Boise Valley groundwater geochemistry – Origin, infiltration rate and transport characteristics

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Ground water/ aquifer interrelationships and estimates of vertical infiltration rates and horizontal flow rates are estimated. Groundwater chemistry of the Boise Valley aquifer is apparently inverted from what is commonly found in most large intermontane groundwater basins with highly dilute groundwater at depth. Highly dilute groundwater underlies higher TDS groundwater in the aquifer.

The Boise aquifer has a complex geohydrologic history tha includes elevated concentrations of microbially generated carbon dioxide gas originating from a buried lacustrine sedimentary sequence. Thermal ground water is present at depth and also occurs along the faulted northern boundary of the basin where it interacts with natural surface water recharge from the Boise River. Large scale historical flood irrigation has created an upper alluvial groundwater system with a considerably different groundwater chemistry than the deeper ground water aquifer recharges.

Groundwater geochemistry indicates that the oxidized shallow alluvial groundwater is moving into previously reduced deeper sections of the alluvial aquifer creating an intermediate-depth oxidizing portion of the alluvial aquifer. The vertical infiltration rate of the upper aquifer, is estimated from nitrate concentrations and tritium activities sampled from water wells of various depths.

Calculated groundwater ages based on carbon-14 isotopes support the geohydrologic interpretations based on the groundwater chemistry. Remarkably, the deep ground water chemistry has almost the same chemistry as that of the natural recharge water (Boise River) even though it has moved miles horizontally through the Boise aquifer through thousands to tens of thousands of years of contact time with the aquifer mineralogy.

Geochemical indicators of natural and anthropogenic water inputs to a lake in a mixed land use watershed

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The geochemical compositions of lake waters and source water inputs are investigated to examine human impacts on the biogeochemical cycling of phosphorus in a lake and to evaluate the utility of selected chemical species as indicators of specific source types. The project is conducted in the Table Rock Lake watershed (4020 square miles) on the Missouri-Arkansas border. The lake is an 43,000 acre reservoir with a watershed that includes a diversity of land uses and an array of potentially significant phosphorus sources, which include point sources and non-point sources such as decentralized wastewater treatment systems, confined animal feeding operations, poultry litter applied to farm fields, and storm water runoff.

The project involves a coordinated plan of sampling and analysis of potential sources and lake water at sites that have been impacted by particular types of sources (source-rich surface waters). Identification of lake sampling locations was performed using geospatial data analysis techniques to relate land use patterns and other surface characteristics with areas of potentially high densities of source types. Sampling and on-site analyses were performed once per season to assess effects of seasonal variation in source loadings and lake dynamics. Samples were analyzed for dissolved and total phosphorus, a suite of anions (Br^-, Cl^-, F^-, NO_2^-, NO_3^-, PO_4^{3-}, SO_4^{2-}), major elements (Ca, Mg, K, Na), and trace elements (As, Ba, Cd, Co, Cr, Cu, Hg, Mo, Ni, Pb, Sb, Sr, U, V, Zn). Evaluation of the large dataset looks for patterns of dissolved species that are unique to specific source types. Multivariate statistical analysis methods, including principal component analysis, are used to identify factors that are characteristic of both natural and anthropogenic inputs. Using a web-based geographic information system (GIS), the analytical results of the present study were integrated with measurements by other groups and additional geospatial data on the watershed (e.g., land use, size and locations of permitted discharges) and made available to other parties interested in Table Rock Lake water quality.