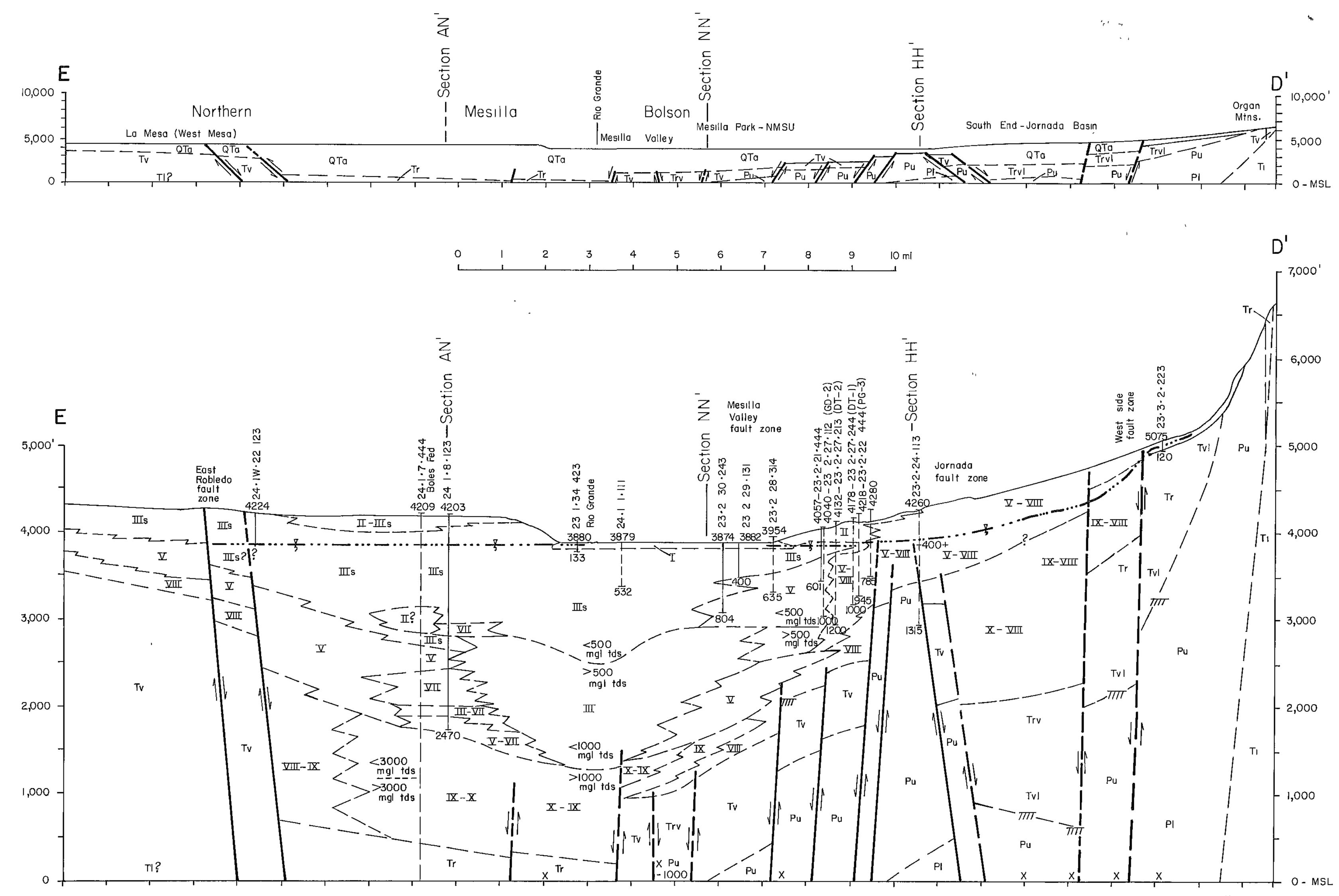


PLATE 6. HYDROGEOLOGIC SECTION ED' — PRELIMINARY

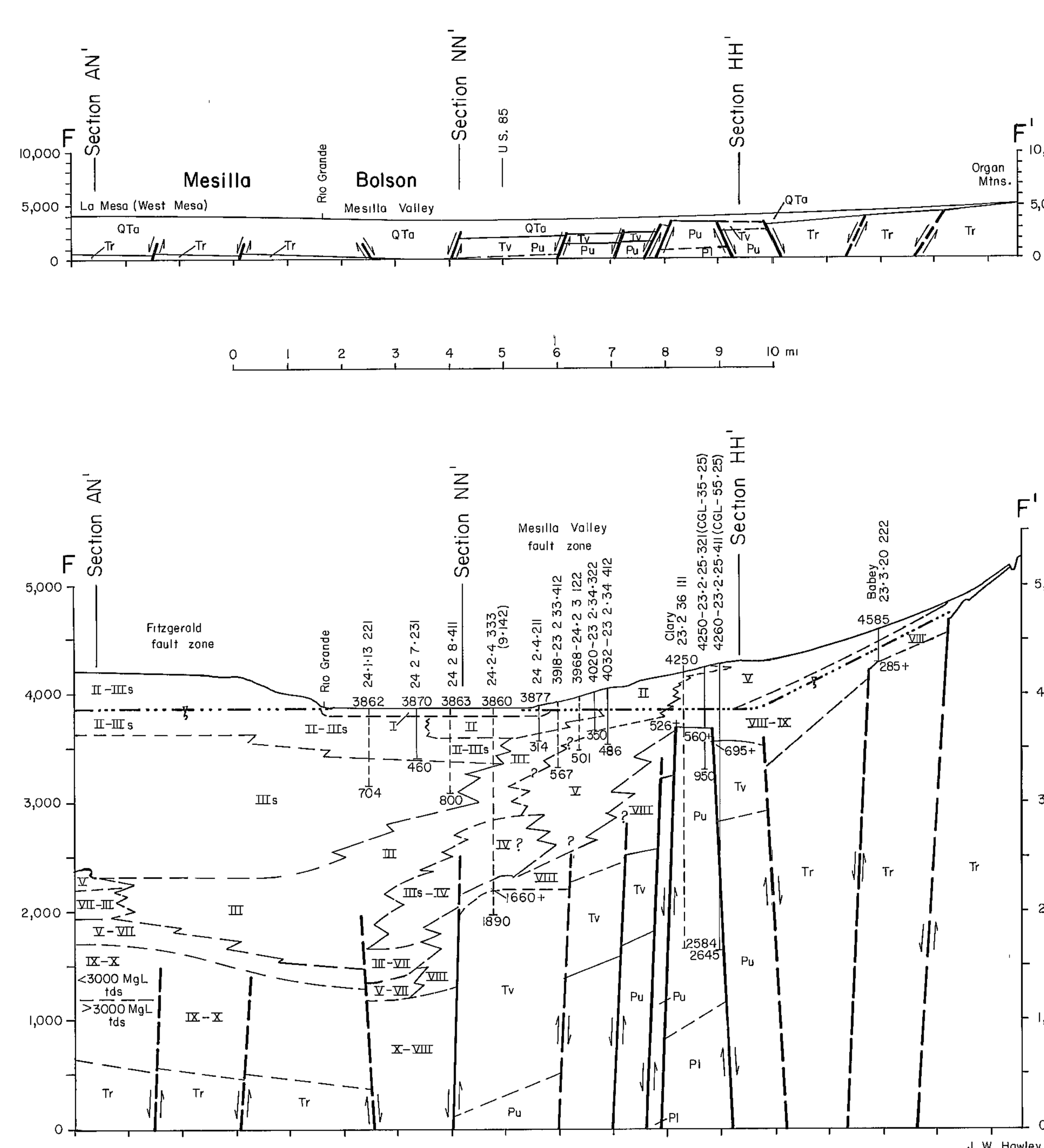


