ASSESSMENT OF UNDISCOVERED MINERAL RESOURCES
IN THE PACIFIC NORTHWEST:
A CONTRIBUTION TO THE INTERIOR COLUMBIA BASIN ECOSYSTEM MANAGEMENT PROJECT

Edited by

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Open-File Report OF 95-682

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1996

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Executive Summary

This report is one in a series of digital maps, data files, and reports generated by the U.S. Geological Survey to provide geologic process and mineral resource information to a U.S. Forest Service and Bureau of Land Management interagency project, the Interior Columbia Basin Ecosystem Management Project (ICBEMP).

Short term predictions of future mineral-economic activity can be extrapolated from the existing resource base in discovered deposits (see Bookstrom and others, 1996). However, long term forecasts must also account for the future discovery of extensions of known mineral deposits (within a km of a known mineral deposit), as well as for the future discovery of presently undiscovered mineral deposits. In this report we provide quantitative estimates of the presently undiscovered mineral resources in the ICBEMP area.

Quantitative estimates of undiscovered metallic mineral resources in the ICBEMP area involved delineating 124 tracts or areas that are permissive for the occurrence of 30 different metallic mineral deposit types, delineating areas that are favorable for undiscovered mineralization (some indication that mineralization is present or mineralizing processes have occurred) within these permissive tracts, estimating probability distributions of the number of undiscovered deposits that may be present within each permissive tract for 25 of the mineral deposit types, and numerically simulating the amount of undiscovered in-situ metals. A mean of 87 undiscovered deposits of the 25 deposit types considered in this analysis are estimated to be present in the ICBEMP area. Results of the numerical estimation of the in-situ amount of undiscovered metallic mineral resources that lie within the ICBEMP area are given in Summary Table below. Results of the numerical simulation for individual tracts are summarized in Appendix A.

This analysis provides some constraints on the amount of in-situ resources that remain within the study area but does not address the economic potential of these deposits. The information in this report constitutes some of the information necessary to forecast the likelihood and general location of the potential supply of metals from undiscovered mineral resources in the ICBEMP study area.

Summary Table: Summary statistics of the probabilistic estimate of undiscovered, in-situ resources of precious and base metals (metric tonnes of metal) in ICBEMP study area. Summary includes all deposit types and tracts that occur within the study area.

<table>
<thead>
<tr>
<th></th>
<th>Au</th>
<th>Ag</th>
<th>Cu</th>
<th>Pb</th>
<th>Zn</th>
<th>Mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.95 quantile</td>
<td>1,094</td>
<td>24,866</td>
<td>5,260,400</td>
<td>91,457</td>
<td>331,960</td>
<td>22,703</td>
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<tr>
<td>0.90 quantile</td>
<td>1,248</td>
<td>31,590</td>
<td>6,697,700</td>
<td>195,080</td>
<td>645,390</td>
<td>51,977</td>
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<tr>
<td>0.50 quantile</td>
<td>2,082</td>
<td>70,776</td>
<td>14,589,000</td>
<td>1,951,800</td>
<td>4,005,100</td>
<td>363,880</td>
</tr>
<tr>
<td>0.10 quantile</td>
<td>3,261</td>
<td>150,640</td>
<td>31,743,000</td>
<td>11,657,000</td>
<td>18,560,000</td>
<td>1,427,800</td>
</tr>
<tr>
<td>0.05 quantile</td>
<td>3,741</td>
<td>183,590</td>
<td>39,579,000</td>
<td>17,022,000</td>
<td>26,485,000</td>
<td>1,953,800</td>
</tr>
<tr>
<td>Mean</td>
<td>2,198</td>
<td>83,717</td>
<td>17,433,900</td>
<td>4,259,720</td>
<td>7,497,460</td>
<td>590,080</td>
</tr>
</tbody>
</table>
Some generalizations can be made about the likely areal distribution of undiscovered deposits in the ICBEMP area, and these are illustrated in the following summary figures (figs. A to F). For each of the economic elements in the Summary Table, more than 50% of the estimated mean undiscovered resource in the ICBEMP study area is estimated to occur in a limited contiguous area. 58% of the estimated mean undiscovered Au resources are estimated to occur in a contiguous area of southeastern Oregon, southwestern Idaho, and northeastern Nevada, predominantly in shallowly deposited vein and hot springs deposits (fig. A). 54% of the estimated mean undiscovered Ag resources are estimated to occur in the Belt Basin of northwestern Montana, northern Idaho, and easternmost Washington (fig. B). A nearly identical area in Montana, Idaho and Washington accounts for 72% of the estimated mean undiscovered resource (fig. C). A broadly overlapping but slightly different area in northwestern Montana, northern Idaho and northeastern Washington accounts for 93% of the estimated mean undiscovered Pb resource (fig. D) and 87% of the estimated mean undiscovered Zn resource (fig. E). Finally an arcuate area extending from southwestern Idaho to northwestern Montana is estimated to contain 59% of the estimated mean undiscovered molybdenum resource (fig. F).

