The great demand for ground water in the valley, which lacks other dependable supplies for irrigation, resulted in a progressive lowering of ground-water levels during the period 1951–60, and led to studies to determine the average annual recharge to the ground-water body. Data now available indicate that the recharge may be only about 5,000 acre-feet per year for the entire drainage basin, which covers about 60 square miles. The estimated recharge is about two-thirds of the annual pumpage during recent years.

Chemical analyses of ground water from the alluvium and from the lava indicate that the waters from the two aquifers are similar in character and are of generally good quality for most uses.

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204. FACIES DISTRIBUTION AND HYDROLOGY OF INTERMONTANE BASIN FILL, SAFFORD BASIN, ARIZONA

By Edward S. Davidson, Tucson, Ariz.

Work done in cooperation with the University of Arizona

The Safford basin includes about 1,350 square miles in southeastern Arizona (fig. 204.1). Reconnaissance mapping in this area shows that the extent of permeable gravels may have been significantly overestimated. Previous descriptions of the basin sediments have been made by G. K. Gilbert (1875), Schwennesen (1919, 1921), and Knechtel (1938).

The Safford basin is a northwest-trending depression lying between the Gila and Whitlock Mountains to the northeast and the Pinaleno and Santa Teresa Mountains and Mount Turnbull to the southwest. Peaks in the mountains to the northeast average about 5,500 feet in altitude, and those to the southwest range from 10,000 feet in the Pinaleno Mountains to 7,000 feet in the Santa Teresa Mountains and at Mount Turnbull. The central part of the basin has an altitude of about 2,800 feet. The Gila River drains the basin, entering from the east and leaving to the west at Coolidge Dam.

The basin is a typical basin-and-range downfaulted sediment-filled trough lying between the uplifted ranges. The maximum displacement and thickness of sediment are not known, but a well near Pima (fig. 204.1) was drilled to a depth of more than 3,700 feet without reaching bedrock.

The mountains to the northeast are composed of mafic lava flows, agglomerate, and tuff; those to the southwest consist of granite and assorted metamorphic and indurated sedimentary rocks, including granitic gneiss, limestone, and conglomerate.

Sediments in the basin are classified in this report as (a) terrace gravel and alluvium, (b) deformed conglomerate or gravel, and (c) basin fill. The basin fill unconformably overlies the deformed conglomerate or gravel beds and is erosionally overlain by the terrace gravels and alluvium. The terrace gravels and alluvium are not distinguished on figure 204.1.

Terrace gravels and alluvium were deposited by the Gila and its tributaries. The terrace gravels mantle slopes extending from the mountain fronts to the present stream flood plain. The alluvium fills valleys of the present streams.

The deformed conglomerate or gravel beds crop out in a closely limited area, and are apparently derived from local sources. The beds are moderately to firmly cemented and moderately folded and faulted. These rocks are exposed only on the basin margins; a finer grained facies may occur in the central part of the basin, but this is not yet definitely known. The deformation of the beds probably occurred during a major pulse of block faulting preceding deposition of the unconformably overlying basin-fill sediments.

The basin-fill sediments are thick extensive deposits of flat-lying unconsolidated sediment forming the bulk

