4. HYDROGEOLOGIC EVIDENCE OF THE EXTENSION OF THE EAST RANGE FAULT, HUMBOLDT AND PERSHING COUNTIES, NEVADA

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Faults and associated phenomena are known to influence the occurrence and movement of ground water, and apparent hydrologic anomalies commonly are explained on the basis of inferred faults. Less commonly, as in this report, hydrogeologic evidence is used to demonstrate the existence or extension of a fault.

A northward-trending, westward-dipping, high-angle normal fault, herein referred to as the East Range fault (fig. 4.1) borders the western slope of the East Range, Humboldt and Pershing Counties, Nev., where it was mapped by Ferguson, Muller, and Roberts (1951). Evidence of the fault includes fault scarps, displaced strata, slickensides, brecciated zones, and hydrothermal mineralization.

During current hydrologic studies, about 175 test borings were drilled in the unconsolidated deposits of the Humboldt River basin near Winnemucca, Nev. Some of the hydrogeologic data thus collected suggest that the East Range fault extends at least about 2 miles farther northward than previously mapped.

The Krum Hills, the unnamed hills north of the Humboldt River, and that part of the East Range shown in figure 4.1 are composed of dense sedimentary and igneous rocks of Mesozoic age and basaltic lava flows of late Tertiary or Quaternary age. These rocks generally have low permeability and therefore do not transmit appreciable amounts of water, except perhaps through fractured zones.

Most of the ground water of the area is in relatively unconsolidated sedimentary deposits that range in age from Pliocene to Recent. These strata include fanglomerate of Pliocene or Pleistocene age, lacustrine deposits of Pleistocene Lake Lahontan age, and fluviatile and subaerial flood-plain deposits of Recent age.

The fanglomerate ranges from well-sorted moderately permeable sand and gravel to poorly sorted relatively impermeable slope wash. The Lake Lahontan deposits include three stratigraphic units: A so-called lower silt and clay, a medial gravel, and an upper silt and clay; the lower two units are recognized only in the subsurface. The lower silt and clay unit, whose thickness is uncertain, and the upper silt and clay unit, which is about 55 feet thick, consist largely of dense relatively impermeable silt, clayey silt, and clay. The medial gravel, whose maximum thickness is about 150 feet, consists of well-sorted highly permeable sand and gravel. The flood-plain deposits range from highly permeable stringers of sand and gravel to relatively impermeable lenses of silty clay and clay.

The water-level contours of figure 4.1 show the shape of the piezometric surface in December 1960 and suggest that the principal ground-water movement is westward and southwestward, roughly parallel to the course of the Humboldt River.

Streamflow of the Humboldt River tends to increase, especially during periods of low flow, between the east margin of the mapped area shown on figure 4.1 and staff gage *D*. The increase of streamflow, about 5 to 6 cubic feet per second, is largely a result of the discharge of ground-water underflow from Grass Valley into the Humboldt River. Part of the increase, however, may be due to a partial ground-water barrier beneath the channel of the Humboldt River, the barrier being related to the northward extension of the East Range fault.

Other hydrogeologic evidence which suggests that the East Range fault probably extends farther northward than previously mapped includes (a) an area of rising thermal ground water partly indicated by springs 1 and 2, (b) dense siliceous rock exposed in the flood plain about 300 feet north of well 5, (c) thermal water and iron oxide-coated pebbles found in well 5, (d) intense hydrothermal alteration of the material penetrated in well 3, (e) the occurrence of a bedrock high as indicated by the material penetrated in well 4, and (f) the dissolved-solids content of the waters of the area.

A local ground-water mound, as defined by the water levels at springs 1 and 2 and well 3, is about 100 feet above the regional water table. The temperature of the water at springs 1 and 2 and well 3 is 83° F, 82° F, and 82° F respectively, about 20° F to 25° F warmer than the water in all but one of the other wells shown in figure 4.1. The relatively high temperature of the thermal waters presumably is due largely to the contribution of deeply circulating ground water moving through fractured zones associated with the fault and discharging into the alluvium.

