

U.S. DEPARTMENT OF THE INTERIOR
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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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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.

	Au	Ag	Cu	Pb	Zn	Mo
0.95 quantile	1,094	24,866	5,260,400	91,457	331,960	22,703
0.90 quantile	1,248	31,590	6,697,700	195,080	645,390	51,977
0.50 quantile	2,082	70,776	14,589,000	1,951,800	4,005,100	363,880
0.10 quantile	3,261	150,640	31,743,000	11,657,000	18,560,000	1,427,800
0.05 quantile	3,741	183,590	39,579,000	17,022,000	26,485,000	1,953,800
Mean	2,198	83,717	17,433,900	4,259,720	7,497,460	590,080

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.

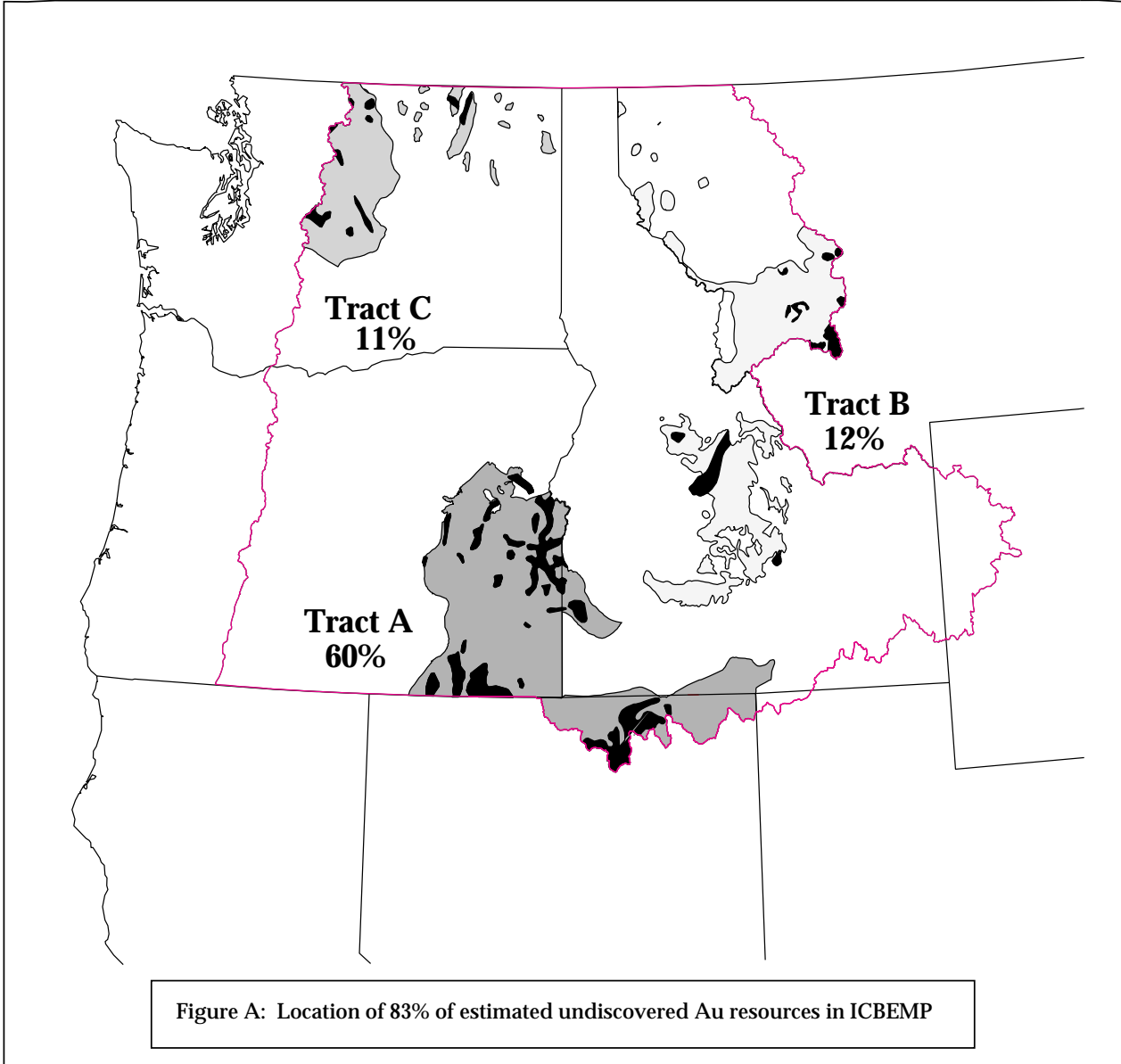





Figure A: Location of 83% of estimated undiscovered Au resources in ICBEMP

Undiscovered Au Resources Explanation

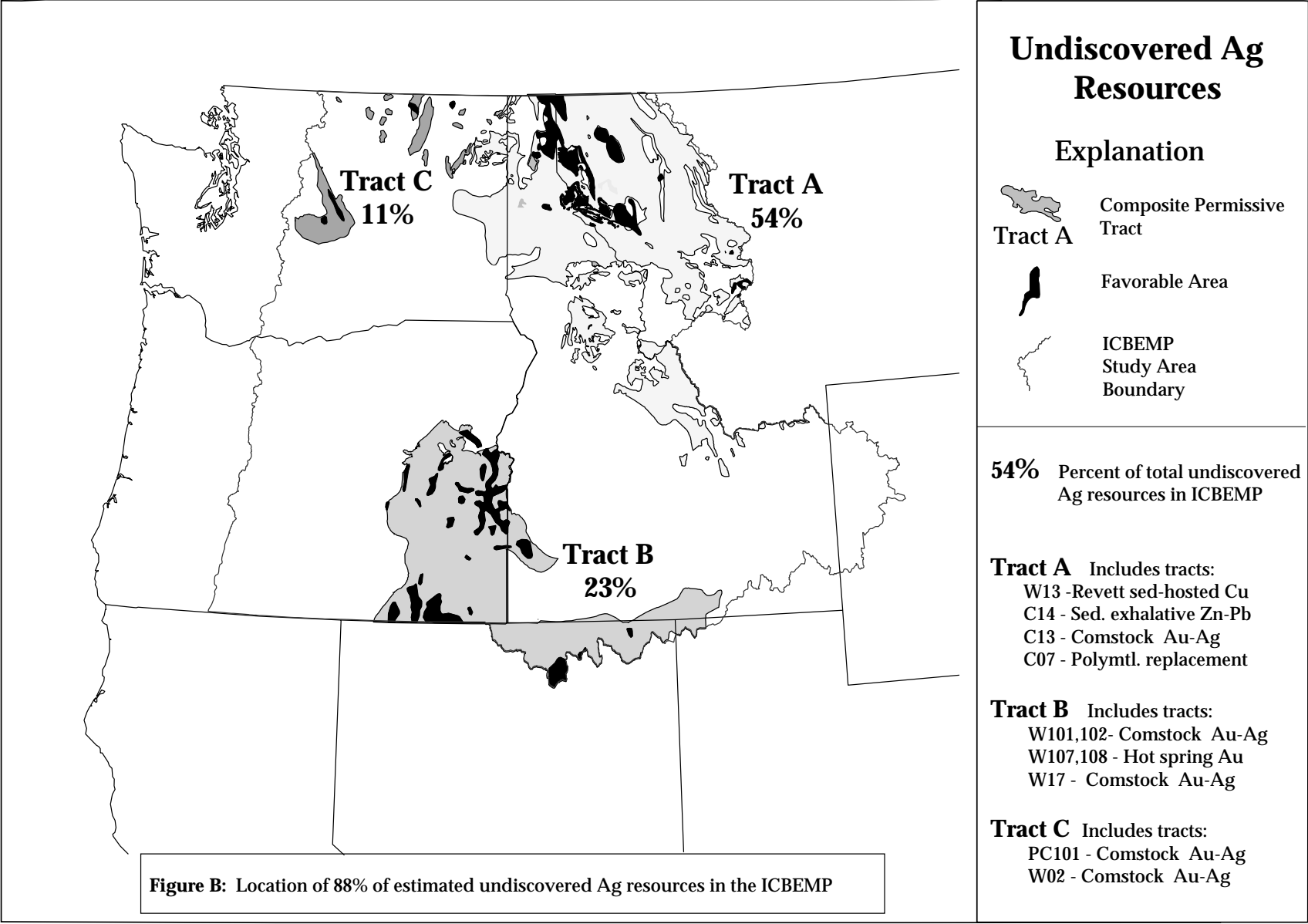
-  Composite Permissive Tract
-  Favorable Area
-  ICBEMP Study Area Boundary

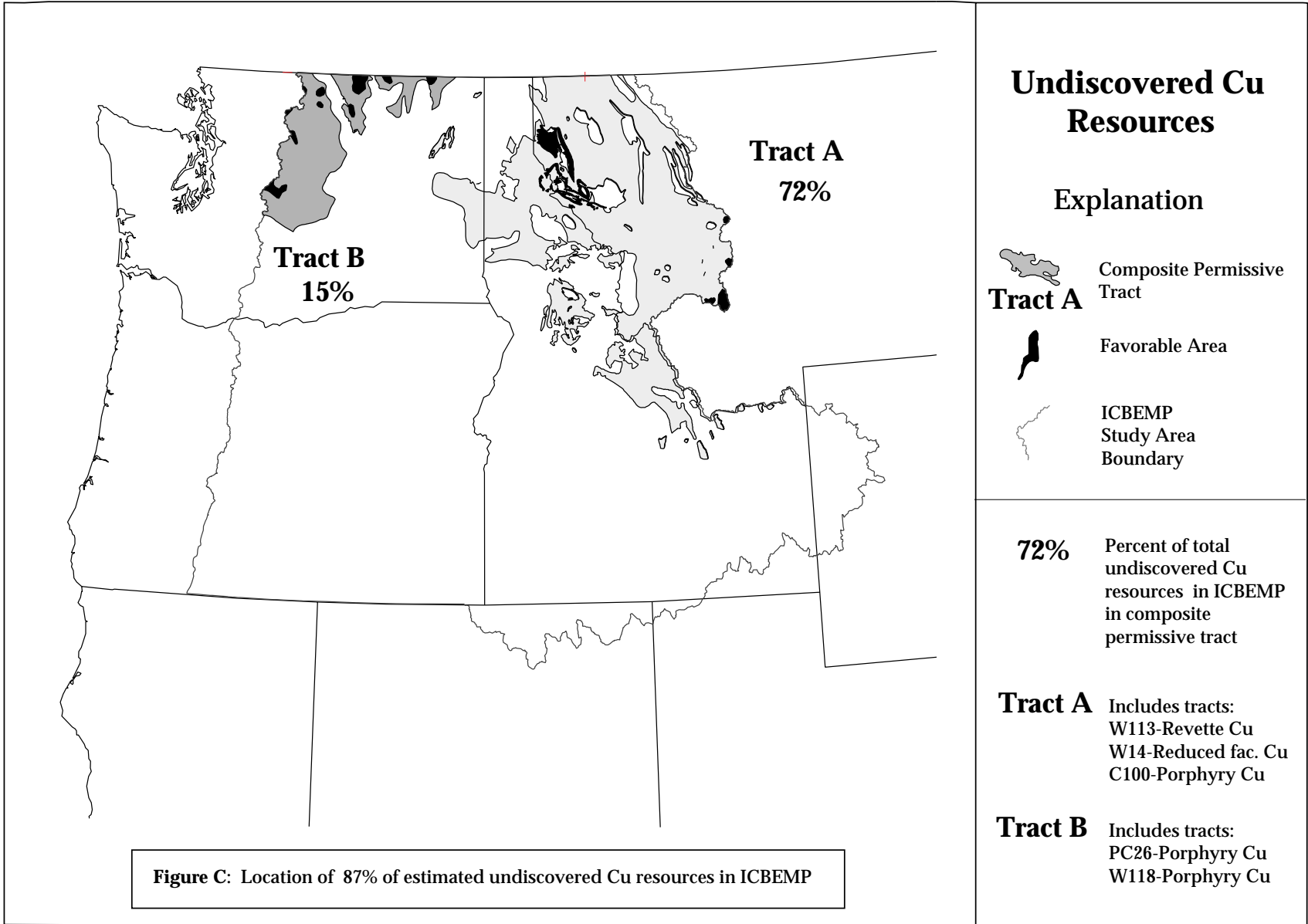
12% Percent of total undiscovered Au resources in ICBEMP