PLATE 7. HYDROGEOLOGIC SECTION FF' — PRELIMINARY

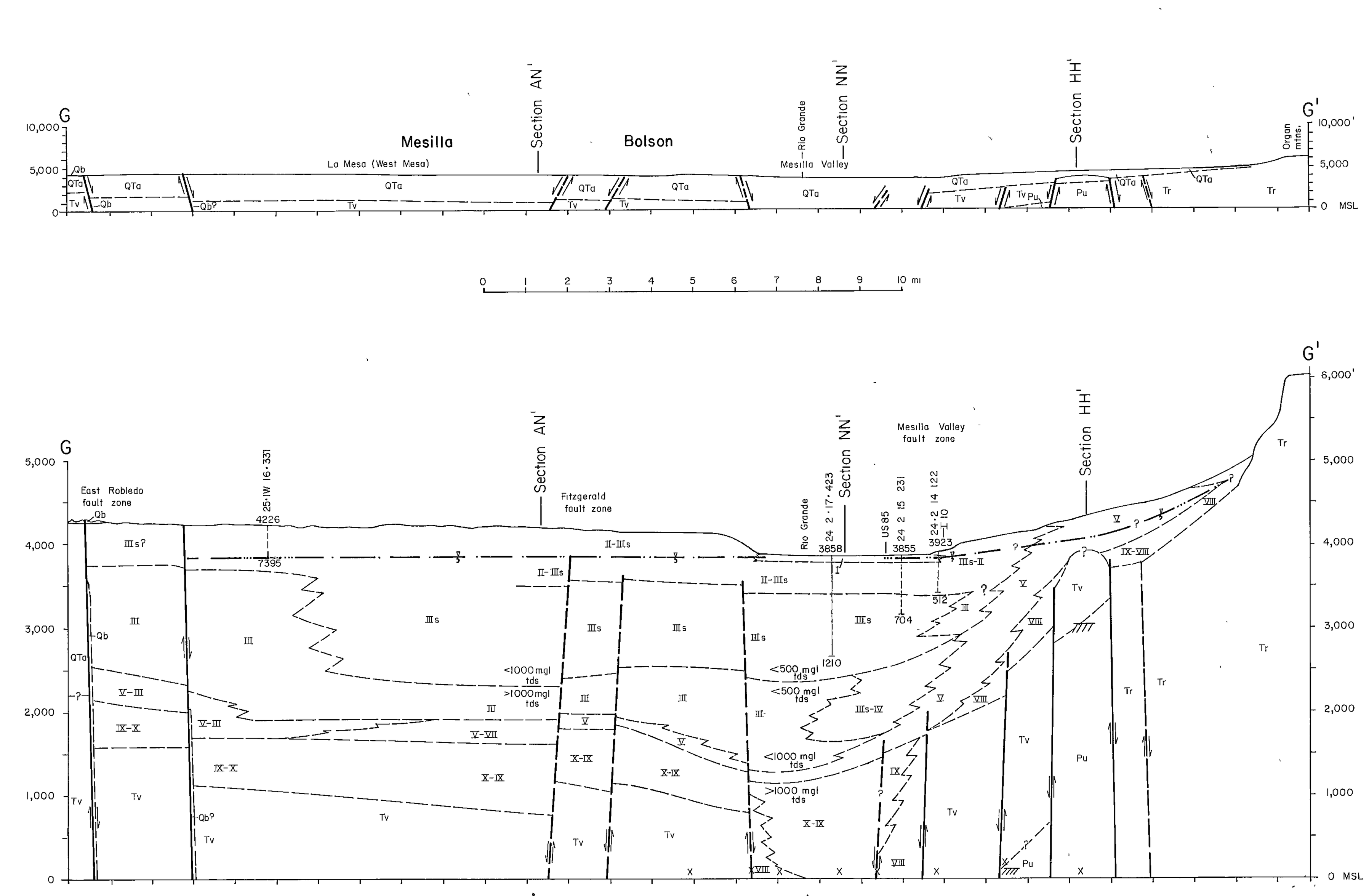