Comparison can be made (fig. G) between the past production, known but unmined resources (both from Bookstrom and others, 1996), and estimated undiscovered resources (from this report) for the entire ICBEMP study area. For Au, Ag, Cu, Pb, Zn, and Mo, the estimated undiscovered resources account for 54%, 46%, 29%, 34%, 45%, and 16%, respectively, of the total resources (past production + known resources + estimated undiscovered resources) for the ICBEMP study area. For the same elements, the estimated undiscovered resources account for the following percentages of the total unmined resources (known resources + estimated undiscovered resources): 67%, 70%, 36%, 91%, 80%, and 16%, respectively. By implication, the specific sites which account for most of the resource of unmined copper and molybdenum are known. However, the specific sites of most of the unmined resources of gold, silver, lead, and zinc are not known, although the general regions in which they are most likely to occur are known.
Figure A: Location of 83% of estimated undiscovered Au resources in ICBEMP

**Undiscovered Au Resources**

**Explanation**

- **Composite Permissive Tract**
- **Favorable Area**
- **ICBEMP Study Area Boundary**

**12%** Percent of total undiscovered Au resources in ICBEMP

**Tract A** Includes tracts:
- W107 - Hot spring Au
- W108 - Hot spring Au
- W109 - Hot spring Au
- W21 - Hot spring Au
- W27 - Carlin sed-hosted Au
- W101 - Comstock Au-Ag
- W102 - Comstock Au-Ag
- W17 - Comstock Au-Ag

**Tract B** Includes tracts:
- W129 - Hot spring Au
- C05 - Hot spring Au
- C02 - Au skarn
- C13 - Comstock Au-Ag
- C100 - Porphyry Cu

**Tract C** Includes tracts:
- PC26 - Porphyry Cu
- PC 101 - Comstock Au-Ag
- W02 - Comstock Au-Ag
Figure B: Location of 88% of estimated undiscovered Ag resources in the ICBEMP

**Undiscovered Ag Resources**

**Explanation**

- **Tract A**
  - Composite Permissive Tract
  - Favorable Area
  - Includes tracts:
    - W13 - Revett sed-hosted Cu
    - C14 - Sed. exhalative Zn-Pb
    - C13 - Comstock Au-Ag
    - C07 - Polymtl. replacement

- **Tract B**
  - Includes tracts:
    - W101,102 - Comstock Au-Ag
    - W107,108 - Hot spring Au
    - W17 - Comstock Au-Ag

- **Tract C**
  - Includes tracts:
    - PC101 - Comstock Au-Ag
    - W02 - Comstock Au-Ag

54% Percent of total undiscovered Ag resources in ICBEMP

- **Figure B:** Location of 88% of estimated undiscovered Ag resources in the ICBEMP
Figure C: Location of 87% of estimated undiscovered Cu resources in ICBEMP
Figure D: Location of 93% of estimated undiscovered Pb resources in the ICBEMP.

Undiscovered Pb Resources

Explanation
- Composite
- Permissive Tract
- Favorable Area
- ICBEMP Study Area Boundary

93% Percent of total undiscovered Pb resources in ICBEMP

Tract A Includes tracts:
- C14 - Sed. Exhalative Zn-Pb
- W16 - Sed. Exhalative Zn-Pb
- W07 - Sed. Exhalative Zn-Pb
- C07 - Polymtl. replacement
- W08 - Miss. Valley type Pb-Zn
- C02 - Au Skarn
- C15 - Pb-Zn Skarn
Figure E: Location of 87% of estimated undiscovered Zn resources in the ICBEMP
Figure F: Location of 92% of estimated undiscovered Mo resources in ICBEMP.

Tract A
- Includes tracts: W138 Porphyry Mo, C100 Porphyry Cu

Tract B
- Includes tracts: PC 26 - Porphyry Cu, W139 - Porphyry Mo, W118 - Porphyry Cu

Tract C
- Includes tract: X3 - Porphyry Mo

Explanation
- Composite Permissive Tract
- Favorable Area
- ICBEMP Study Area Boundary

Undiscovered Molybdenum Resources

<table>
<thead>
<tr>
<th>Tract</th>
<th>Percent of undiscovered Mo resources estimated to occur in composite permissive tract</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>59%</td>
</tr>
<tr>
<td>B</td>
<td>22%</td>
</tr>
<tr>
<td>C</td>
<td>11%</td>
</tr>
</tbody>
</table>
Figure G: Relative apportionment of total metal endowments of the Interior Columbia Basin between past production, known but unmined resources, and estimated undiscovered deposits.

- Past production
- Known resources
- Estimated undiscovered deposits
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