

## Basin-scale variations in California ground-water chemistry utilizing a publicly available database

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As part of a study of landscape geochemistry in north-central California, we examined the chemistry of ground water in an area of ~40,000 km<sup>2</sup> that includes the southern half of the Sacramento River valley and the adjacent Coast and Sierra Nevada mountain ranges. We retrieved more than 5,000 ground-water analyses from 1,539 unique sites from the USGS National Water Information System (NWIS) database (<http://waterdata.usgs.gov/nwis>). The NWIS database contains data from all 50 of the United States, but many of the samples downloaded for this study had only a few field determinations such as pH, conductance, or temperature, with few or no chemical analyses. About a third of all samples lacked cation data, and between 16% (for Cl) and 67% (for carbonate species) of samples lacked anion data.

With the assumption that the older data are less precise and accurate, all data older than 1975 were deleted as were all qualified data (<x, >x, etc.). Charge balance, speciation, and saturation indices were calculated for the remaining data (1153 ground-water samples) using PHREEQC [1]. Of these data, 1,108 ground-water samples had a charge balance within +/- 20%. The chemical analyses were used to construct thematic maps using a GIS application, and kriging and inverse-distance weighting methods were used to construct interpolated surfaces depicting major chemical parameters in the Sacramento Valley.

Based on recent modeling, the Sacramento River forms a ground-water divide. Our results show substantial differences in ground-water chemistry between the east and west sides of the Sacramento Valley, with greater concentrations of Na, Ca, Mg, B, Cl, and SO<sub>4</sub> on the west, and greater concentrations of Si and K on the east. These patterns are consistent with petrologic and chemical differences between the Coast Range (marine crustal rocks), which was the sediment source for the west side of the Valley, and the Sierra Nevada (mostly continental crust material) on the east. In localized cases, some aspects of the ground-water chemistry appear to be inherited from surface water.

[1] Parkhurst & Appelo (1999) *U.S. Geol. Survey Water-Resources Investigations Report 99-4259*, 310 pp.

## Molecular characterization of Nickel species in aerosols: Comparison of synchrotron XANES and sequential leaching

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Soluble nickel species have been classified as Cat. 1 carcinogens in the European Union based on speciation conducted in the late 1990s using a sequential leaching method common to the Ni industry (the Zatka method).

In this study, we evaluated sequential extraction and synchrotron Ni K-edge X-ray Absorption Near-Edge Structure (XANES) spectroscopy for use in occupational exposure assessment at Ni processing operations. We also evaluated the potential for oxidation of Ni and S during sampling and storage, as earlier published speciation studies have not adequately addressed this potential confounder.

Duplicate stationary aerosol samples were analyzed both by XANES and the Zatka method under a number of experimental conditions, including different air flow rates and sampling durations. The filters were purged with nitrogen following sampling to minimize the potential for sample oxidation (sulphate generation) between collection and analysis. In addition, residues from individual extraction steps were analyzed by XANES.

Our preliminary analyses indicate that there are potentially significant differences between XANES and sequential leaching in the allocation of Ni to the different species thought to be important as inhalation carcinogens. Sample storage under oxidizing conditions may be important. XANES has enabled us to evaluate the effectiveness of sequential extraction by giving "snapshots" of speciation during the various leaching steps.