- 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





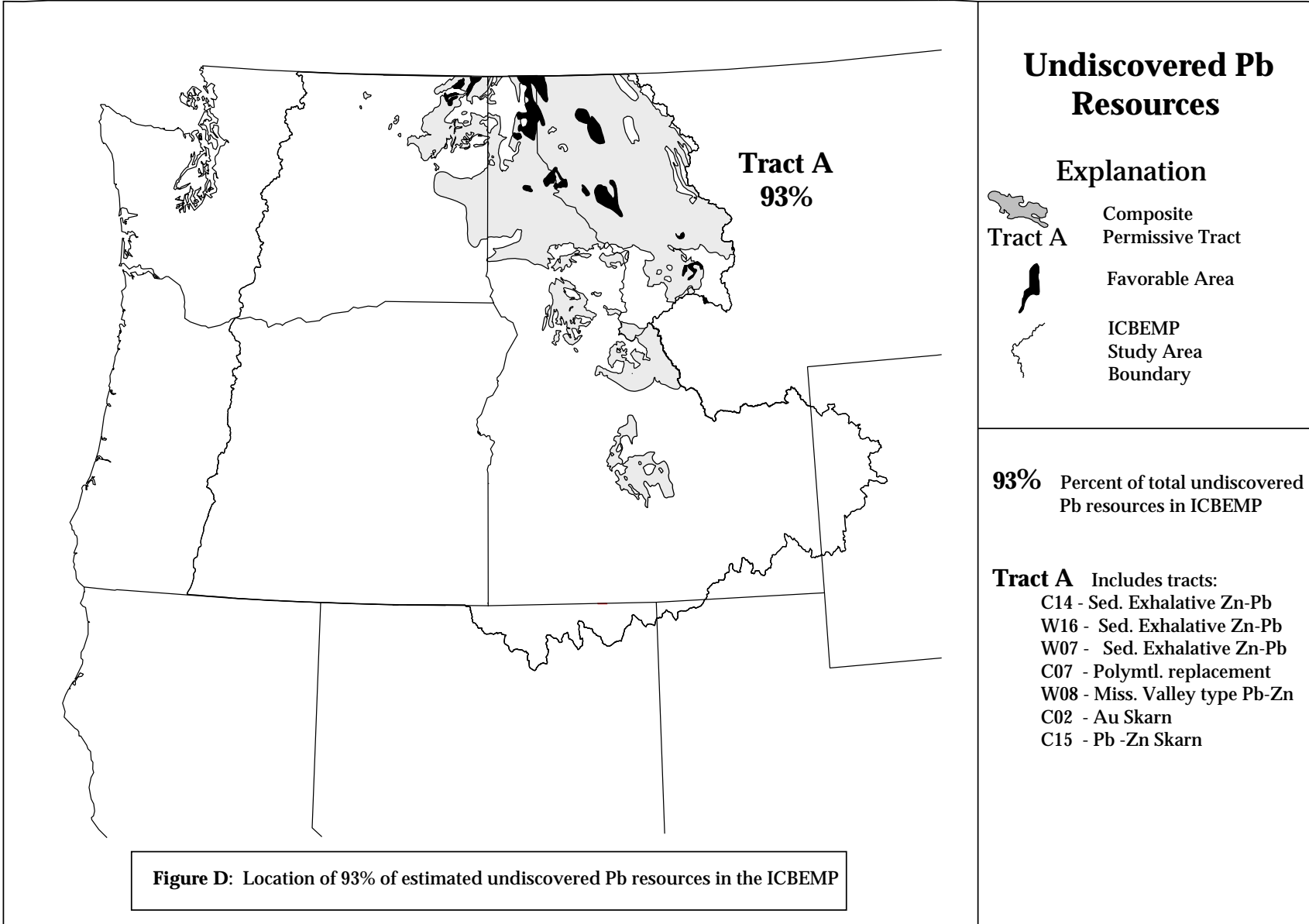


Figure D: Location of 93% of estimated undiscovered Pb resources in the ICBEMP

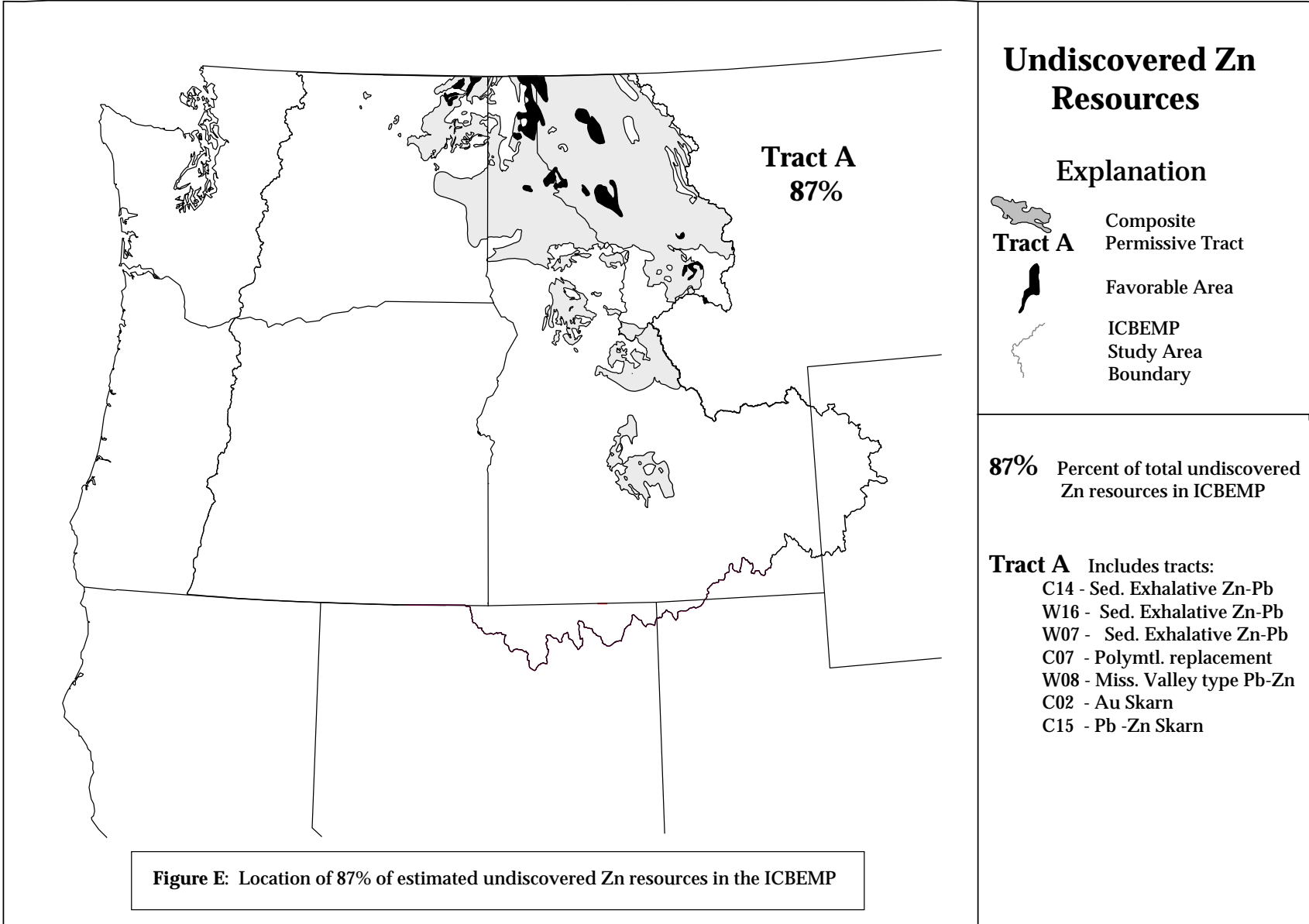


Figure E: Location of 87% of estimated undiscovered Zn resources in the ICBEMP

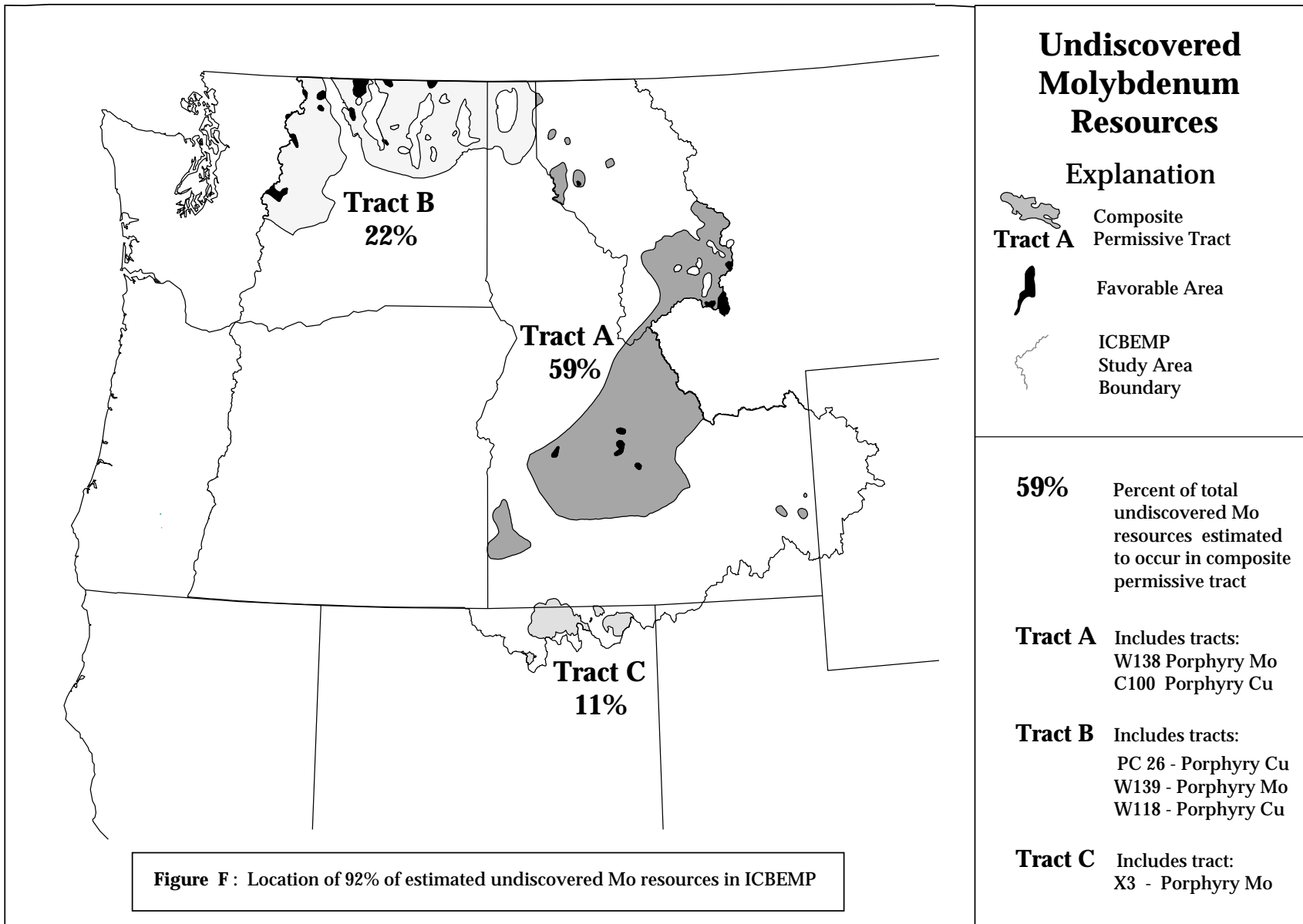
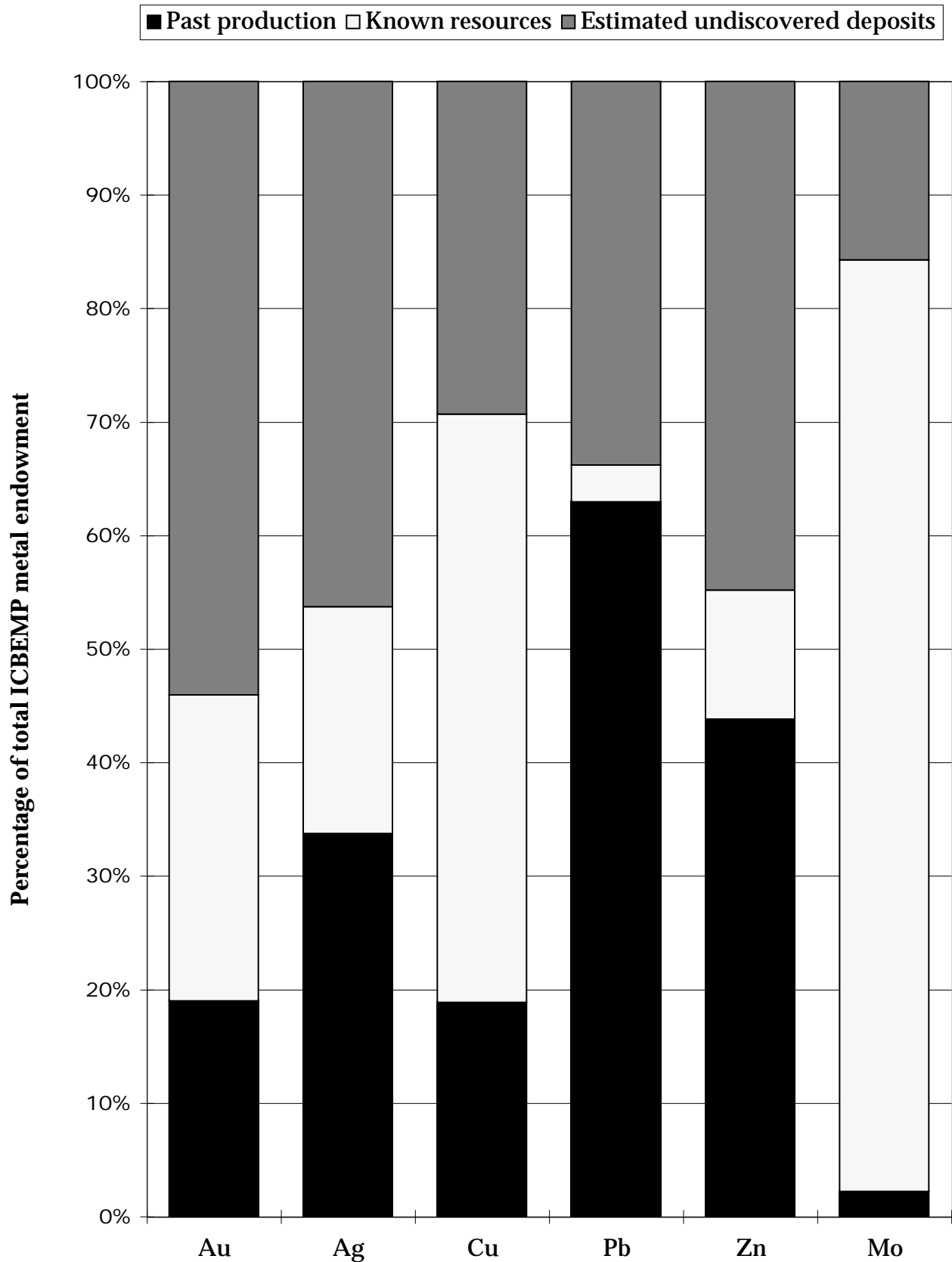