Calcareous and siliceous spring sinter is exposed at and near the orifice of spring 1. The previously men-

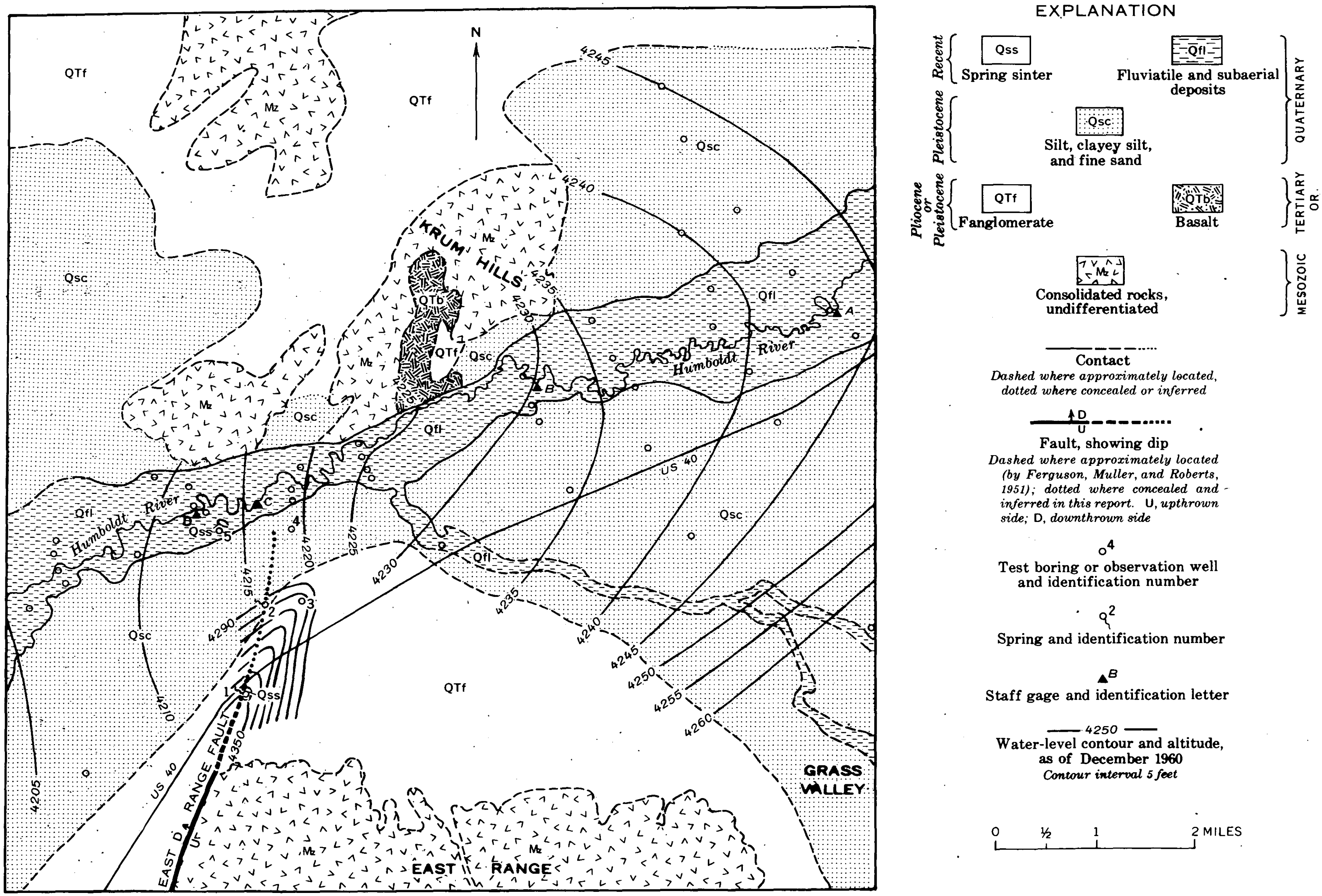

FIGURE 4.1.—Generalized hydrogeologic map of a segment of the Humboldt River valley.