PLATE 8. HYDROGEOLOGIC SECTION GG' — PRELIMINARY

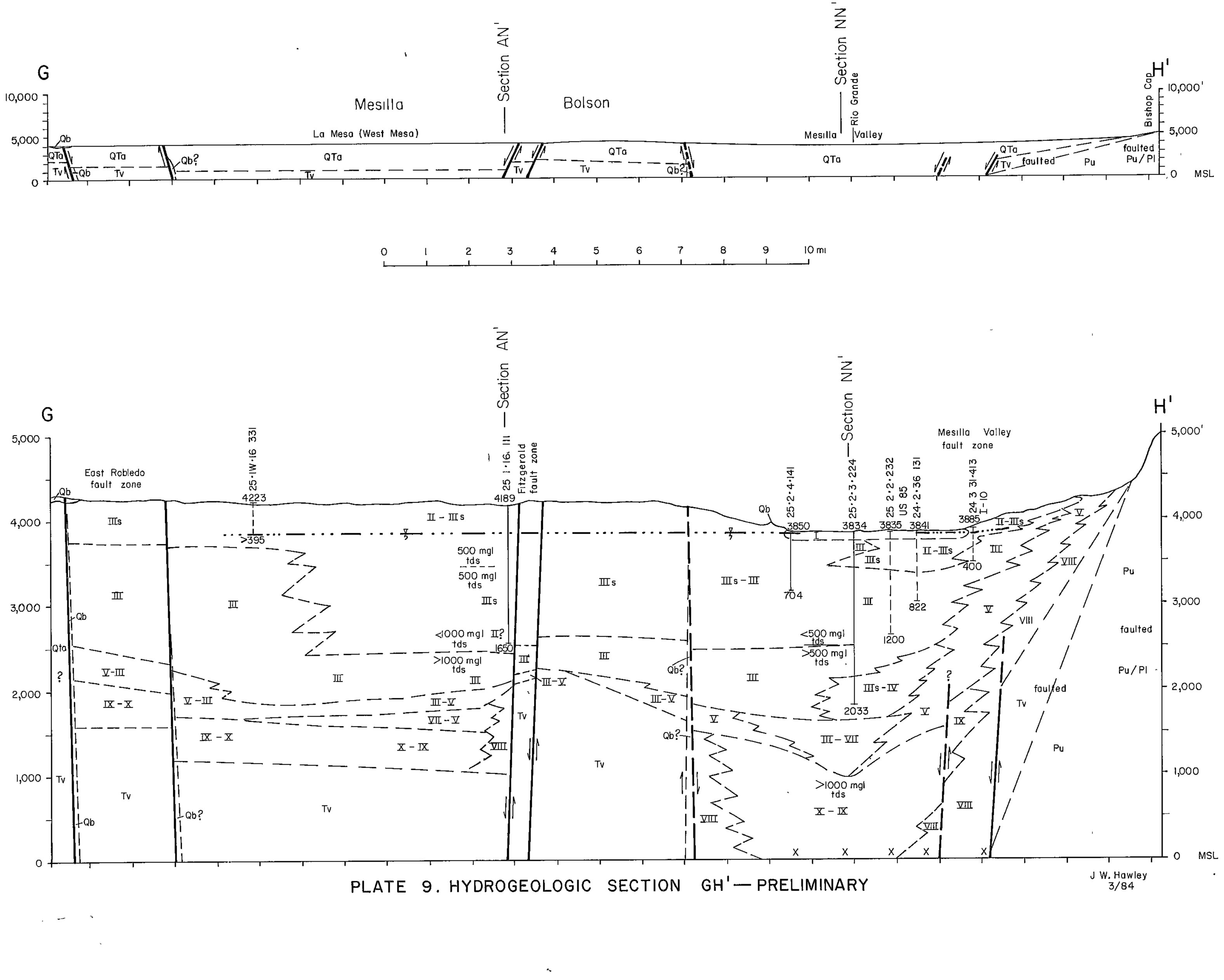


PLATE 9. HYDROGEOLOGIC