



In a very broad sense, the mineralogy of aquifers can be divided into two groups—those aquifers that contain relatively reactive minerals and those with mostly unreactive minerals. In aquifers composed of reactive rocks and minerals like limestone, dolomite, gypsum, halite, and organic matter, solute concentrations (and isotopic compositions) can change significantly with distance along a ground-water flow path, reflecting extensive chemical reaction. In aquifers composed of mostly unreactive material, like sand and gravel from the chemical and mechanical breakdown of silicate rocks and minerals, solute concentrations change only slightly with distance down a flow path. In these relatively unreactive aquifers, such as the Santa Fe Group aquifer system, water tends to acquire its predominant chemical composition during the process of recharge and retains that composition as it flows through the aquifer.

Much of the ground water in the Middle Rio Grande Basin has acquired its chemical (and isotopic) composition during recharge, either as infiltration of precipitation on the basin margin, as seepage from rivers and arroyos, or as ground-water underflow from adjacent aquifer systems that border the basin. Water chemistry differs depending on the source of water, the degree to which it has been evaporated, the types of rock and mineral it has encountered, and the time it has been in contact with reactive minerals.

Therefore, water in the Middle Rio Grande Basin commonly differs in the concentration of any particular solute and the concentration of that solute relative to other solutes. These distinct differences allow for the delineation of areas of the aquifer that have similar chemical “signatures.” The spatial extents and configurations of these areas can provide important information about the ground-water-flow system. For example, the chemistry of an area with a particular signature can be compared with the chemistry that might be expected from water moving through a source area with a known rock type or seeping through a river with known surface-water chemistry. The likely source of the ground water can be determined from such comparisons. Boundaries between areas of dissimilar chemical signatures can represent general boundaries between waters from the different sources. The shapes of the areas can also broadly define the directions of ground-water flow. Also, the vertical extent of ground water in the aquifer having a particular chemical signature can indicate how well water is mixing vertically through the aquifer. If this vertical extent is known, the approximate volumes of ground water with different signatures can be calculated and used to estimate the relative amounts of recharge from different sources.

Interpretations of water-chemistry data are most reliably made within a conceptual framework of the ground-water system that has been derived from several additional types of hydrologic and geologic data, such as water levels, that indicate general directions of ground-water flow (see Box *F*). In combination with the multitude of hydrologic and geologic data obtained as part of the USGS Middle Rio Grande Basin Study, water-chemistry data have improved the understanding of the aquifer through recognition of ground-water sources, delineation of flow paths, and determination of ground-water traveltimes calculated using isotopic data (see Box *I*).



*Ground-water sampling at the 98th Street well. Because monitoring wells typically do not contain pumps, a portable sampling pump must be lowered into the well.*