Figure G: Relative apportionment of total metal endowments of the Interior Columbia Basin between past production, known but unmined resources, and estimated undiscovered deposits.



References cited

- Adkins, A.R., 1993, Geology of the Montanore stratabound Cu-Ag deposit, Lincoln and Sanders Counties, Montana: Belt Symposium III, Program and Abstracts, Belt Association, Inc., unpaginated.
- Albers, J.P., and Robertson, J.F., 1961, Geology and ore deposits of the East Shasta copper zinc district: U.S. Geological Survey Professional Paper 338, 107 p.
- Anderson, A.L., 1949, Silver-gold deposits of the Yankee Fork district, Custer County, Idaho: Idaho Bureau of Mines and Geology, Pamphlet 83, 37 p.
- Anderson, Alfred L., 1941, Geology of the Idaho Almaden quicksilver mine: Idaho Bureau of Mines and Geology Pamphlet 55, 9 p.
- Anderson, C.A., 1931, Geology of the Engels and Superior Mines, Plumas County, California (with a note on the ore deposits of the Superior mine): California University Geological Sciences Bulletin, v. 20, no. 8, p. 293-330.
- Asher, R.R., 1968, Geology and mineral resources of a portion of the Silver City region, Owyhee County, Idaho: Idaho Bureau of Mines and Geology Pamphlet 138, 106 p.
- Aubertin, Don, and staff, 1984, Revised Geology and Mineral Potential of the Colville Indian Reservation, Washington: Colville Confederated Tribes, Nespelem, Washington, 81 p., 13 pl.
- Bagby, W.C., Menzie, W. D., Mosier, D.L., and Singer, D.A., 1986, Grade and tonnage model of carbonate-hosted Au-Ag: in Cox, D.P., and Singer, D.A., eds., Mineral deposit models: U.S. Geological Survey Bulletin 1693, p. 175-177.
- Baker, D.W., and Berg, R.B., eds., 1991, Guidebook of the Central Montana Alkalic Province--Geology, ore deposits, and origin: Montana Bureau of Mines and Geology Special Publication 100, 201 p.
- Bartels, Ed; Douglas, I., Van Huffel, G., and Busby, S., 1990 [abstract and road log] , Beartrack project, Mackinaw mining district, Lemhi County, Idaho: in Moye, F.J., ed., Geology and ore deposits of the trans-Challis fault system/Great Falls tectonic zone: Tobacco Root Geological Society, fifteenth Annual Field Conference, p. 31-35.
- Barton, M.D., Battles, D.A., Debout, G.E., Capo, R.C., Christensen, J.N., Davis, S.R., Hanson, R.B., Michelsen, C.J., and Trim, H.E., 1988, Mesozoic contact metamorphism in the western United States, p. 110-178, in Ernst, W.G., ed., Metamorphism and crustal evolution of the western United States, Rubey Volume VII: New Jersey, Prentice Hall, 1153 p.
- Bailey, R.W., and James, H.L., 1973, Precambrian iron-formations of the United States: Economic Geology, v. 68, p. 934-959.
- Beaty, D.W., Hahn, G.A., and Threlkeld, W.E., 1988, Field, isotopic, and chemical studies of tourmaline-bearing rocks in the Belt-Purcell Supergroup: genetic constraints and exploration significance for Sullivan-type ore deposits: Canadian Journal of Earth Sciences, v. 25, p. 392-402.
- Beaudoin, Georges, and Sangster, D.F., 1992, A descriptive model for silver-lead-zinc veins in clastic metasedimentary terranes: Economic Geology, v. 87, p. 1005-1021.
- Bennett, E.H., and Springer, Donald, 1990, Mine production in the Coeur d'Alene district, 1981-1990: Idaho Geological Survey, GeoNote 20, 1 p.
- Bennett, E.H., undated, The fabulous Coeur d'Alene mining district: Idaho Geological Survey GeoNote 07, 1 p.
- Berger, B.R., 1985, Geologic-geochemical features of hot-spring precious metal deposits, in Tooker, E.W., Ed., Geologic characteristics of sediment- and volcanic-hosted disseminated gold deposits—search for an occurrence model: U.S. Geological Survey Bulletin 1646, p. 47-48
- Berger, B.R., 1986a, Descriptive model of carbonate-hosted Au-Ag, in Cox, D.P., and Singer, D.A., eds., Mineral deposit models: U.S. Geological Survey Bulletin 1693, p. 175.

- Berger, B.R., 1986b, Descriptive model of Homestake Au, *in* Cox, D.P., and Singer, D.A., eds., Mineral Deposit Models: U.S. Geological Survey Bulletin 1693, p. 244.
- Berger, B. R., 1986c, Descriptive model of hot-spring Au-Ag deposits, *in* Cox, D.P., and Singer, D.A., eds., Mineral deposit models: U.S. Geological Survey Bulletin 1693, p. 143.
- Berger, B.R., 1986d, Descriptive model of low-sulfide Au-quartz veins, *in* Cox, D.P., and Singer, D.A., eds., Mineral deposit models: U.S. Geological Survey Bulletin 1693, p. 239.
- Berger, B.R., and Bagby, W.C., 1991, The geology and origin of Carlin type deposits, *in* Foster, R.P., ed., Gold Exploration and Metallogeny: London, Blackie and Sons, p. 210-248.
- Berger, B.R., and Henley, R.W., 1989, Advances in the understanding of epithermal gold-silver deposits, with special reference to the western United States, *in* Keays, R.R., Ramsay, W.R.H., and Groves, D.I., eds., The Geology of Gold Deposits: the Perspective in 1988: Economic Geology Monograph 6, p. 405-423.
- Berger, B.R., and Singer, D.A., 1992, Grade and tonnage model for hot spring Au-Ag, *in* Bliss, J.D., ed., Developments in mineral deposit modeling, U.S. Geological Survey Bulletin 2004, p. 23-25.
- Best, M.G., Christiansen, E.H., Deino, A.L., Grommé, C.S., McKee, E.H., and Noble, D.C., 1989, Excursion 3A—Eocene through Miocene volcanism in the Great Basin of the western United States, *in* Chapin, C.E. and Zidek, Jiri, eds., Field Excursion to Volcanic Terranes in the Western United States, Volume II: Cascades and Intermountain West: New Mexico Bureau of Mines and Mineral Resources Memoir 47, p. 91-133.
- Binda, P.L., Koopman, H.T., and Koopman, E.R., 1989, A stratiform copper occurrence in the Helikian Siyeh Formation of Alberta and British Columbia, *in* Boyle, R.W., Brown, A.C., Jefferson, C.W., Jowett, E.C., and Kirkham, R.V., eds., Sediment-hosted stratiform copper deposits: Geological Association of Canada, Special Paper 36, p. 269-285.
- Blakely, R. J., 1988, Curie temperature isotherm analysis and tectonic implications of aeromagnetic data from Nevada, *Journal of Geophysical Research*, v. 93, p. 11, 817-11,832.
- Blakely, R.J., and Jachens, R.C., 1991, Concealed ore deposits in Nevada: insights from three-dimensional analysis of gravity and magnetic anomalies *in* Raines, G.L., Lisle, R.E., Schafer, R.W., and Wilkinson, W.H., eds., Geology and ore deposits of the Great Basin—Symposium Proceedings: Reno, Geological Society of Nevada, v. 1, April 1990, p. 185-192.
- Blakely, R.J., and Plouff, Donald, 1991, Geophysical interpretations, *in* Diggles, M.F., ed., Assessment of undiscovered porphyry copper deposits within the range of the Northern Spotted Owl, northwestern California, western Oregon, and western Washington: U.S. Geological Survey Open-File Report 91-377, p. 21-30.
- Bliss, J.D., 1986, Grade and tonnage model of low-sulfide Au-quartz veins, *in* Cox, D.P., and Singer, D.A., eds., Mineral deposit models: U.S. Geological Survey Bulletin 1693, p. 239-243
- Bliss, J.D., 1992, Developments in Mineral Deposit Modeling: U.S. Geological Survey Bulletin 2004, 168 p.
- Bliss, J.D., 1994 a, Grade, tonnage, and other models of Blue Mountain-type Au-Ag polymetallic veins, Blue Mountains, Oregon, for use in resource and environmental assessment: U.S. Geological Survey Open-File Report 94-677, 33 p.
- Bliss, J.D., 1994 b, Mineral deposit modeling using components for complex mineral deposits: Mixed base- and precious-metal veins of the Idaho batholith, Idaho: U.S. Geological Survey Open-File Report 94-690, 53 p.
- Bliss, J.D., and Cox, D.P., 1986, Grade and tonnage model of polymetallic veins, *in* Cox, D.P., and Singer, D.A., eds., Mineral deposit models: U.S. Geological Survey Bulletin 1693, p. 125-129.
- Bliss, J.D., and Jones, G.M., 1988, Mineralogic and grade-tonnage information on low-sulfide Au-quartz veins: U.S. Geological Survey Open-File Report 88-0229, 99 p.