SECTION GH' — PRELIMINARY

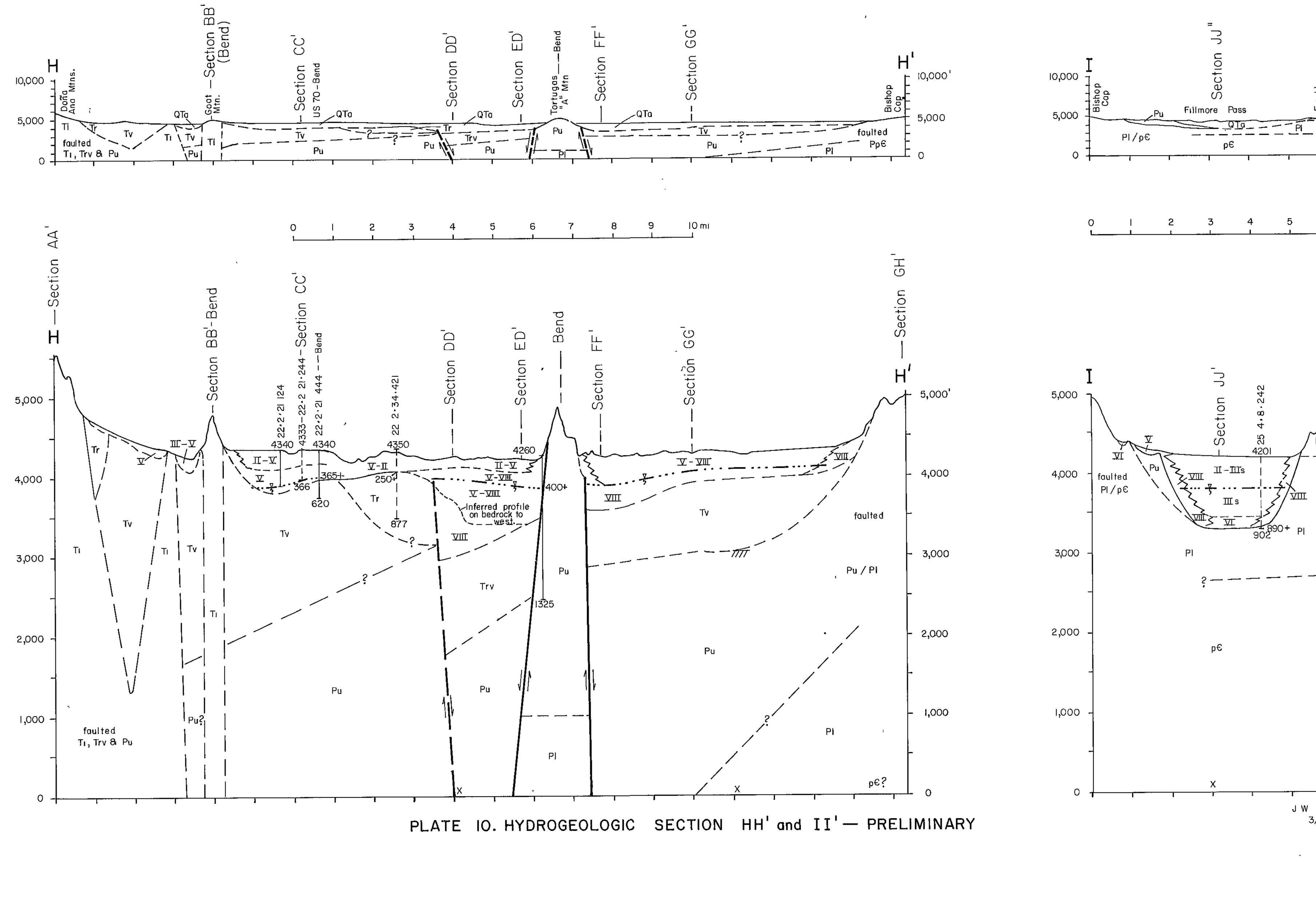
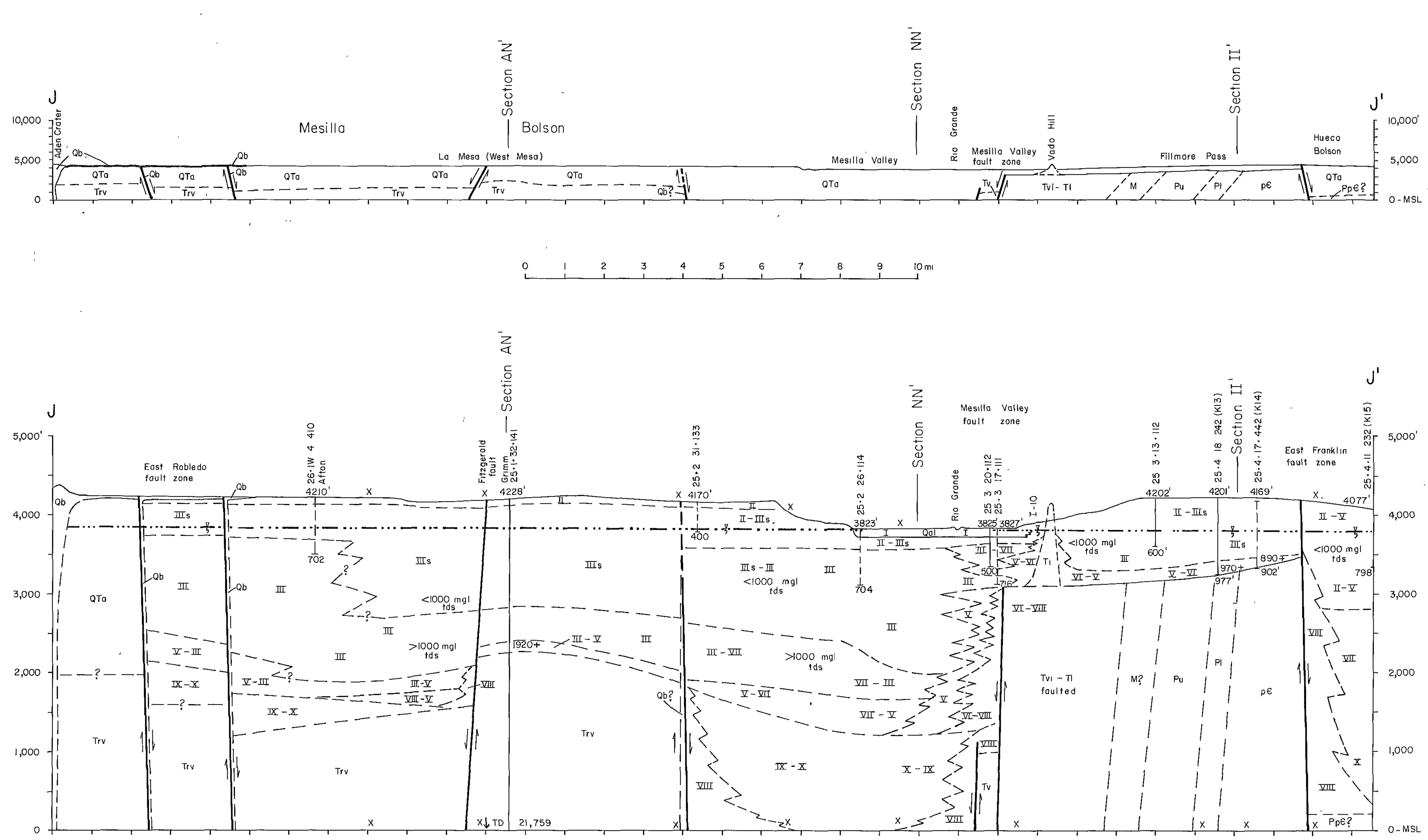


