



# Miscellaneous Geochemical Data from Waters in the Upper Animas River Watershed, Colorado

By Raymond H. Johnson and Douglas B. Yager



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## **Table**

1. Water-quality data .....	link
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# **Miscellaneous Geochemical Data from Waters in the Upper Animas River Watershed, Colorado**

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## **Abstract**

This report releases geochemistry data in waters from the upper Animas River watershed that have been analyzed by inductively coupled plasma–mass spectrometry. These samples were collected at various sites and at various dates (41 sites and 86 samples from 2008 to 2010). A main data table is provided and the text discusses the sampling methods and locations in relation to other published reports.

## **Introduction**

In the late nineteenth century, the San Juan Mountains in San Juan County, Colorado (Colo.), were the center of a metal-mining boom. Although most mining activity ceased by the 1990s, the effects of historical mining continue to contribute dissolved metals to groundwater and surface water. Streams in this area have low pH and elevated metal loads due to naturally occurring acid-rock drainage, but the influence of acid-mine drainage due to historical mining activities has further degraded preexisting groundwater and surface-water quality (Church and others, 2006).

The report by Church and others (2006) provides a large database of water samples that were collected in the upper Animas River watershed. In addition, a large number of additional samples of groundwater and surface water have been collected and analyzed from Prospect Gulch (Johnson and others, 2007). Since these two reports were published, various additional sampling in Prospect Gulch and the upper Animas River watershed has been completed. A variety of sampling has been completed from (1) surface waters in Prospect Gulch, (2) surface waters in the upper Animas River watershed, and (3) groundwater from wells in Prospect Gulch. Stream-water sampling that was completed in relation to remediation within Prospect Gulch has been reported in Johnson and others (2011) (#1 above). Table 1 in this report provides a data release for additional sampling related to surface-water samples completed within the upper Animas River watershed (#2 above) and groundwater samples within Prospect Gulch (#3 above). These additional samples within the upper Animas River watershed provide data for inductively coupled plasma–mass spectrometry (ICP-MS) results that were completed in conjunction with dissolved organic carbon (DOC) sampling in these surface waters. The DOC data are provided in Yager and others (2010). ICP-MS data from groundwater samples are part of an ongoing effort to monitor any changes in groundwater quality in several monitoring wells in Prospect Gulch that were installed in 2004, with much of the initial data having been reported in Johnson and others (2007).

## **Sampling Methods**

Water samples were collected using either a peristaltic pump (used in shallow wells or stream/spring samples that required higher capacity filtering), a bailer (used on the Prospect Gulch upper well, UPG), or a syringe (used for direct sampling of stream and spring waters). All samples were field filtered using 0.45-micron disposable filters. For the peristaltic pump sampling, new tubing was used between each sample and the filter was placed “inline” for the sampling. For the bailer samples, the collected water was placed into a new plastic bottle, which then allowed for filtering using the peristaltic pump (these samples had very high sediment loads). The syringe sampling was completed using direct filling and attachable syringe filters. All samples were collected in plastic bottles which were rinsed three times with sample water and then acidified with ultra-pure nitric acid ( $\text{HNO}_3$ ) to a pH less than two (for preservation). Field parameters included pH, specific conductance, temperature, and dissolved oxygen measured via standard handheld field meters.

## **Analytical Methods**

All samples were analyzed using ICP–MS techniques at the USGS Mineral Resources Laboratory (Denver, Colo.) following the method described in Lamothe and others (2002).

## **Data**

All of the resulting data are provided in table 1. Many of the samples were collected at the same location with different samples collected through time. These samples are indicated in the latitude/longitude fields with “same as above” and have the same sample description. However, the actual field numbers may have varied and are indicated in table 1 to provide a match to the original data. The sample names in table 1 for “Mineral Creek Gage” through “Senator Beck Basin at Mouth” match the order and names for DOC data provided in Yager and others (2010). The next three sample categories for Browns Gulch, Minnie Gulch, and Brendal Gulch were samples related to the DOC sampling that have ICP–MS data, but no DOC data were reported in Yager and others (2010). The set of samples from “Cement Creek before Prospect” to “Red Spring in Prospect” are all related to spring, surface-water, or groundwater samples in and near Prospect Gulch. Field numbers in this sample set are the same as those from Johnson and others (2007).

Any field with no data entry indicates a lack of sample data for that parameter and that particular sample. Note that for alkalinity, the value is zero for a pH less than 4.5, so alkalinity was not collected for any sample with a measured pH less than 4.5.

In table 1, the comment field for samples BRDL091008-1FA and BRDL091108-2FA indicates that these samples may have been reversed in the data report. The samples have been placed in table 1 based on the latitude, longitude, and sample descriptions from the original laboratory data set. However, the sample-numbering scheme appears to be reversed (the “1” and “2” indication) in the sample name compared to field notes on sample order. A possible reversal of these two samples is possible, but could not be confirmed.

## **Quality Assurance/Quality Control**

Blank samples were taken on several different dates and are listed in table 1. Only a few samples showed measured element concentrations above detection limits. These were: Al at 2.8 micrograms per liter ( $\mu\text{g/L}$ ), Be at 0.1  $\mu\text{g/L}$ , Co at 0.03  $\mu\text{g/L}$ , Li at 0.6  $\mu\text{g/L}$ , and Ti at 0.7  $\mu\text{g/L}$ .

These detections were slightly greater than the detection limits and should be considered when evaluating measured sample concentrations of these elements that are close to the detection limit. Overall, the blank analyses indicate that any significant procedural sample contamination is not likely. The blank water used was standard laboratory-deionized water that is available in the Minerals Program Laboratories in Denver, Colo. This water was transported into the field and the bottles were filled using the sample methods indicated in table 1 with the same procedure as actual water sampling.

Since many of the samples in this report revisited previously sampled sites and given time and budgetary constraints, no duplicate samples were taken.

## Acknowledgments

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