- Bliss, J.D., Sutphin, D.M., Mosier, D.L., and Allen, M.S., 1992, Grade-tonnage and target-area models of Au-Ag-Te veins associated with alkaline rocks: U.S. Geological Survey Open-File Report 92-208, 15 p.
- Bond, J.G., 1978, Geologic map of Idaho: Idaho Bureau of Mines and Geology, scale 1:500,000.
- Bonham, 1989--from Carlin Nevada tract description
- Bonnichsen, Bill, 1982, The Bruneau-Jarbridge eruptive center, southwestern Idaho, *in* Bonnichsen, Bill and Breckenridge, Roy M., eds., *Cenozoic Geology of Idaho*, Idaho Bureau of Mines and Geology Bulletin 26, p. 237-254.
- Bookstrom, A. A., Zientek, M. L., Box, S. E., Derkey, P. D., Elliott, J. E., Frishman, David, Ashley, R.P., Everts, R. C., Moyer, L. A., Cox, D. P., and Ludington, S. D., 1996, Status and metal content of significant metallic mineral deposits in the Pacific Northwest: a contribution to the Interior Columbia Basin Ecosystem Management Project: U.S. Geological Survey Open-File Report 95-688, 93 p.
- Briskey, J.A., 1986a, Descriptive model of sedimentary exhalative Zn-Pb, *in* Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 211.
- Briskey, J.A., 1986b, Descriptive model of southeast Missouri Pb-Zn, *in* Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 220-221.
- Brooks, H.C. , and Ramp, Len, 1968, Gold and silver in Oregon: Oregon Department of Geology and Mineral Industries Bulletin 61, 337 p.
- Brooks, H.C., and Vallier, T.L., 1978, Mesozoic rocks and tectonic evolution of eastern Oregon and western Idaho, *in* David G. Howell and Kristin A. McDougall, editors, *Mesozoic paleogeography of the western United States, Pacific section*, Society of Economic Paleontologists and Mineralogists, Pacific Coast Paleogeography Symposium 2, p. 133-146.
- Bussey, S.D., and Anderson, P.J., 1994, Geology of the Iron Dyke mine and surrounding Permian Hunsaker Creek Formation *in* Vallier, T.L., and Brooks, H.C., eds., *Geology of the Blue Mountains region of Oregon, Idaho, and Washington: U.S. Geological Survey Professional Paper 1439*, p. 151-182.
- Carden, J. R. , Wendland, D.W., and Rassmussen, M.G., 1992, The discovery and geology of the Lame Foot gold deposit, Ferry County, Washington [abs]: Abstracts, New World of Minerals, Northwest Mining Association 98th Annual Convention, p. 26.
- Carden, J.R., 1995, The geology and mineralization of the Lamefoot gold deposit, Ferry County, Washington (abs.), *in* *Geology and ore deposits of the American cordillera, Programs with Abstracts*, Geological Society of Nevada symposium, Reno/Sparks, Nevada, p. A17
- Carten, R.B., White, W.H., and Stein, H.J. (in press) High-grade granite-related Mo systems: Classification and origin: *in* Kirkham, R.V., ed., *Geological Society of Canada, Special Paper IAGOD Conference--Deposit Modeling Program, Oct. 2, 1991*.
- Chadwick, R.A., 1970, Belts of eruptive centers in the Absaroka-Gallatin volcanic province, Wyoming-Montana: *Geological Society of America Bulletin*, v. 81, p. 267-274.
- Chesterman, C.W., Chapman, R.H., and Gray, C.H., Jr., 1986, Geology and ore deposits of the Bodie mining district, Mono County, California: *California Division of Mines and Geology Bulletin 206*, 36p.
- Christensen, O. D., 1993, Carlin trend geologic overview: *in* Christensen, O.D., ed., *Gold deposits of the Carlin trend, Nevada: Society of Economic Geologists Guidebook Series*, v. 18, p. 12-26.
- Church, S.E., LeHuray, A.P., Grant, A.R., Delevaux, M.H., and Gray, J.E., 1986, Lead-isotopic data from sulphide minerals from the Cascade Range, Oregon and Washington: *Geochimica et Cosmochimica Acta*, v. 50, p. 317-328.
- Clark, W.B., 1976, Gold districts of California: *California Division of Mines and Geology Bulletin 193*, 186 p.

- Coats, R.R., and Stephens, E.C., 1968, Mountain City Copper Mine, Elko County, Nevada, in Ridge, J.D., ed., Ore deposits of the United States, 1933-1967 (Graton Sales Volume): New York, American Institute of Mining Metallurgical, and Petroleum Engineers, v. 2, p. 1074-1101.
- Coney, P.J., and Harms, T.A., 1984, Cordilleran metamorphic core complexes--Cenozoic relics of Mesozoic compression: *Geology*, v. 12, p. 550-554.
- Cookro, T.M., Silberman, M.L., and Berger, B.R., 1988, Gold-tungsten-bearing hydrothermal deposits in the Yellow Pine mining district, Idaho: in Schafer, R.W., Cooper, J.J., and Vikre, P.G., eds., Bulk mineable precious metal deposits of the western United States: Reno, Nevada, Geological Society of Nevada, p. 577-624.
- Couch, R.W., and Riddihough, R.P., 1989, The crustal structure of the western continental margin of North America, in Pakiser, L.C., and Mooney, W.D., eds., Geophysical framework of the continental United States: Geological Society of America Memoir 172, p. 103-128.
- Cox, D.P., 1986a, Descriptive model of Besshi massive sulfide, in Cox and Singer, eds., Mineral Deposit Models: U.S. Geological Survey Bulletin 1693, p. 139-138.
- Cox, D.P., 1986b, Descriptive model of polymetallic veins: in Cox, D.P., and Singer, D.A., eds., Mineral Deposit Models: U.S. Geological Survey Bulletin 1693, p. 125.
- Cox, D.P., 1986c, Descriptive model of porphyry Cu, in Cox, D.P., and Singer, D.A., eds., Mineral deposit models: U.S. Geological Survey Bulletin 1693, p. 76.
- Cox, D.P., 1986d, Descriptive model of porphyry Cu-Mo, in Cox, D.P., and Singer, D.A. (editors), Mineral Deposit Models: U.S. Geological Survey Bulletin 1693, p. 115.
- Cox, D.P., 1986e, Descriptive model of Zn-Pb skarn deposits, in Cox, D.P., and Singer, D.A., eds., Mineral deposit models: U.S. Geological Survey Bulletin 1693, p. 90.
- Cox, D.P., 1992, Descriptive model of distal disseminated Ag-Au, in Bliss, J.D., ed., Developments in deposit modeling: U.S. Geological Survey Bulletin 2004, p. 19
- Cox, D.P., and Bagby, W.C., 1986, Descriptive model of Au-Ag-Te veins in Cox, D. P., and Singer, D. A., eds., Mineral deposit models: U.S. Geological Survey Bulletin 1693, p. 124.
- Cox, D.P., and Singer, D.A., eds., 1986, Mineral Deposit Models: U.S. Geological Survey Bulletin 1693, 379 p.
- Cox, D.P., and Singer, D.A., 1992a, Descriptive and grade and tonnage model of distal-disseminated Ag-Au, in Bliss, J.D., ed., Developments in deposit modeling: U.S. Geological Survey Bulletin 2004, p. 20-22.
- Cox, D.P., and Singer, D.A., 1992b, Gold--Distribution of gold in porphyry copper deposits, in DeYoung, J.H., Jr., and Hammarstrom, J.M., editors, Contributions to commodity geology research, U.S. Geological Survey Bulletin 1877, p. C1-C14.
- Cox, D.P., and Theodore, T.G., 1986, Descriptive model of Cu skarn deposits, in Cox, D.P., and Singer, D.A., eds., Mineral Deposit Models: U.S. Geological Survey Bulletin 1693, p. 86-89.
- Cox, D.P., Ludington, Steve, Sherlock, M.G., Singer, D.A., Berger, B.R., and Tingley, J.V., 1991, Mineralization patterns in time and space in the Great basin of Nevada, in Raines, G.L., Lisle, R.E., Schafer, R.W., and Wilkinson, W.H., eds., Geology and ore deposits of the Great Basin--Symposium Proceedings: Reno, Geological Society of Nevada, v. 2, April 1990, p. 193-198.
- Davidson, G.J., 1992, Hydrothermal geochemistry and ore genesis of sea-floor volcanogenic copper-bearing oxide ores: *Economic Geology*, v. 87, p. 889-912.
- Derkey, R.E., 1993, Metallic mineral deposits: in Derkey, R.E., Gulick, C.W., and Lingley, W.S., Jr., eds., Washington's Mineral Industry--1992: Washington Geology, v. 21, no. 1, p. 4-30.
- Derkey, R.E., Joseph, N.L., and Lasmanis, Raymond, 1990, Metal mines of Washington--preliminary report: Washington Division of Geology and Earth Resources Open-File Report 90-18, 577 p.

- DeYoung, J.H., Lee, M.P., and Lipin, B.R., 1984, International strategic minerals inventory summary report—chromium: U.S. Geological Survey Circular 930-b, 41 p.
- Dickinson, W.R., Ingersoll, R.W., Cowan, D.S., Helmhold, K.P., and Cuczek, C.A., 1982, Provenance of Franciscan sandstones in coastal California: *Geological Society of America Bulletin*, v. 93, p. 95–107.
- Diggles, M.F., Frisken, J.G., Plouff, Donald, Munts, S.R., and Peters, T.J., 1987, Mineral resources of the Skedaddle Mountain Wilderness Study Area, Lassen County, California, and Washoe County, Nevada: U.S. Geological Survey Bulletin 1706-C, 27 p.
- Dilles, P.A., Monteleone, S.E., and Wright, W.A., 1995, West Archimedes: a new gold discovery at the Ruby Hill property, Eureka district, Eureka County, Nevada, *in* *Geology and ore deposits of the American cordillera*, Programs with Abstracts, Geological Society of Nevada symposium, Reno/Sparks, Nevada, p. A24.
- Dragovitch, J.D., and Derkey, R.E., 1994, A Late Triassic island-arc setting for the Holden volcanogenic massive sulfide deposit, North Cascades, Washington: *Washington Geology*, v. 22, no. 1, p. 22-39.
- Drost, B.W., and Whiteman, K.J., 1986, Surficial geology, structure, and thickness of selected geohydrologic units in the Columbia Plateau, Washington: U.S. Geological Survey Water Resources Investigations Report 84-4326, 1 text sheet, 10 map sheets, scale 1:500,000.
- Earhart, R.L., 1986, Descriptive model of Blackbird Co-Cu: *in* Cox, D.P., and Singer, D.A., eds., *Mineral Deposit Models*: U.S. Geological Survey Bulletin 1693, p. 142.
- Earhart, R.L., Mudge, M.R., Whipple, J.W., and Connor, J.J., 1981, Mineral resources of the Choteau 1°x2° quadrangle, Montana: U.S. Geological Survey Miscellaneous Field Studies Map MF- 858-A.
- Eckren, E.B., McIntyre, D.H., Bennett, E.H., and Marvin, R.F., 1982, Cenozoic stratigraphy of western Owyhee County, Idaho, *in* Bonnicksen, Bill and Breckenridge, Roy M., eds., *Cenozoic Geology of Idaho*, Idaho Bureau of Mines and Geology Bulletin 26, p. 215-236.
- Eckstrand, O.R., 1984, Canadian mineral deposit types—a geological synopsis: *Geological Survey of Canada Economic Geology Report 36*, 86 p.
- Einaudi, M.T., Meinert, L.D., and Newberry, R.J., 1981, Skarn deposits, *in* Skinner, B.J., ed., *Economic Geology Seventy-Fifth Anniversary Volume*: Economic Geology Publishing Company, p. 317-392.
- Elliott, J.E., Kirk, A.R., and Johnson, T.W., 1992, Field guide; gold-copper-silver deposits of the New World district, *in* Elliott, J.E., ed., 1992, *Guidebook for the Red Lodge-Beartooth Mountains-Stillwater Area*, Tobacco Root Geological Society Seventeenth Annual Field Conference: *Northwest Geology*, v. 20/21, p. 1-19.
- Elliott, J.E., Loen, J.S., Wise, K.K., and Blaskowski, M.J., 1992, Maps showing locations of mines and prospects in the Butte 1°x2° quadrangle, western Montana: U.S. Geological Survey Miscellaneous Field Investigations Series Map I-2050-C.
- Emmons, W.H., and Calkins, F.C., 1913, *Geology and ore deposits of the Philipsburg quadrangle*, Montana: U.S. Geological Survey Professional Paper 78, 271 p.
- Evans, James, 1994, Depositional history of the Eocene Chumstick Formation: Implications of tectonic partitioning for the history of the Leavenworth and Entiat-Eagle Creek fault systems, Washington: *Tectonics*, vol. 13, no. 6, p. 1425-1444.
- Fifarek, R.H., Juhas, A.P., and Field, C.W., 1994, Geology, mineralization, and alteration of the Red Ledge volcanogenic massive sulfide deposit, western Idaho, *in* Vallier, T.L., and Brooks, H.C., eds., *Geology of the Blue Mountains region of Oregon, Idaho, and Washington*: U.S. Geological Survey Professional Paper 1439, p. 113-150.
- Folger, H.W., Snee, L.W., Mehnert, H.H., Hofstra, A.H., and Dahl, A.R., 1995, Significance of K/Ar and 40Ar/39Ar dates on illite in Carlin-type gold deposits: Evidence from the Jerritt Canyon district, Nevada [abs]: *Geology and ore deposits of the American Cordillera*, Program with Abstracts: Geological Society of Nevada, p. A31.