PLATE 10. HYDROGEOLOGIC SECTION HH' and II' — PRELIMINARY



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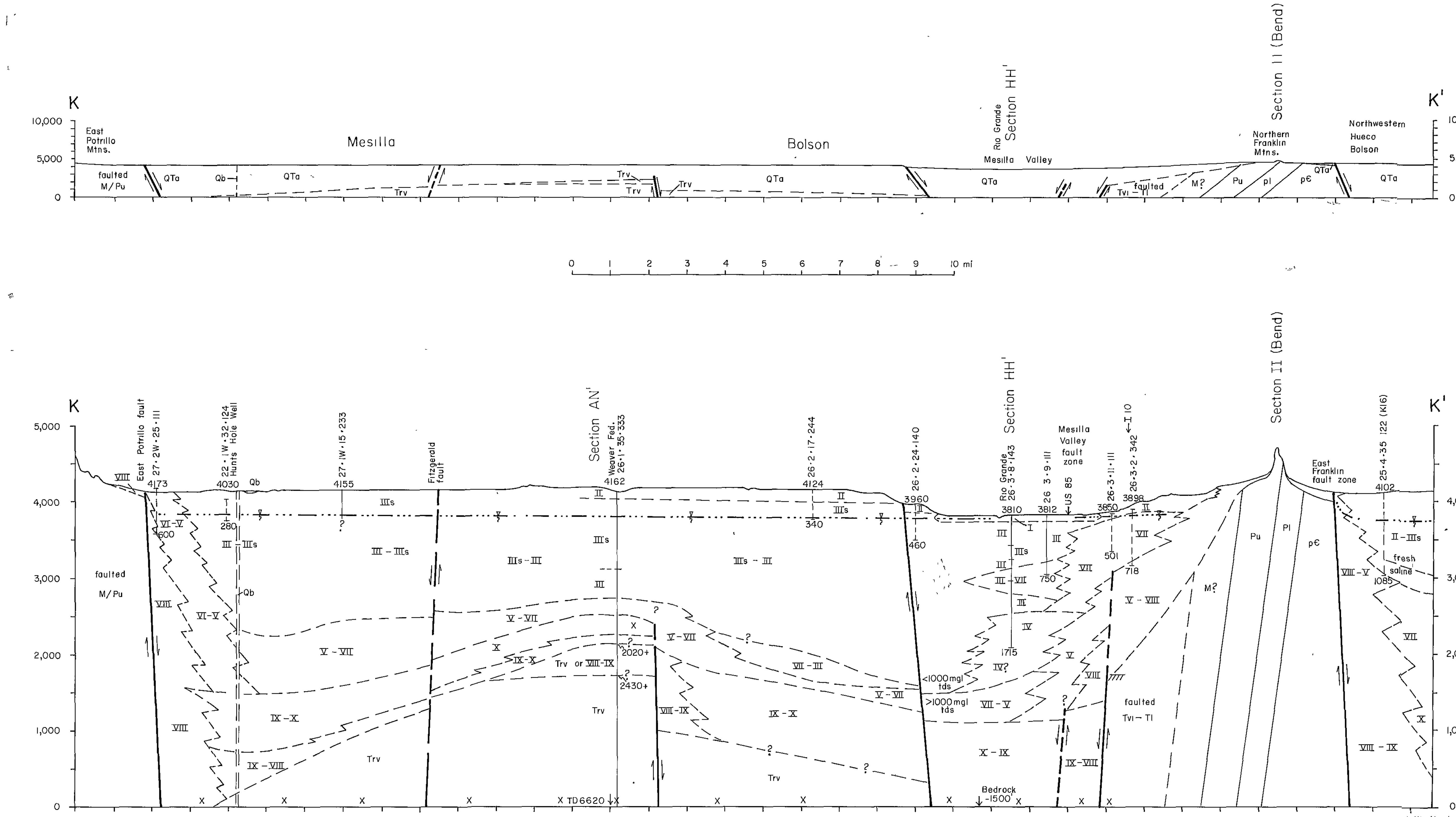

