ABSTRACT

HYDROCHEMICAL FACIES IN THE NORTHERN PORTION OF THE SACRAMENTO VALLEY

by

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Groundwater resources in the northern portion of the Sacramento Valley can be classified into three hydrochemical facies: Eastern Facies, Western Facies, and Low TDS (total dissolved solids) Facies. These facies are identified based on comparisons between the concentrations of six major ions in natural water (calcium, magnesium, sodium, bicarbonate, chloride, and sulfate) using groundwater quality data from 206 wells. Low TDS Facies water is identified by an overall low average TDS concentration and is suspected to represent groundwater near recharge areas. Western Facies water is characterized by an abundance of calcium ions. The source of calcium appears to be dissolved calcium carbonate and calcium-rich plagioclase minerals from sedimentary geologic units of the Coast Ranges and adjacent alluvial deposits. Eastern Facies water is characterized by the predominance of magnesium ions. The source of magnesium is most likely the ferro-magnesium minerals
associated with the volcanic rocks in the Southern Cascade Range. Volcanic
glass in the Tuscan Formation is the most likely source of abundant silica ions
in Eastern Facies water.

An apparent pattern of increasing dissolved ion concentrations from
east to west across the study area is attributed to differing geology on the
margins of the valley. The Southern Cascade Range in the east is comprised
of volcanic rocks with secondary porosity and permeability which resist
weathering and yield few dissolved constituents to surface runoff. The
sedimentary rocks of the Coast Ranges have intergranular porosity and
permeability with increased mineral surface area contact to water, resulting
in increased mineral dissolution.

Stiff diagrams and ionic ratios were used to evaluate inorganic
constituents in groundwater and indicate that Eastern and Western
hydrochemical facies waters are chemically dissimilar with respect to calcium
and magnesium. Linear regression analysis performed on inorganic
groundwater data for all three hydrochemical facies identified a positive
relationship between calcium and magnesium cations and a statistically
significant correlation between calcium and magnesium cations.