- Foster, F., Chadwick, T., and Nilsen, T.H., 1993, Paleodepositional setting and synsedimentary mineralization in Belt Supergroup rocks of the Whitehall area: Belt Symposium III, Program and Abstracts, Belt Association, Inc., unpaginated.
- Foster, Fess, and Childs, J.F., 1993, An overview of significant lode gold systems in Montana, and their regional geologic setting: *Exploration and Mining Geology*, v. 2, p. 217-244.
- Fox, J.S., 1984, Besshi-type volcanogenic sulphide deposits--A review: *Canadian Institute Mining and Metallurgy Bulletin*, v. 77, no. 864, p. 57-68.
- Fox, K.F., Jr., 1973, The geology of alkalic complexes in north-central Washington: U.S. Geological Survey Open-File Report 73-73, 192 p.
- Frykland, V.C., Jr., 1964, Ore deposits of the Coeur d'Alene district, Shoshone County, Idaho, *with a section on The bleached rock in the Coeur d'Alene district by Paul L. Weis*: U.S. Geological Survey Professional Paper 445, 103 p.
- Fyles, J.T., 1984, Geological setting of the Rossland mining camp: British Columbia Ministry of Energy, Mines and Petroleum Resources, Bulletin 74, 61 p.
- Gammons, C.H., 1988, Studies in hydrothermal phenomena: 1. The solubility of silver sulfide in aqueous sulfide solutions to 300°C., 2. A paragenesis and fluid inclusion study of polymetallic mineralization in the Big Creek mining district, central Idaho: Pennsylvania State University, Ph.D. dissertation, 337 p.
- Gott, G.B., and Cathrall, J.B., 1980, Geochemical-exploration studies in the Coeur d'Alene district, Idaho and Montana: U.S. Geological Survey Professional Paper 1116, 63 p.
- Grauch, V.J.S., Blakely, R.J., Blank, H.R., Oliver, H.W., Plouff, Donald, and Ponce, D.A., 1988, Geophysical delineation of granitic plutons in Nevada: U.S. Geological Survey Open-File Report 88-11, 7 p.
- Grauch, V.J.S., Jachens, R.C., and Blakely, R.J., 1995, Evidence for a basement feature related to the Cortez disseminated gold trend and implications for regional exploration in Nevada: *Economic Geology*, v. 90, no. 1, p. 203-207.
- Graybeal, F.T., 1981, Characteristics of disseminated silver deposits in the western United States, in Dickinson, W.R., and Payne, W.D., eds., *Relations of tectonics to ore deposits in the southern Cordillera*: Arizona Geological Society Digest, v. 14, p. 271-282.
- Gresens, R.L., 1983, Geology of the Wenatchee and Monitor quadrangles, Chelan and Douglas Counties, Washington: Washington Division of Geology and Earth Resources Bulletin 75, 75 p.
- Guilbert, J.M., and Park, C.F., Jr., 1985, *Ore Deposits*: New York, W.H. Freeman and Co., 985 p.
- Hall, W.E., 1986, Stratigraphy of and mineral deposits in Middle and Upper Paleozoic rocks of the black-shale mineral belt, central Idaho: U.S. Geological Survey Bulletin 1658J, p. 117-131.
- Hall, W.E., 1987, Cretaceous molybdenum stockworks: *in* Fisher, F.S. and Johnson, K.M., Preliminary manuscript for "Mineral Resource Potential and geology of the Challis 1°x2° quadrangle, Idaho: U.S. Geological Survey Open File Report OF-87-480, p. 152-157.
- Hamilton, J.M., Bishop, D.T., Morris, H.C., and Owens, O.E., 1982, Geology of the Sullivan orebody, Canada, in Hutchinson, C.D.S. and Franklin, J.M, eds., *Precambrian sulphide deposits*: Geological Association of Canada Special Paper 25, p.: 597-665.
- Hammarstrom, J.M., Zientek, M.L., and Elliott, J.E., eds., 1993, Mineral resource assessment of the Absaroka-Beartooth study area, Custer and Gallatin National Forests, Montana: U.S. Geological Survey Open-File Report 93-207, 296 p., 19 plates.
- Harrison, J.E. and Reynolds, M.W., 1979, Preliminary geology of the Blacktail Mountain drilling site, Flathead County, Montana: U.S. Geological Survey Open-File Report 79-938, 30 p.
- Harrison, J.E., 1972, Precambrian Belt basin of northwestern United States: Its geometry, sedimentation, and copper occurrences: *Geological Society of America Bulletin*, v. 83, p. 1215-1240.

- Harrison, J.E., Cressman, E.R., Long, C.L., Leach, D.L., and Domenico, J.A., 1986, Resource appraisal map for Sullivan-type stratabound lead-zinc-silver deposits in the Wallace 1° x 2° Quadrangle, Montana and Idaho: U.S. Geological Survey Miscellaneous Investigation Series Map I-1509-G.
- Harrison, J.E., Domenico, J.A., and Leach, D.L., 1986, Resource appraisal map for stratabound copper-silver deposits, in the Wallace 1°x2° Quadrangle, Montana and Idaho: U.S. Geological Survey Miscellaneous Investigation Series Map I-1509-F.
- Harrison, J.E., Leach, D.L., and Kleinkopf, M.D., 1986, Resource appraisal maps for mesothermal base- and precious-metal veins of the Wallace 1° x 2° quadrangle, Montana and Idaho: U.S. Geological Survey Map I-1509-I, 2 sheets.
- Harrison, J.E., Leach, D.L., Kleinkopf, D.M., and Long, C.L., 1986, Resource appraisal map for porphyry molybdenum-tungsten, platinum-group metals, and epithermal silver deposits in the Wallace 1° x 2° quadrangle, Montana and Idaho: U.S. Geological Survey Miscellaneous Investigations Series Map I-1509-H.
- Hart, E.W., 1966, Mines and mineral resources of Monterey County, California: California Division of Mines and Geology County Report 5, 142 p.
- Hausel, W.D., 1982, General geologic setting and mineralization of the porphyry copper deposits, Absaroka Volcanic Plateau, Wyoming: Wyoming Geological Association, Guidebook for Thirty-Third Annual Field Conference, p. 297-313.
- Hausel, W.D., 1991, Economic geology of the South Pass granite-greenstone belt, southern Wind River Range, western Wyoming: Geological Survey of Wyoming Report of Investigations No. 44, 129 p.
- Hayes, T.S., and Einaudi, M.T., 1986, Genesis of the Spar Lake stratabound copper-silver deposit, Montana
- Herdrick, Melvin, and Bunning, B.B., 1984, Geology of the Gold Dike mine, Ferry County, Washington: Washington Geologic Newsletter, v. 12, no. 1, p. 20-22.
- Hewett, D.F., 1931, Zonal relations of the lodes of the Sumpter quadrangle: A.I.M.E. Transactions, v. 5, p. 305-346.
- Hickey, R.J., 1992, The Buckhorn Mountain (Crown Jewel) gold skarn deposit, Okanogan county, Washington: Economic Geology, v. 87, no. 1, p. 125-141.
- Himes, M.D., and Petersen, E.U., 1990, Geological and mineralogical characteristics of the Sheep Creek copper-cobalt sediment-hosted stratabound sulfide deposit, Meagher County, Montana: Proceedings of the Gold '90 Symposium, p. 533-546.
- Hobbs, S.W., and Fryklund, V.C., Jr., 1968, The Coeur d'Alene district, Idaho: in Ridge, J.D., ed., Ore Deposits of the United States, 1933-1967, the Graton-Sales Volume, p. 1418-1435.
- Hofstra, A.H., Landis, G.P., Leventhal, J.S., Northrop, H.R., Rye, R.O., Doe, T.C., and Dahl, A.R., 1991, Genesis of sediment-hosted, disseminated gold deposits by fluid mixing and sulfidation of iron in the host rocks—chemical reaction path modeling of ore depositional processes at Jerritt Canyon, Nevada, in Raines, G.L., Lisle, R.E., Schafer, R.W., and Wilkinson, W.H., eds., Geology and ore deposits of the Great Basin—Symposium Proceedings: Reno, Geological Society of Nevada, v. 1, April 1990, p. 235-238.
- Hotz, P.E., 1971, Geology of lode gold districts in the Klamath Mountains, California and Oregon: U.S. Geological Survey Bulletin 1290, 91 p.
- Hoy, Trygve, 1991, Volcanogenic massive sulphide deposits in British Columbia, in McMillan, W.J., and others, eds., Ore Deposits, tectonics and metallogeny in the Canadian Cordillera, Ministry of Energy, Mines, and Petroleum Resources, Paper 1991-4, p. 89-123.
- Hunting, M.T., 1956, Inventory of Washington minerals—Part II, Metallic minerals: Washington Division of Mines and Geology Bulletin 37, v. 1, 428 p./ v. 2, 67 p.
- Hunting, M.T., Bennett, W.A.G., Livingston, V.E., Jr., and Moen, W.S., 1961, Geologic map of Washington: Washington Division of Mines and Geology, scale 1:500,000.

- Ilchik, R.P., and Barton, M.D., 1995, Numerical simulation of the development of Carlin-type gold deposits of the Great Basin, a source-sink approach to mineral deposit formation [abs]: *Geology and ore deposits of the American Cordillera, Program with Abstracts: Geological Society of Nevada, Reno, Nevada*, p. A39.
- Ivosevic, S.W., 1978, Johnnie gold district, Nevada, and implications on regional stratigraphic controls: *Economic Geology*, v. 73, p. 100-105.
- Jackson, E. D., 1968, The chromite deposits of the Stillwater Complex, Montana, in Ridge, J.D., ed., *Ore deposits in the United States, 1933-1967, the Graton-Sales volume: New York, American Institute of Mining, Metallurgical and Petroleum Engineers*, v. 2, p. 1495-1510.
- Jennings, C.W., 1977, *Geologic map of California: California Division of Mines and Geology Geologic Map of California, scale 1:750,000.*
- John, D.A., Thomason, R.E., and McKee, E.H., 1989, Geology and geochronology of the Paradise Peak Mine and the relationship of pre-Basin and Range extension to early Miocene precious metal mineralization in west-central Nevada: *Economic Geology*, v. 84, p. 631-649.
- Jones, A.E., and Jones, D.L., 1991, Paleogeographic significance of subterranean of the Golconda allochthon, northern Nevada, in Raines, G.L., Lisle, R.E., Schafer, R.W., and Wilkinson, W.H., eds., *Geology and ore deposits of the Great Basin—Symposium proceedings: Reno, Geological Society of Nevada*, p. 21-23.
- Jones, G.M., and Menzie, W.D., 1986, Grade and tonnage model of Cu skarn deposits, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 86-89.
- Karlstrom, T.N.V., 1948, *Geology and ore deposits of the Hecla mining district, Beaverhead County, Montana: Montana Bureau of Mines and Geology, Memoir No. 25*, 87 p.
- Ketner, K.B., 1991, Stratigraphy and strata-bound, lead-zinc-barium mineralization of lower Paleozoic rocks in northeastern Nevada, in Raines, G.L., Lisle, R.E., Schafer, R.W., and Wilkinson, W.H., eds., *Geology and ore deposits of the Great Basin—Symposium Proceedings: Reno, Geological Society of Nevada*, v. 2, April 1990, p. 539-551.
- Kiilsgaard, T. H., and Bacon, L.D., in press, *Geology and mineral deposits of the Atlanta Hill area, Elmore County, Idaho: in Worl, R.G., ed., Hailey CUSMAP Project, U.S. Geological Survey Bulletin.*
- Kiilsgaard, T.H., 1950, *Geology and ore deposits of the Triumph-Parker mine mineral belt, in Anderson, A.L., Kiilsgaard, and Frykland, V.C., Jr., Detailed geology of certain areas in the Mineral Hill and Warm Springs mining districts, Blaine county, Idaho: Idaho Bureau of Mines and Geology Pamphlet 90*, 73 p.
- Kiilsgaard, T.H., and Bennett, E.H., 1987, Mixed base- and precious-metal veins: in Fisher F.S., and Johnson, K.M., eds., *Preliminary manuscript for "Mineral-Resource Potential and Geology of the Challis 1° x 2° Quadrangle, Idaho:" U.S. Geological Survey Open-File Report 87-480*, p. 126-133.
- Kiilsgaard, T.H., Fisher, F.S., and Bennett, E.H., 1986, *The Trans-Challis fault system and associated precious metal deposits, Idaho: Economic Geology*, v. 81, p. 721-724.
- Kiilsgaard, T.H., Fisher, F.S., and Bennett, E.H., 1989, *Gold-silver deposits associated with the Trans-Challis fault system, Idaho: in Shaw, D.R. and Ashley, R.P., eds., United States Gold Terranes, Part 1: U.W. Geological Survey Bulletin 1857B*, p. B22-B44.
- Kinkel, A.R., Jr., Hall, W.E., and Albers, J.P., 1956, *Geology and base-metal deposits of West Shasta copper-zinc district, Shasta County, California: U.S. Geological Survey Professional Paper 285*, 156 p.
- Kirkham, R.V., 1989, Distribution, settings, and genesis of sediment-hosted stratiform copper deposits, in Boyle, R.W., Brown, A.C., Jefferson, C.W., Jowett, E.C., and Kirkham, R.V., eds., *Sediment-hosted Stratiform Copper Deposits: Geological Association of Canada Special Paper 36*. p. 3-38.
- Klein, T.L., and Day, W.C., 1994, *Descriptive and grade-tonnage models of Archean low-sulfide Au-quartz and a revised grade-tonnage model of Homestake Au: U.S. Geological Survey Open-File Report 94-250.*