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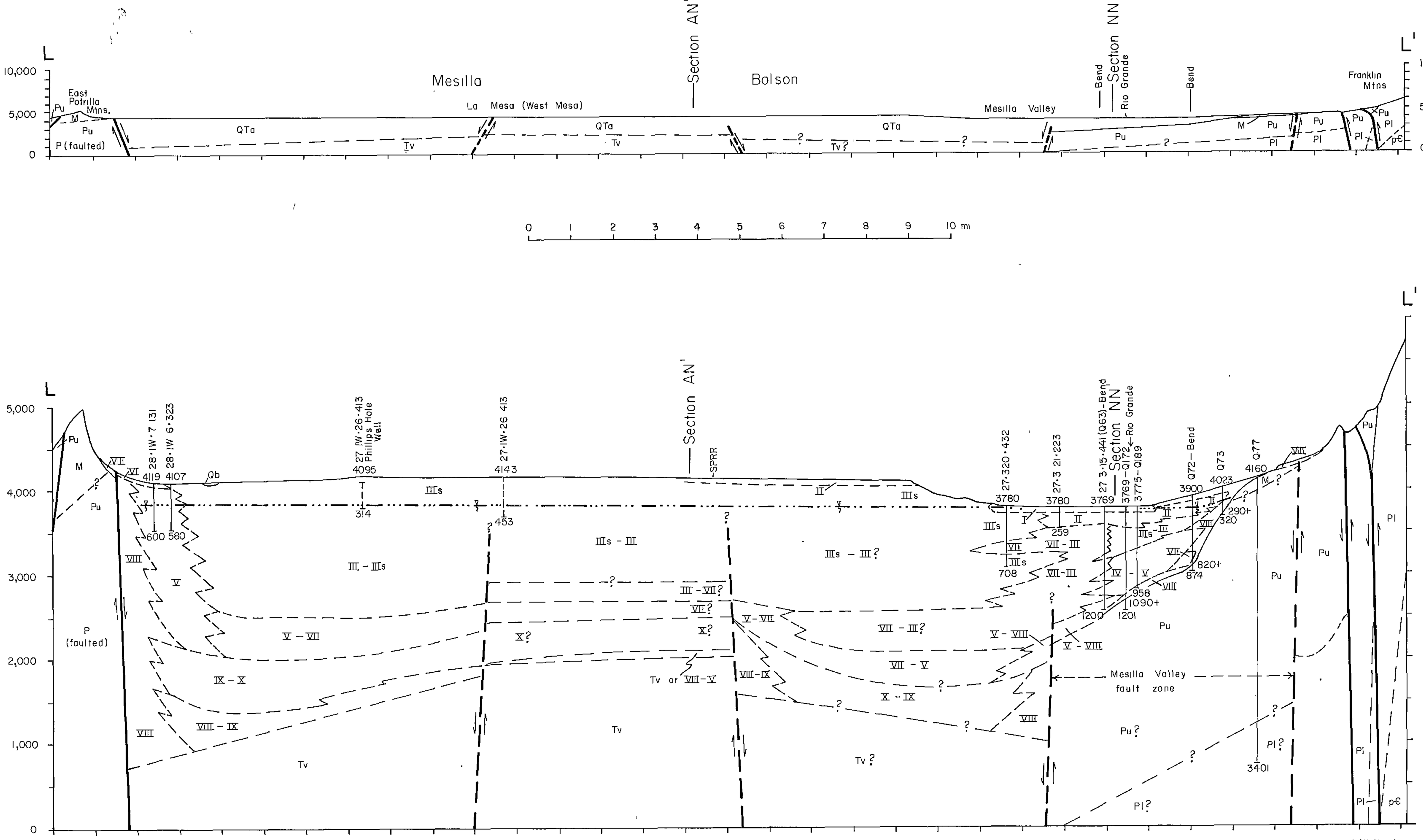

