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# USGS Abandoned Mine Lands Research

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**U.S. Geological Survey**  
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# USGS Abandoned Mine Lands Work

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- **Geologic Discipline**
  - ◆ Mineral Resources Program
  - ◆ Energy Resources Program
- **Water Resources Discipline**
  - ◆ State offices
  - ◆ National Research Program
- **Biological Resources Discipline**

# Some things we DON'T do\*

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- Inventory abandoned mine sites
- Assess physical hazards
- Design/engineer remediation strategies
- Evaluate individual mine sites
- Long term site monitoring
- Give grants for remediation projects

# *Some things we DO do*

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- **Process studies and technology transfer**
    - ◆ Metal deposits
    - ◆ Ground and surface waters (incl. pit lakes)
    - ◆ Effects on bio-receptors
    - ◆ Coal deposits
  - **Characterization studies**
    - ◆ Backgrounds and baselines
    - ◆ Geoenvironmental models
  - **Broadly multi-disciplinary research**
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# USGS Watershed-Scale Research

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- **USGS AML Initiative (1997-2001)**
  - ◆ <http://amli.usgs.gov/>
  - ◆ **Animas River watershed in Colorado**
    - ◆ **Professional Paper 1651 to be published in 2006**
  - ◆ **Boulder River watershed in Montana**
    - ◆ **Professional Paper 1652 published in 2004**
- **Partnership with BLM, USDA-FS, EPA, states of Colorado and Montana, and watershed citizen's group (ARSG) in Silverton**

# Objectives of Watershed-Scale Studies

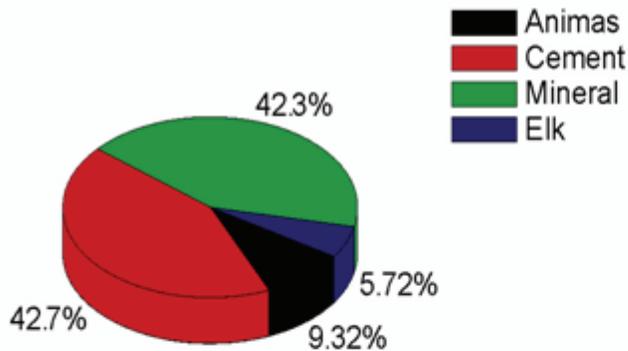
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- To develop scientifically rigorous watershed-scale characterization methodologies
  - To evaluate what scientific tools need to be applied, given the geologic setting, to adequately assess the effects of historical mining on the watershed
  - To assess the effectiveness of individual scientific approaches to evaluate watersheds impacted by historical mining
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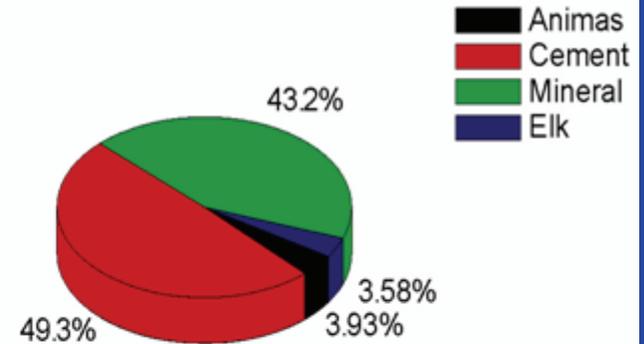


# Summary of Water Quality Data from Tracer Studies

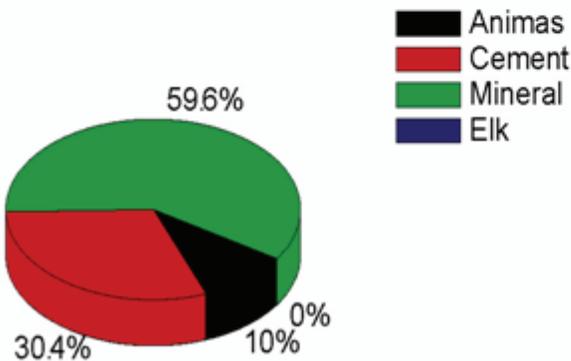
(A) Aluminum



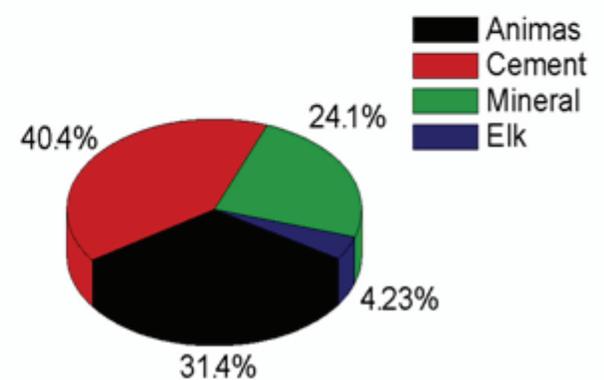
(B) Iron



(C) Copper



(D) Zinc



# Lessons Learned from the AML Initiative

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- **Geologic setting controls watershed morphology, baseline soil and water geochemistry, and plant ecology**
  - **Mineral deposit type controls metals available for production**
  - **Economics and deposit characteristics control commodities produced as well as those discarded during milling**
  - **Milling methods and commodity recovery control the composition of sediment in the streams**
  - **Extent of hydrothermal alteration and amount of pyrite in mine wastes and surrounding the deposit control water chemistry and drive selection of remediation technologies**
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# Regional-Scale Methods to Assess the Effects of Inactive and Abandoned Mines on Watersheds

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## Central Colorado Assessment (2004-2008)

[http://minerals.cr.usgs.gov/projects/colorado\\_assessment](http://minerals.cr.usgs.gov/projects/colorado_assessment)

- Examine 300 watersheds selected on the basis of geology, hydrothermal alteration, and historical mining activity
- Water chemistry and sediment geochemistry
- Macro invertebrate (MI) populations from 150 watersheds
- Metal burdens in about 700 individual MI to determine toxicity effects

# Some research challenges, part 1

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- Can we increase the effectiveness of small-scale measurements so that we grasp the entirety of the large-scale processes we attempt to model and predict?
  - Can we apply modern digital analysis techniques to create multidimensional models of the life cycles of mineral commodities?
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# Some research challenges, part 2

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- **How can we best describe and quantify the nature and importance of the links between geologic processes and human health?**
- **Can we determine the relative effects of geochemical and geophysical fluxes on human health?**

# How can you influence USGS work?

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- Understand that we are primarily a nation-wide natural science research institution
- Contact us (Kate Johnson at [kjohnson@usgs.gov](mailto:kjohnson@usgs.gov), Stan Church at [schurch@usgs.gov](mailto:schurch@usgs.gov), or other USGS staff you know) to talk about your interests
- Help us to understand your needs
- Help us partner with others
- Be involved

# On the Internet

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- USGS: <http://www.usgs.gov/>
- Mineral Resources Program: <http://minerals.usgs.gov/>
- AML Initiative (data and published reports): <http://amli.usgs.gov/>
- Colorado project: <http://minerals.cr.usgs.gov/projects/>

# For more information

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- Contact me:
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  - ◆ (703) 648-6110
- Visit our web site:
  - ◆ <http://www.usgs.gov/>
- Come visit USGS