- Klepper, M.R., Weeks, R.A., and Ruppel, E.T., 1957, *Geology of the southern Elkhorn Mountains, Jefferson and Broadwater Counties, Montana*: U.S. Geological Survey Professional Paper 292, 82 p.
- Knopf, Adolph, 1935, The Plumas County copper belt, California, in *Copper Resources of the World: 16th International Geologic Congress, Washington D.C., v. 1, p. 241-245.*
- Koski, R.A., and Derkey, R.E., 1981, Massive sulfide deposits in ocean-crust and island-arc terranes in southwestern Oregon: *Oregon Geology*, v. 43, no. 9, p. 119-125.
- Koski, R.A., Jonasson, I.R., Kadko, D.C., Smith, V.K., and Wong, F.L., 1994, Compositions, growth mechanisms, and temporal relations of hydrothermal sulfide-sulfate-silica chimneys at the northern Cleft segment, Juan de Fuca Ridge: *Journal of Geophysical Research*, v. 99, p. 4813-4832.
- Koski, R.A., Lamons, R.C., Dumoulin, J.A., and Bouse, R.M., 1993, Massive sulfide metallogenesis at a late Mesozoic sediment-covered spreading axis: Evidence from the Franciscan complex and contemporary analogues: *Geology*, v. 21, p. 137-140.
- Kuehn, C.A., and Rose, A.W., 1995, Carlin gold deposits, Nevada: origin in a deep zone of mixing between normally pressured and overpressured fluids: *Economic Geology*, v. 90, no. 1, p. 17-36.
- Kuhns, R.J., and Baitis, H.W., 1987, Preliminary study of the Turner Albright Zn-Cu-Ag-Au-Co massive sulfide deposit, Josephine County, Oregon: *Economic Geology*, v. 82, p. 1362-1376.
- Lange, I.M., Haun, G.A., and Jonson, D.C., 1995, The high-sulfidation Ag-Au base metal Hog Heaven deposit of northwestern Montana: The product of pre- and Post-diatreme and endogenous dome mineralization (abs.), in *Geology and ore deposits of the American cordillera, Programs with Abstracts, Geological Society of Nevada symposium, Reno/Sparks, Nevada*, p. A46.
- Lange, I.M., Herberger, D., Whipple, J.W., and Krouse, H.R., 1989, Stratiform Cu-Ag and Pb-Zn mineralization in the Spokane and Helena Formations in the eastern part of the Belt Basin, Montana: A common origin?, in Boyle, R.W., Brown, A.C., Jefferson, C.W., Jowett, E.C., and Kirkham, R.V., eds., *Sediment-hosted stratiform copper deposits: Geological Association of Canada, Special Paper 36*, p. 287-304.
- Lange, I.M. and Sherry, R.A., 1986, Nonmassive sulfide deposits in the Late Precambrian Belt Supergroup of western Montana, in Roberts, S.M., ed., *Belt Supergroup: A guide to Proterozoic rocks of western Montana and adjacent areas: Montana Bureau of Mines and Geology Special Publication 94*, p. 269-278.
- Lanier, George, John, E.C., Swenson, A.J., Reid, Julia, Bard, C.E., Caddy, S.W., and Wilson, J.C., 1978, General geology of the Bingham mine, Bingham Canyon, Utah: *Economic Geology*, v. 73, p. 1228-1241.
- Large, D.E., 1980, Geologic parameters associated with sediment-hosted, submarine exhalative Pb-Zn deposits: An empirical model for mineral exploration, in *Stratiform Cu-Pb-Zn deposits: Geologisches Jahrbuch, Series D*, v. 40, p. 59-129.
- Leach, D.L., Landis, G.P., and Hofstra, A.H., 1988, Metamorphic origin of the Coeur d'Alene base- and precious-metal veins in the Belt basin, Idaho and Montana: *Geology*, v. 16, p. 122-125.
- Lehrman, N.J., 1986, The McLaughlin mine, Napa and Yolo Counties, California, in Tingley, J.V., and Bonham, H.F., Jr., eds., *Precious-metal mineralization in hot-spring systems, Nevada-California: Nevada Bureau of Mines and Geology Report 41*, p. 90-92
- Libby, F.W., and Corcoran, R.E., 1962, The Oregon King mine, Jefferson County, Oregon: Oregon Department of Geology and Mineral Industries Short Paper 23, 49 p.
- Lindgren, Waldemar, 1933, *Mineral Deposits: New York and London, McGraw-Hill Book Co.*, 930 p.
- Livingston, D.C., and Laney, F.B., 1920, The copper deposits of the Seven Devils and adjacent districts: Idaho Bureau of Mines and Geology Bulletin No. 1, 105 p.
- Loen, J.S., and Pearson, R.C., 1989, Map showing locations of mines and prospects in the Dillon 1° x 2° quadrangle, Idaho and Montana: U.S. Geological Survey Map I-1803-C, scale 1:250,000.

- Love, J.D., and Antweiler, J.C., 1973, Copper, silver, and zinc in the Nugget Sandstone, western Wyoming, *in* Geology and mineral resources of the greater Green River Basin, Wyoming Geological Association Guidebook, 25th Field Conference, p. 139-147.
- Love, J.D., and Christiansen, A.C., 1985, Geologic map of Wyoming: U.S. Geological Survey Map, scale 1:500,000.
- Ludington, Stephen D., 1986, Descriptive model of Climax Mo deposits, *in* Cox, D.P., and Singer, D.A., eds., Mineral deposit models: U.S. Geological Survey Bulletin 1693, p. 73.
- Ludington, Steve, Cox, D.P., Sherlock, M.G., Singer, D.A., Berger, B.R., and Tingley, Joe, *in press*, Spatial and Temporal analysis of precious-metal deposits for a mineral resource assessment of Nevada: Ottawa, Canada, Transactions IAGOD/IUGS Symposium, 15 p.
- Lund, Karen, and Snee, L.W., 1988, Metamorphism, structural development, and age of the continent-island arc juncture in west-central Idaho, *in* Ernst, W.G., ed., Metamorphism and Crustal Evolution of the Western United States, Rubey volume VII: New Jersey, Prentice-Hall, p. 296-331.
- Margolis, Jacob, 1989, Arkose-hosted, aquifer-controlled, epithermal Au-Ag mineralization, Wenatchee, Washington: Economic Geology, v. 84, p. 1891-1902.
- McWilliams, J.R., 1958, Mining methods and costs at the Holden mine, Chelan Division, Howe Sound Company, Chelan County, Washington: U.S. Bureau of Mines Information Circular 7870, 44 p.
- Meinert, L.D., 1989, Gold skarn deposits—geology and exploration criteria, *in* Keays, R.R., Ramsay, W.R.H., and Groves D.I., eds., The Geology of Gold Deposits: the Perspective in 1988: Economic Geology Monograph 6, p. 537-552.
- Menzie, W.D., and Mosier, D.L., 1986, Grade and tonnage model of sedimentary exhalative Zn-Pb, *in* Cox, D.P., and Singer, D.A., eds., Mineral deposit models: U.S. Geological Survey Bulletin 1693, p. 212-215.
- Menzie, W.D., and Singer, D.A., 1993, Grade and tonnage model of porphyry Cu deposits in British Columbia, Canada, and Alaska, USA: U.S. Geological Survey Open-File Report 93-275, 8 p.
- Menzie, W.D., and Theodore, T.G., 1986, Grade and tonnage model of porphyry Mo, low-fluorine, *in* Cox, D.P., and Singer, D.A. (editors), Mineral Deposit Models: U.S. Geological Survey Bulletin 1693, p. 120-122.
- Meyer, Charles, Shea, E.P., Goddard, C.C., Jr., Zeihen, L.G., Guilbert, J.M., Miller, R.N., McAleer, J.F., Brox, G.B., Ingersoll, R.G., Jr., Burns G.J., and Wigal, Thomas, 1968, Ore deposits at Butte, Montana, *in* Ridge, J.D., ed., Ore deposits of the United States, 1933–1967, v. 2: New York, American Institute of Mining, Metallurgical, and Petroleum Engineers, p. 1373-1416.
- Mills, J.W., 1976, Metamorphism of the zinc-lead sulfide ores of the Yellowhead horizon, Metaline Limestone Formation, northeast Washington: Economic Geology, v. 71, p. 1601–1609.
- Mills, J.W., 1977, Zinc and lead deposits in carbonate rocks, Stevens County, Washington: Washington Division of Geology and Earth Resources Bulletin 70, 171 p.
- Mitchell, V.E., and Bennett, E.H., 1983, Production statistics for the Coeur d'Alene mining district, Shoshone County, Idaho--1884-1980: Idaho Geological Survey Technical Report 83-3, 33 p.
- Modreski, P.J., 1985, Stratabound cobalt-copper deposits in the Middle Proterozoic Yellowjacket Formation in and near the Challis Quadrangle: *in* McIntyre, D.H., ed., Symposium on the geology and mineral deposits of the Challis 1° x 2° Quadrangle, Idaho: U.S. Geological Survey Bulletin 1658 A-S, p. 203-220.
- Morris, H.T., 1986, Descriptive model of polymetallic replacement deposits, *in* Cox, D.P., and Singer, D.A., Mineral deposit models: U.S. Geological Survey Bulletin 1693, p. 99-100.
- Mortimer, N., 1986, Late Triassic, arc-related potassic igneous rocks in the North American Cordillera: Geology, v. 14, p. 1035-1038.

- Morton, J.A., 1992, Re-evaluation of the geology and Zn-Pb ore deposits of the Metaline mining district, northeastern Washington: *Washington Geology*, Washington Department of Natural Resources, Division of Geology and Earth Resources, v. 20, no. 3, p. 3-14.
- Mosier, D.L., 1986a, Grade and tonnage model of Homestake Au in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 245.
- Mosier, D.L., 1986b, Grade and tonnage model of Zn-Pb skarn deposits, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 90-93.
- Mosier, D.L., Berger, B.R., and Singer, D.A., 1986, Descriptive model of Sado epithermal veins, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 155-157.
- Mosier, D.L., and Briskey, J.A., 1986, Grade and tonnage model of southeast Missouri Pb-Zn and Appalachian Zn deposits, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 224-226.
- Mosier, D.L., Menzie, W. D., and Kleinhampl, F.J., 1986, Geologic and grade-tonnage information on Tertiary epithermal precious- and base-metal vein districts associated with volcanic rocks: *U.S. Geological Survey Bulletin 1666*, 39 p.
- Mosier, D.L., Morris, H.T., and Singer, D.A., 1986, Grade and tonnage model of polymetallic replacement deposits, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 101-104.
- Mosier, D.L., and Sato, Takeo, 1986, Grade and tonnage model of Sado epithermal veins, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 155-157.
- Mosier, D.L., Sato, Takeo, and Singer, D.A., 1986, Grade-tonnage model of Creede epithermal veins, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 151-153.
- Mosier, D.L., Singer D.A., Bagby, W.C., and Menzie, W. D., 1992, Grade and tonnage model of sediment-hosted Au, in Bliss, J.D., ed., *Developments in deposit modeling: U.S. Geological Survey Bulletin 2004*, p. 26-28.
- Mosier, D.L., Singer, D.A., and Berger, B.R., 1986a, Descriptive model of Comstock epithermal veins, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 150.
- Mosier, D.L., Singer, D.A., and Berger, B.R., 1986b, Grade and tonnage model of Comstock epithermal veins, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 151-153.
- Mosier, D.L., Singer, D.A., Sato, T., and Page, N.J, 1986, Relationship of grade, tonnage, and basement lithology in volcanic-hosted epithermal precious- and base-metal quartz-adularia-type districts: *Mining Geology*, v. 36, no. 4, p. 245-264.
- Munts, S.R., 1978, Geology and mineral deposits of the Quartzville mining district, Linn County, Oregon: University of Oregon, unpub. M.S. thesis, 212 p.
- Munts, S.R., and Peters, T.J., 1987, Mineral resources of the Skedaddle study area, Lassen County, California and Washoe County, Nevada: U.S. Bureau of Mines Open-File Report MLA 022-87, 52 p.
- Mutschler, F.E., and Mooney, T.C., 1995, Precious metal deposits related to alkaline igneous rocks—provisional classification, grade-tonnage data, and exploration frontiers: IAGOD symposium (in press).
- Nash, J.T., 1989, Geology and geochemistry of synsedimentary cobaltiferous-pyrite deposits, Iron Creek, Lemhi County, Idaho: *U.S. Geological Survey Bulletin 1882*, 33 p.
- Nash, J.T., and Hahn, G.A., 1989, Stratabound Co-Cu deposits and mafic volcanoclastic rocks in the Blackbird mining district, Lemhi County, Idaho: in Boyle, R.W., Brown, A.C., Jefferson, C.W., Jowett,