PLATE 13. HYDROGEOLOGIC SECTION LL' — PRELIMINARY

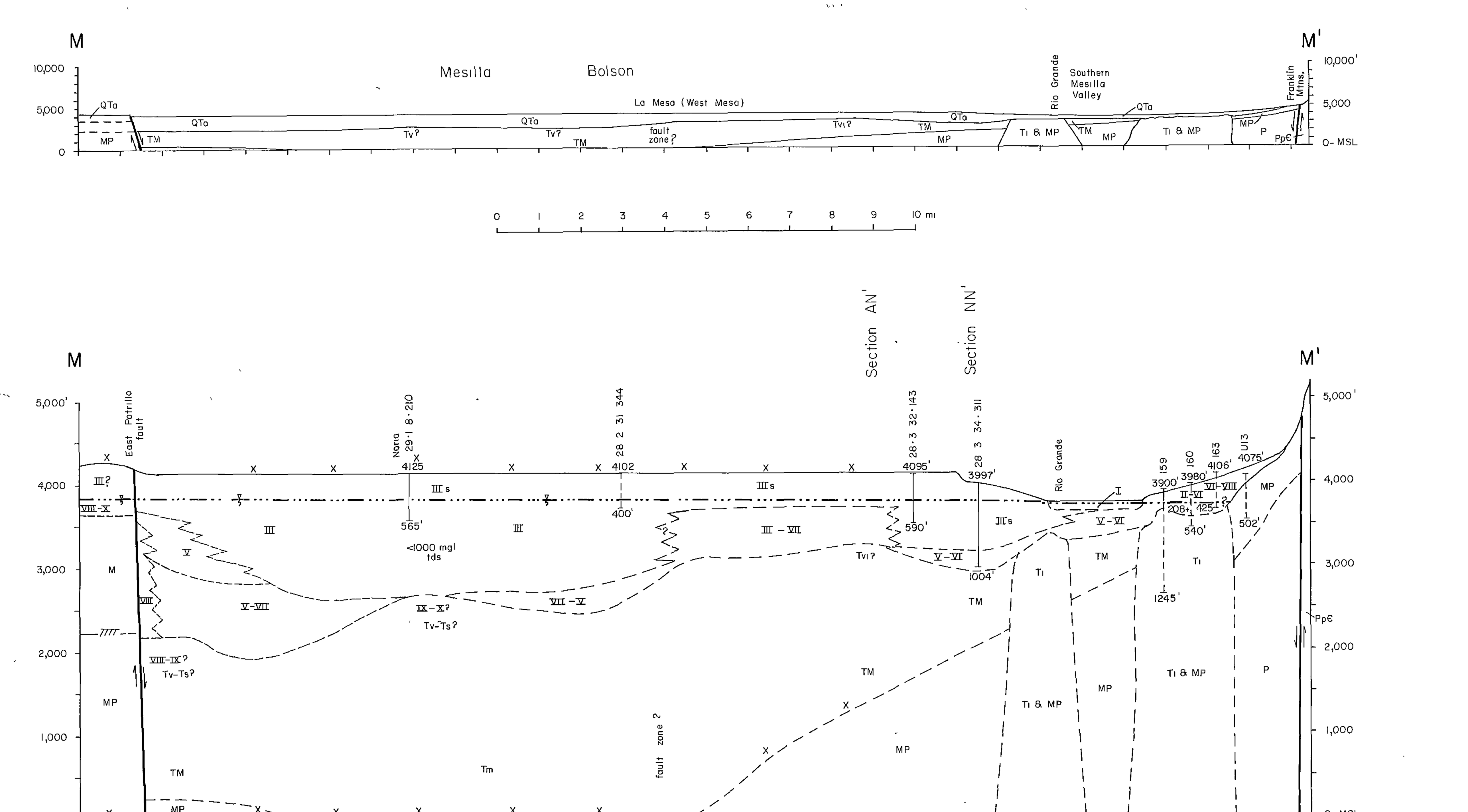

PLATE 14. HYDROGEOLOGIC SECTION MM' — PRELIMINARY