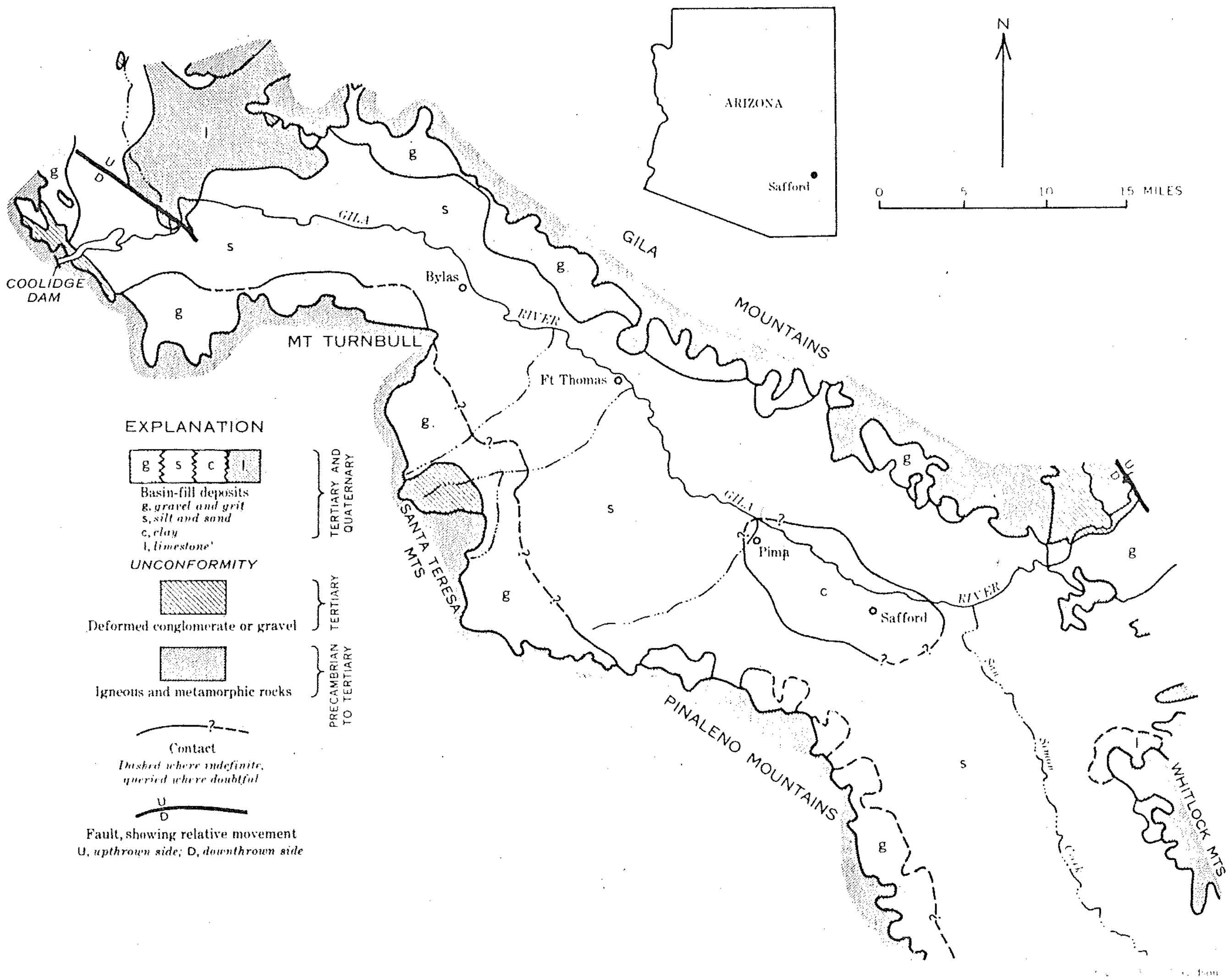

FIGURE 204.1.—Geologic map of the Safford basin, Arizona, showing distribution of basin-fill deposits.

of fill in the basin. They range in age from Pliocene to middle Pleistocene (Knechtel, 1938; Wood, 1960; Lance, 1960). Four principal types of basin-fill sediments can be distinguished: (a) gravel and grit—spread out from the mountains basinward, but deposited in substantial amounts only where large streams entered the basin; (b) silt and sand—deposited over much of the basin by running water, probably in poorly defined stream courses; (c) green and black clay—probably deposited mainly in marshes or swamps; and (d) limestone—deposited in fresh-water lakes. Tuff and diatomite beds and lava flows are interbedded in the sediments and in most areas provide the only convenient means of correlating units from place to place.

The distribution of the several facies of the basin fill and their sedimentary structures suggest that the sediments were deposited by streams heading in the mountains and converging in two low areas represented by extensive limestone and clay facies. Thus, at the time of deposition of the basin-fill sediments, the drainage was largely centripetal, and not throughgoing as at present.

Fanlike gravel beds did not coalesce to form the continuous gravelly basin edge seen in many generalized maps of western basins. The gravel deposits are notably small and sporadic northeast of Safford, at the Whitlock Mountains, and along the edge of the Pinaleno Mountains. Most individual gravel beds do not extend basinward in tongues; instead they grade rather abruptly basinward to silt and fine sand. At some places, particularly north of Fort Thomas to north of Pima, the gravels appear to be relatively thin, and may represent only a thin mantle of gravel a bedrock surface. North of the Pinaleno Mountains, gravel in the fans is very poorly sorted, and the fans contain considerable clay.

The basinward edge of the gravel facies is not more than 2 or 3 miles from the older rocks along the basin margin except in a few places where the gravels extend 6 to 8 miles inward from the point where the streams of Tertiary and Quaternary age entered the basin. One of these places is a well-known locality, the site of Gilbert's (1875) type section of the Gila conglomerate, where the present Gila River enters the Safford basin. A similar large stream entered the basin from the south; its mouth is about 10 miles southeast of Coolidge Dam.

Ground water in basin-fill sediments similar to those described is recharged primarily by runoff from rain and snowmelt in adjacent mountains. The most effective channelway for this recharge is the coarse-gravel facies that occurs near the margin of the basin. This gravel margin is not everywhere present, nor is it everywhere highly permeable; thus, water wells drilled in the marginal areas may not everywhere be good producers. Moreover, a thin mantle of gravel over bedrock, clay-rich gravel, silt, or other fine sediment where gravel normally is expected, and a shorter basinward extension of gravel than is commonly expected, all reduce the effective recharge to the basin-fill sediments.

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205. MIOCENE AND PLIOCENE HISTORY OF CENTRAL ARIZONA

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The Mogollon Rim separates the Basin and Range ovince from the Colorado Plateaus province in cenal Arizona. Southwest of the Mogollon Rim, Ceno- rocks fill many basins and valleys, some of which indicated on figure 205.1. The geological history this region is shown diagrammatically on figure 5.3, and is summarized below.

A thick series of volcanic rocks, chiefly tuffaceous liments, pyroclastic deposits, and basaltic lavas, oc- throughout much of the Basin and Range prov-e, and part of the Colorado Plateaus province in tral Arizona. Volcanic rocks in one area may not strictly correlative with those in another; however. major period of Cenozoic volcanic activity in cen- Arizona probably started in Miocene time and ted to early Pliocene time.

Basaltic lavas, and pyroclastic and tuffaceous rocks underlain by conglomerate, are called the Hickey formation in the Black Hills (Anderson and Creasey, 1958). Volcanic rocks in the Hickey can be traced into, and correlated with, other volcanic rocks in surrounding areas, and most tuffaceous sediments, pyroclastic rocks, and basaltic lavas in the basins, valleys, and intervening mountains of central Arizona are believed to be equivalent to the Hickey.

The volcanic rocks of the Hickey, and the equivalent volcanics accumulated during a period of recurrent diastrophism. Gradual tilting of large fault blocks produced low-lying areas in which tuffaceous sediments and pyroclastics were deposited. In Rock Springs Valley, Bloody Basin, Seven Springs Basin, lower Verde Valley, and Sunflower Basin, tuffaceous