- E.C., and Kirkham, R.V., eds., *Sediment-hosted Stratiform Copper Deposits: Geological Association of Canada, Special Paper 36*, p. 339-356.
- Nash, J.T., Hahn, G.A., and Saunders, J.A., 1987, The occurrence of gold in siliceous Co-Cu deposits of the Blackbird mining district, Lemhi County, Idaho: U.S. Geological Survey Open-File Report 87-410, 14 p.
- Nisbet, P.C., Scales, W.G., Honsinger, E.G., and Bending, J.S., 1994, The Blackpine mine, a Cu-Co-Au exhalative sulfide system, Idaho cobalt belt, Lemhi County, Idaho [abs]: Mine Quest, Pacific Northwest Metals and Minerals Conference Abstracts, Columbia Section, Society for Mining, Metallurgy, and Exploration, Inc., p. 18.
- Nold, J.L., 1990, The Idaho cobalt belt, northwestern United States--A metamorphosed Proterozoic exhalative ore district: *Mineralium Deposita*, v. 25, p. 163-168.
- Page, Norman J., 1986a, Descriptive model of Bushveld Cr, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p.13.
- Page, Norman J., 1986b, Descriptive model of Merensky Reef PGE, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 14.
- Page, Norman J., 1986c, Descriptive model of Stillwater Ni-Cu, in Cox, D. P., and Singer, D. A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 11.
- Page, N. J., Zientek, M. L., Lipin, B. R., Mann, E. L. (Bob), Schmidt, E. A., Turner, A. R., Czamanske, G. K., and Raedeke, L. D., 1985b, Exploration and mining history of the Stillwater Complex and adjacent rocks, in Czamanske, G. K., and Zientek, M. L., eds., *The Stillwater Complex, Montana: Geology and guide: Montana Bureau of Mines and Geology Special Publication 92*, p. 77-92.
- Pearson, R.C., and Obradovich, J.D., 1977, Eocene rocks in northeast Washington--Radiometric ages and correlation: *U.S. Geological Survey Bulletin 1433*, 41 p.
- Pearson, R.C., Hanna, W.F., James, H.L., Loen, J.S., Moll, S.H., Ruppel, E.T., and Trautwein, C.M., 1990, Map showing mineral resource assessment for silver, cobalt, and base metals in Proterozoic sedimentary rocks and for iron, chromium, nickel, talc, chlorite, gold, and graphite in Archean crystalline rocks, Dillon 1° x 2° Quadrangle, Idaho and Montana: U.S. Geological Survey Miscellaneous Investigation Series Map I-1803-D.
- Peck, D.L., Griggs, A.B., Schlicker, H.G., Wells, F.G., and Dole, H.M., 1964, Geology of the central and northern parts of the western Cascade Range in Oregon: *U.S. Geological Survey Professional Paper 449*, 56 p.
- Percival, T.J., Bagby, W.C., and Radtke, A.S., 1988, Physical and chemical features of precious metal deposits hosted by sedimentary rocks in the western United States: in Schafer, R.W., Cooper, J.J., and Vikre, P.G., eds., *Bulk mineable precious metal deposits of the western United States: Geological Society of Nevada*, p. 11-34.
- Peters, E.K., 1991, Gold-bearing hot spring systems of the northern Coast Ranges, California: *Economic Geology*, v. 86, p. 1519-1528.
- Peters, S.G., Albino, George, Brooks, H.C., Evans, J.G., Carlson, R.R., Lee, G.K., Griscom, Andrew, and Halvorson, P.F., 1994, Deposit Models and tracts for undiscovered metallic resources in the Malheur-Jordan-Andrews Resource area, southeastern Oregon, in Smith, C.L., ed., *Mineral and Energy Resources of the BLM Malheur-Jordan Resource areas, southeastern Oregon: U.S. Geological Survey administrative report*, p. B1-B21.
- Peterson, J.A., 1991, Known copper deposits, in Diggles, M.F., ed., *Assessment of undiscovered porphyry copper deposits within the range of the Northern Spotted Owl, northwestern California, western Oregon, and western Washington: U.S. Geological Survey Open-File Report 91-377*, p. 17-21.
- Power, S.G., 1984, The "tops" of porphyry copper deposits--mineralization and plutonism in the western Cascades, Oregon: Corvallis, Oregon State University, Ph.D. thesis, 234 p.

- Raedeke, L. D., and Vian, R. W., 1986, A three-dimensional view of mineralization in the Stillwater J-M Reef: *Economic Geology*, v. 81, p. 1187-1195.
- Rasmussen, M.G., 1993, The geology and origin of the Overlook gold deposit, Ferry County, Washington: University of Washington, Unpublished Ph.D. dissertation, 153 p.
- Ratcliff, M.W., 1973, Copper and molybdenum mineralization in the Continental deposit, East Butte district, Montana, p. I-1 - I-8, in Miller, R.N., ed., *Guidebook for the Butte Field Meeting of Society of Economic Geologists: Society of Economic Geologists, Butte, Montana*, 120 p.
- Reid, J.E., 1991, Skarn occurrences in Utah and the potential for associated gold mineralization: Utah Geological Survey Contract Report 91-13, 49 p.
- Rose, A.W., and Kuehn, C.A., 1987, Ore deposition from highly acidic CO₂-enriched solutions at the Carlin gold deposit, Eureka County, Nevada [abs.]: *Geological Society of America, Abstracts with Programs*, v. 19, no. 7, p. 824.
- Ross, C.P., 1937, Geology and ore deposits of the Bayhorse region, Custer county, Idaho: *U.S. Geological Survey Bulletin 877*, 161 p.
- Ross, C.P., Andrews, D.A., and Witkind, I.J., 1955, Geologic map of Montana: U.S. Geological Survey . scale 1:500,000.
- Rostad, O., 1978, K-Ar dates of mineralization in the White Cloud-Cannivan porphyry molybdenum belt of Idaho and Montana—a discussion: *Economic Geology*, v. 73, p. 1366-1368.
- Root, David H., Menzie, W. David, and Scott, William A., 1992, Computer Monte Carlo simulation in quantitative resource estimation: *Nonrenewable Resources*, vol. 1, no. 2, p. 125-138
- Rye, R.O., Roberts, R.J., Snyder, W.S., Lahusen, G.L., and Motica, J.E., 1984, Textural and isotopic studies of the Big Mike cupriferous volcanogenic massive sulfide deposit, Peshing County, Nevada: *Economic Geology*, v. 79, p. 124-140.
- Rye, R.O., Whelan, J.F., Harrison, J.E., and Hayes, T.S., 1984, The origin of copper-silver mineralization in the Ravalli Group as indicated by preliminary studies of stable isotopes, in Hobbs, S.W., ed., *The Belt, Abstracts and summaries, Belt Symposium II, 1983: Montana Bureau of Mines and Geology Special Publication 90*, p. 104-107.
- Rytuba, J.J., 1988, Volcanism, extensional tectonics, and epithermal systems in the northern Basin and Range, CA, NV, OR, and ID [abs.]: *Geological Society of Nevada Newsletter*, May, 1988.
- Rytuba, J.J., 1989, Volcanism, extensional tectonics, and epithermal mineralization in the northern Basin and Range Province, California, Nevada, Oregon, and Idaho, in Schindler, K.S., ed., *U.S. Geological Survey Research on Mineral Resources - 1989 Program and Abstracts, Fifth Annual V.E. McKelvey Forum on Mineral and Energy Resources [abs.]: U.S. Geological Survey Circular 1035*, p. 59-61.
- Sahinen, U.M., 1950, Geology and ore deposits of the Highland Mountains, southwestern Montana: *Montana Bureau of Mines and Geology Memoir 32*, 63 p.
- Sawlan, M.G., and Russell, K.D., 1991, Rhyolite domes, NW-trending faults, gold deposits, and high-alumina basalt in the Devils Garden-NW Basin and Range: rapid volcanic and structural evolution from 8-6 Ma at Quartz Mountain, south-central Oregon [abs.]: *Geological Society of America Abstracts with Programs*, v. 23, p. 94.
- Schmidt, E.A., Brock, M., and White, R., 1983, Geology of the Thompson Creek molybdenum deposit, Custer County, Idaho: in *The Genesis of Rocky Mountain ore deposits: Changes with time and tectonics: Denver Region Exploration Geologists Society*, p. 79-84
- Seager, G.F., 1944, Gold, arsenic, and tungsten deposits of the Jardine-Crevasse Mountain district, Park County, Montana: *Montana Bureau of Mines and Geology Memoir 23*, 111 p.
- Seedorff, Eric, 1991, Magmatism, extension, and ore deposition of Eocene to Holocene age in the Great Basin—mutual effects and preliminary proposed genetic relationships, in Raines, G.L., Lisle, R.E.,

- Schafer, R.W., and Wilkinson, W.H., eds., *Geology and ore deposits of the Great Basin, Symposium Proceedings: Reno, Geological Society of Nevada*, v. 1, April 1990, p. 133-178.
- Shannon, S.S., Jr., 1980, Uranium hydrogeochemical and stream-sediment reconnaissance data release for the Ashton NTMS quadrangle, Idaho/Montana/Wyoming, including concentrations of 42 additional elements: U.S. Department of Energy, GJBX no. 189 (80).
- Shawe, D.R. and Stewart, J.H., 1976, Ore deposits as related to tectonics and magmatism, Nevada and Utah: *Transactions of Society of Mining Engineers*, v. 260, p. 225-231.
- Sherrod, D.R., and Smith, J.G., 1989, Preliminary map of upper Eocene to Holocene volcanic and related rocks of the Cascade Range, Oregon: U.S. Geological Survey Open-File Report 89-14, 1:500,000 scale, text 20 p.
- Siems, P. L., 1994, Economic geology of Coeur d'Alene-type silver-lead-zinc deposits: Northwest Mining Association Abstract Book, p. 14-15.
- Silberling, N.J., Jones, D.L., Blake, M.C., Jr., and D.G. Howell, 1987, Lithotectonic terrane map of the western conterminous United States, US Geological Survey Miscellaneous Field Studies Map MF-1874-C, scale 1:2,500,000.
- Silberman, M.L., and Danielson, Joanne, 1993, Gold-bearing quartz veins in the Klamath Mountains in the Redding 1⁰ x 2⁰ degree quadrangle, northern California: *California Geology*, v. 46, p. 35-44.
- Silberman, M.L., Stewart, J.H., and McKee, E.H., 1976, Igneous activity, tectonics and precious metal mineralization in the Great Basin during Cenozoic time: *Society of Mining Engineers, AIME Transactions*, v. 260, p. 253-263.
- Singer, D.A., 1986a, Descriptive model of Cyprus massive sulfide, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p.131.
- Singer, D.A., 1986b, Descriptive model of kuroko massive sulfide, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 189-190.
- Singer, D.A., 1986c, Grade and tonnage model of Besshi massive sulfide deposits, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 136-138.
- Singer, D.A., 1992, Grade and tonnage model of Sierran kuroko deposits, in Bliss, J.D., ed., *Developments in deposit modeling: U.S. Geological Survey Bulletin 2004*, p. 29-32.
- Singer, D.A., ed., 1996, An assessment of Nevada's mineral resources: Nevada Bureau of Mines and Geology Open-file Report OF-96-2, 180 p.
- Singer, D.A., and Mosier, D.L., 1986a, Grade-tonnage model of Cyprus massive sulfide, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p.131-135.
- Singer, D.A., and Mosier, D.L., 1986b, Grade and tonnage model of kuroko massive sulfide, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 190-197.
- Singer, D.A., Mosier, D.L., and Cox, D.P., 1986, Grade-tonnage model of porphyry copper, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 77-81.
- Singer, D.A., Theodore, T.G., and Mosier, D.L., 1986, Grade and tonnage model of Climax Mo deposits, in Cox, D.P., and Singer, D.A., eds., *Mineral deposit models: U.S. Geological Survey Bulletin 1693*, p. 73-75.
- Slack, J.F., 1993, Models for tourmaline formation in the Middle Proterozoic Belt and Purcell supergroups (Rocky Mountains) and their exploration significance: *Current Research, Part E, Geological Survey of Canada, Paper 93-1E*, p. 33-40.
- Smith, J.G., 1993, Geologic map of upper Eocene to Holocene volcanic and related rocks in the Cascade Range, Washington: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-2005, scale 1:500,000, 19 p.

