Using ESRI Software for 3-Dimensional Mapping of Geochemical Data

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Geochemical Data

- Complex dynamic datasets
- Point-source sample sites
- Multiple media types, analyses, laboratories
- Temporal changes (water quality, seasonal)
- One site, many parameters
- 55+ element, factor values possible
- Multiple units of measurement
- Limits of detection, censored data, validity
- Multiple data formats, software packages
Software

- **ESRI ArcGIS**
  - ArcCatalog
    - Geodatabase, feature classes
  - ArcMap
    - Mapping, editing, elevation model, shaded relief
  - ArcScene
    - 3-D scenes, classification, fly-throughs, image export
  - ArcGIS Server / ArcGlobe
    - Serve 3-D scenes to data users

- Microsoft Excel, Access
- Statsoft Statistica
Pebble, AK

Porphyry Cu-Au-Mo deposit
- Unmined, only explored
- Main ore body 3+ miles across

Western deposit near surface
- Concealed under glacial terrain

Eastern deposit 5000+ ft depth

Resource estimates
- 80 billion lbs copper
- 107 million oz gold
- 5.6 billion lbs molybdenum

USGS Sampling

Traverses
- Pebble, Pebble East, SP anomaly, other deposits

Selected water sites
Background sites
- Soil, till, rock, sediment cores
- Pond, stream, spring water
Samples

- Raw lab data
- Data storage
- Targeted queries
- Geodatabase
- Class divisions
- Classification
- 3-D symbol set

![Diagram showing data flow from raw lab data to geodatabase and classification]

- Raw Data: Excel
- Queries: Make table
- Geochemistry
- Sample Sites
- Classes: Statistica
- Cu_ppm: 20.54, 7.78, 429.03
- Method
- Custom Symbols
- Representation
- Layer
- Project DB: Access
- GIS DB: Access
- 2D Symbol Set
- 3D Symbol Set
Symbology

Method: Graduated symbols
Classification: Percentiles (5)
• Resistant to variation, units, etc.
• Calculated on $n$, not data range
• Exclude heavily censored data
• Manually enter break values

Class Label
• Absolute and percentile ranges

3D Symbols
• 3D simple marker symbol
• High-quality sphere
• Size adjusted for map scale
• Color spectrum

Additional symbol part: “pin”
• Duplicate GX layer, unclassified
• Simple black 1-pt marker
• Extrude below sphere symbol (add negative height to base)
Base Heights

Height
- Obtain from elevation surface
- Raster resolution = original
- Avoid using GX layer Z values

Z Unit Conversion
- Z unit conversion = 1.000
- Dependent on linear unit

Offset
- Offset = staggered layers
- Equal step for each GX layer
- Unit = Projection linear unit
- Pin offset = GX layer offset
Pin Extrusion

- Extrusion is a negative value
- Add to feature’s base height
- Amount = GX layer offset
- Group pin with GX layer
Rendering

Visibility
• Render layer at all times

Vector layer effects
• Shade areal features
• Drawing priority = 1

Raster layer effects
• Do not shade
• Elevation Drawing priority = 10
• Shade drawing priority = 7-8
• Adjust value to clean view

Optimize
• Cache layer
• Quality enhancement = high
Base Map

Elevation surface
- Base heights
- Cell sizes
- Display level 10

Shaded relief
- 70% transparent
- Display level 9-8

Hydro
- Necessary for water sites
- Vector or raster

Geologic structures
Ore zones
Other layers
Additional Layers

- Drill core assay data
- Geophysics data
- Geology
- Aerial photography
- Remote sensing
- Topographic maps
Links and Acknowledgments

- **USGS geochemical data from Pebble**

- **Pebble Limited Partnership**
  - http://www.pebblepartnership.com

- **Base map geographic data**
  - http://www.nationalatlas.gov