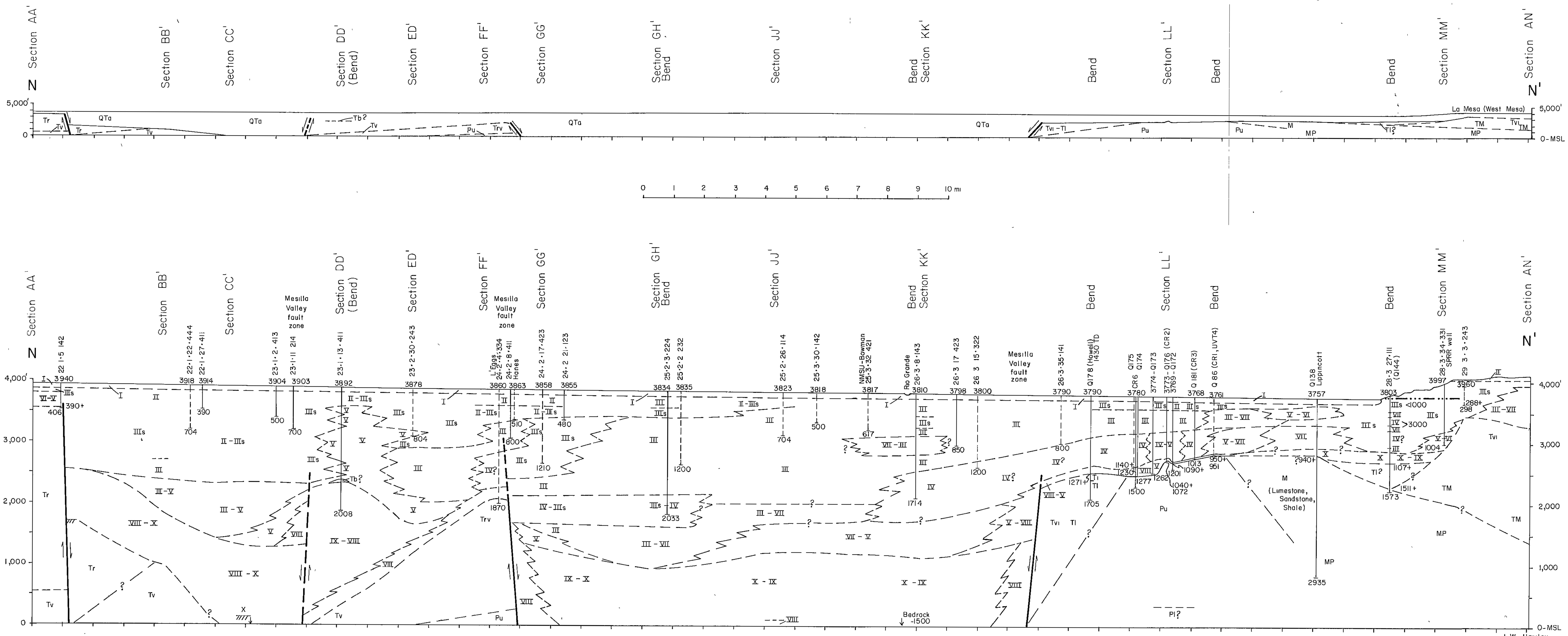

PLATE 15. HYDROGEOLOGIC SECTION NN' — PRELIMINARY

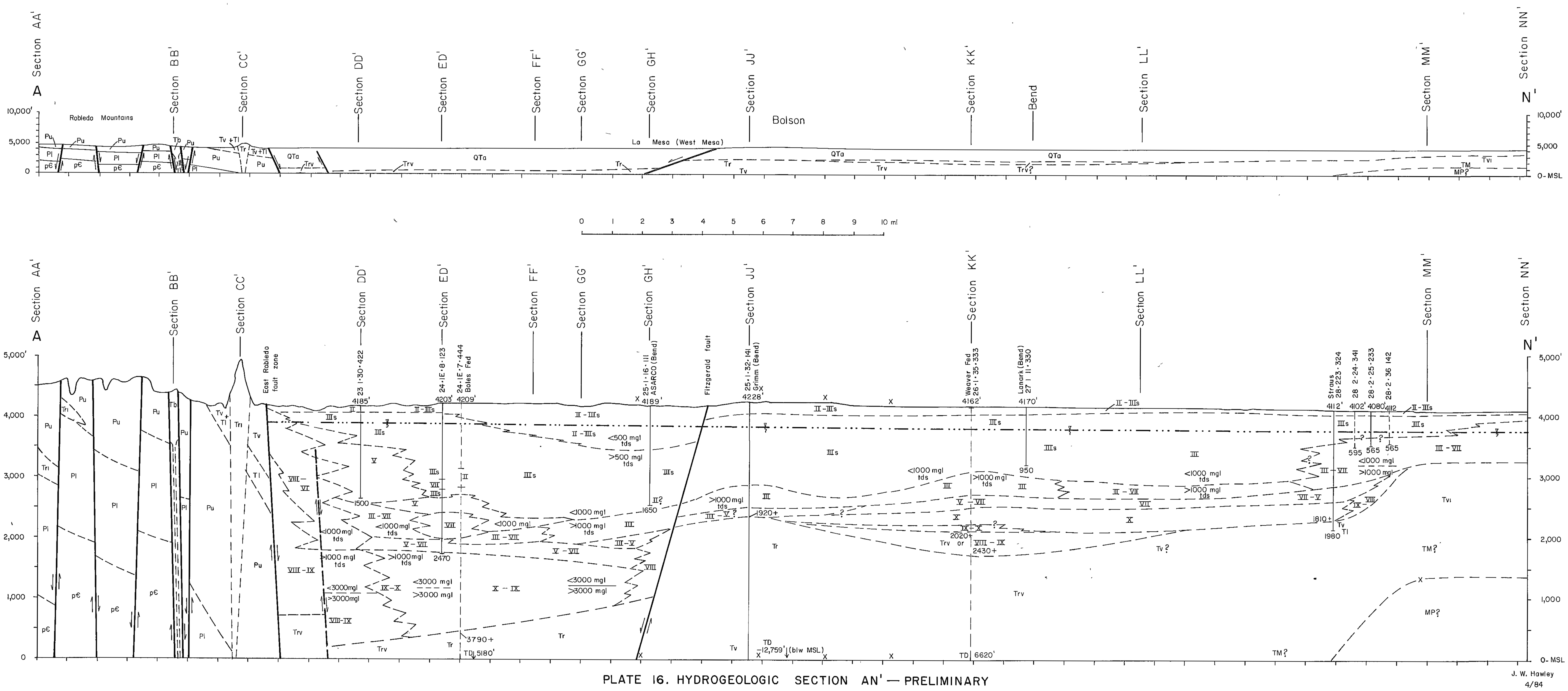

PLATE 16. HYDROGEOLOGIC SECTION AN' — PRELIMINARY