- Smith, Moira, and Gehrels, G.E., 1992, Stratigraphic comparison of the Lardeau and Covada Groups: implications for revision of stratigraphic relations in the Kootenay Arc: *Canadian Journal of Earth Sciences*, v. 29, p. 1320-1329.
- Sorensen, M.L., Plouff, Donald, and Turner, R.L., 1987, Mineral Resources of the South Jackson Mountains Wilderness Stud Area, Humboldt County, Nevada: U.S. Geological Survey Bulletin 1726, 12 p.
- Spanski, G.T., 1992, Quantitative assessment of future development of copper/silver resources in the Kootenai National Forest, Idaho/Montana: Part 1—Estimation of the copper and silver endowments: *Nonrenewable Resources*, v. 1, no. 2, p. 163-183.
- Spanski, G.T., 1994, Quantitative resource assessment for locatable minerals, in Smith, C.L., ed., *Mineral and Energy Resources of the BLM Malheur-Jordan Resource areas, southeastern Oregon, U.S. Geological Survey Administrative Report*, p. C1-C12.
- Speed, R.C., Elison, M.W., and Heck, F.R., 1988, Phanerozoic tectonic evolution of the Great Basin, in, Ernst, W.G., ed., *Metamorphism and crustal evolution of the Western United States (Rubey Volume VII)*: Englewood Cliffs, New Jersey, Prentice Hall, p. 572-605.
- Spurr, J.E., 1901, Ore deposits of Monte Cristo, Washington: U.S. Geological Survey 22nd Annual Report, pt. 2, p. 777-865.
- Stanley, C.R. and Sinclair, A.J., 1989, Depositional environment and stratigraphic setting of stratabound Cu-Ag occurrences in the Bonner Quartzite, Belt Supergroup, western Montana, in Boyle, R.W., Brown, A.C., Jefferson, C.W., Jowett, E.C., and Kirkham, R.V., eds., *Sediment-hosted stratiform copper deposits*: Geological Association of Canada, Special Paper 36, p. 305-318.
- Steven, T.A., and Rowley, P.D., 1984, Calderas of the Marysvale volcanic field, west central Utah: *Journal of Geophysical Research*, v. 89, p. 8751-8764.
- Stewart, J.H., 1980, Geology of Nevada: Nevada Bureau of Mines and Geology Special Pub. 4, 136 p.
- Stewart, J.H., 1988, Tectonics of the Walker lane belt, western Great Basin—Mesozoic and Cenozoic deformation in a shear zone, in Ernst, W.G., ed., *Metamorphism and crustal evolution of the Western United States (Rubey Volume VII)*: Englewood Cliffs, New Jersey, Prentice Hall, p. 683-713.
- Stewart, J.H., and Carlson, J.E., 1978, Geologic map of Nevada: U.S. Geological Survey, scale 1:500,000.
- Stewart, J.H., Moore, W.J., and Zietz, Isidore, 1977, East-west patterns of Cenozoic igneous rocks, aeromagnetic anomalies, and mineral deposits, Nevada and Utah: *Geological Society of America Bulletin*, v. 88, p. 67-77.
- Stoeser, D.B., 1993, Tertiary calderas and regional extension of the east-central part of the Tintic-Deep Creek Mineral Belt, eastern Great Basin, in Scott, R.W., Jr., Detra, T.S., and Berger, B.R., eds., *Advances Related to United States and International Mineral Resources: Developing Frameworks and Exploration Technologies*: U.S. Geological Survey Bulletin 2039, Chap. A, p. 5-23.
- Stoffel, K.L., Joseph, N.L., Waggoner, S.Z., Gulick, S.W., Korosec, M.A., and Bunning, B.B., 1991, Geologic Map of Washington-Northeast quadrant: Washington Division of Geology and Earth Resources, Geologic Map GM-39, scale 1:250,000.
- Storey, L.O., 1978, Geology and mineralization of the Lights Creek stock, Plumas County, California in *Proceedings of the porphyry copper symposium*: Arizona Geological Society Digest, v. XI, p. 49-58.
- Stowe, C.W., 1987, Extended tabulation of chromite ore fields, in Stowe, C.W. (ed.), *Evolution of chromium ore fields*: Van Nostrand Reinhold Company, Inc., New York, p. 321-320.
- Tabor, R.W., Frizzell, V.A., Jr., Booth, D.B., Whetten, J.T., Waitt, R.B., and Zartman, R.E., 1982, Preliminary geologic map of the Skykomish River 1:100,000 quadrangle, Washington: U.S. Geological Survey Open File Map OF 82-747, scale 1:100,000.
- Tabor, R.W., Frizzell, V.A., Jr., Whetten, J.T., Waitt, R.B., Swanson, D.A., Byerly, G.R., Booth, D.B., Hetherington, M.J., and Zartman, R.E., 1987, Geologic map of the Chelan 30-minute by 60-minute quadrangle, Washington: U.S. Geological Survey Miscellaneous Investigations Map I-166 1, scale 1:100,000, text 33 p.

- Tabor, R.W., Waitt, R.B., Jr., Frizzell, V.A., Jr., Swanson, D.A., Byerly, G.R., and Bentley, R.D., 1982, Geologic map of the Wenatchee 1:100,000 quadrangle, central Washington: U.S. Geological Survey Miscellaneous Investigations Map I-1311, scale 1:100,000, text 26 p.
- Theodore, T.G., 1986, Descriptive model of porphyry Mo, low-F, in Cox, D.P., and Singer, D.A., Mineral deposit models: U.S. Geological Survey Bulletin 1693, p. 120-122.
- Theodore, T.G., and Blake, D.W., 1975, Geology and geochemistry of the west orebody and associated skarns, Copper Canyon porphyry copper deposits, Lander County, Nevada, with a section on Electron microprobe analysis of andradite and diopside by N.G. Banks: U.S. Geological Survey Professional Paper, 798-C, 85 p.
- Theodore, T.G., Blake, D.W., Loucks, T.A., and Johnson, C.A., 1992, Geology of the Buckingham stockwork molybdenum deposit and surrounding area, Lander County, Nevada: U.S. Geological Survey Professional Paper 798-D, 307 p.
- Theodore, T.G., Orris, G.J., Hammarstrom, J.M., and Bliss, J.D., 1991, Gold-bearing skarns: U.S. Geological Survey Bulletin 1930, 61 p.
- Thorman, C.H., Brooks, W.E., Snee, L.W., Hofstra, A.H., Chritensen, O.D., and Wilton, D.T., 1995 [abs]: Eocene-Oligocene model for Carlin-type deposits in northern Nevada: Geology and ore deposits of the American Cordillera, Program with Abstracts: Geological Society of Nevada, Reno, Nevada, p. A75.
- Thorman, C.H., Ketner, K.B., Brooks, W.E., Snee, L.W., and Zimmermann, R.A., 1991, Late Mesozoic-Cenozoic tectonics in northeastern Nevada, in Raines, G.L., Lisle, R.E., Schafer, R.W., and Wilkinson, W.H., eds., Geology and ore deposits of the Great Basin—Symposium Proceedings: Reno, Geological Society of Nevada, v. 1, April 1990, p. 25–46
- Thorson, J.P., 1984, Suggested revisions of the lower Belt Supergroup stratigraphy of the Highland Mountains, southwestern Montana, in Hobbs, ed., The Belt, Abstracts with summaries, Belt Symposium II, 1983: Montana Bureau of Mines and Geology Special Publication 90, p. 10-12.
- Thorson, J.P., 1993, Controls of massive sulfide mineralization in the Belt Supergroup: Belt Symposium III, Program and Abstracts, Belt Association, Inc., unpaginated.
- Todd, S. G., Keith, D. W., LeRoy, L. W., Shissel, D. J., Mann, E. L., and Irvine, T. N., 1982, The J-M platinum-palladium Reef of the Stillwater Complex, Montana: I. Stratigraphy and petrology: *Economic Geology*, v. 77, p. 1454-1480
- Tschauder, R.J., 1989, Gold deposits in northern Ferry County, Washington: in Joseph, N.L., and others, eds., Geologic Guidebook for Washington and Adjacent Areas: Washington Division of Geology and Earth Resources Information Circular 86, p. 241-253.
- Turner, R.J.W., Hagen, Arthur, Hoy, Trygve, and Leitch, C.H.G., 1993, The Sullivan-North Star corridor: Regional-scale alteration, fragmental rocks and mineralization associated with the Sullivan stratiform lead-zinc deposit, southeastern British Columbia: Belt Symposium III, Program and Abstracts, Belt Association, Inc., unpaginated.
- Turner, R.J.W., Madrid, R.J., and Miller, E.L., 1989, Roberts Mountains allochthon: comparison with lower Paleozoic outer continental margin strata from the northern Canadian Cordillera: *Geology*, v. 17, p. 341-344.
- Vermaak, C.F., 1986, Summary aspects of the economics of chromium with special reference to southern Africa, in Anhaeusser, C.R., and Maske, S., eds., Mineral deposits of southern Africa: Johannesburg, The Geological Society of South Africa, p. 1155-1181.
- Walker, G.W., and MacLeod, N.S., 1991, Geologic Map of Oregon: U.S. Geological Survey, scale 1:500,000.
- Wallace, A.B. 1979, Possible signatures of buried porphyry copper deposits in middle to late Tertiary volcanic rocks of Western Nevada, in Ridge, J.D., ed., Proceedings of the Fifth Quadrennial IAGOD Symposium: Reno, University of Nevada, Mackay School of Mines, v. 2, p. 69-76.

- Walsh, T.J., Korosec, M.A., Phillips, W.M., Logan, R.L., and Schasse, H.W., 1987, Geologic map of Washington-southwest quadrant: 1:250,000 scale, 28 p.
- Wavra, C.S., Bond, W.D., and Reid, R.R., 1994, Evidence from the Sunshine Mine for dip-slip movement during Coeur d'Alene district mineralization: *Economic Geology*, v. 89, p. 515-527.
- Wavra, C.S., Isaacson, P.E., and Hall, W.E., 1986, Studies of the Idaho black shale belt—Stratigraphy, depositional environment, and economic geology of the Permian Dollarhide Formation: *Geological Society of America Bulletin*, v. 97, p. 1504-1511.
- Wentworth, C.M., Fisher, G.R., and Jachens, R.C., in press, Contour map of the Great Valley basement, California: U.S. Geological Survey Miscellaneous Field Studies Map, scale 1:750,000.
- Westra, Gerhard, and Riedell, K.B., 1995, Geology of the Mount Hope stockwork molybdenum deposit, Eureka County, Nevada [abs]: Program with Abstracts, Geology and ore deposits of the American Cordillera, A symposium sponsored by Geological Society of Nevada, U.S. Geological Survey, and Sociedad Geológica de Chile, p. A78-A79.
- Wetzel, Nicholas, 1986, Chromium resources in the conterminous United States, in Daellenbach, C.B., compiler, Chromium -chromite: Bureau of Mines assessment and research: U.S. Bureau of Mines Information Circular 9087, p. 31-41.
- Wheeler, G.R., 1988, Epithermal gold deposits in eastern Oregon: *Mining Engineering*, v. 40, no. 11, p. 1033-1035.
- White, B.G., 1989, Superposed map-scale folds and subsequent veins unrelated to Osburn strike-slip fault, Coeur d'Alene mining district, Shoshone County, Idaho: Geological Society of America, Abstracts with Programs, v. 21, no. 5, p. 158.
- White, D.E., Heropoulos, Chris, and Fournier, R.O., 1992, Gold and other minor elements associated with hot springs and geysers of Yellowstone National Park, Wyoming, supplemented with data from Steamboat Springs, Nevada: U.S. Geological Survey Bulletin 2001, 19 p.
- White, D.E., Hutchinson, R.A., and Keith, T.E.C., 1988, The geology and remarkable thermal activity of Norris Geyser Basin, Yellowstone National Park, Wyoming: U.S. Geological Survey Professional Paper 1456, 84 p.
- Wiley, T.J., 1991, Mining and exploration in Oregon during 1990: *Oregon Geology*, v. 53, p. 63-69.
- Winters, A.S., 1968, Geology and ore deposits of the Castle Mountain mining district, Meagher County, Montana: Montana Bureau of Mines and Geology, Bulletin 64, 64 p.
- Witkind, I.J., 1973, Igneous rocks and related mineral deposits of the Barker quadrangle, Little Belt Mountains, Montana: U.S. Geological Survey Professional Paper 752, 58 p.
- Woodward, L.A., 1972, Upper Precambrian strata of the eastern Great Basin as potential host rocks for mineralization: *Economic Geology*, v. 67, p. 677-681.
- Zieg, G.A., and Leitch, Craig H.B., 1993, The geology of the Sheep Creek copper deposits, Meagher County, Montana: Belt Symposium III Program and Abstracts, not paginated.
- Zientek, M.L., 1993, Mineral resource appraisal for locatable minerals: the Stillwater Complex, in Hammarstrom, J.M., Zientek, M.L., and Elliott, J.E., (eds.), Mineral resource assessment of the Absaroka-Beartooth study area, Custer and Gallatin National Forests, Montana: U.S. Geological Survey Open-File Report 93-207, p. F1-F83.