Mineral Deposits of Nevada

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Introduction

Nevada is known as the "Silver" state, due primarily to the early (pre-1860) silver production from the Comstock lode in the Virginia City area. This compilation on mineral deposits from Society of Economic Geologists' publications contains references to 251 papers on sites in Nevada. For organizational purposes, the references on Nevada mineral deposits are categorized under 13 headings:

1. Porphyry Deposits;
2. Carlin-type Deposits;
3. Epithermal Deposits;
4. Industrial Minerals;
5. Skarn Deposits;
6. Placers;
7. Geochemistry;
8. Geophysics;
9. Geothermal Deposits;
10. Mineralogy of Deposits;
11. Volcanic Rocks Related to Mineral Deposits;
12. Volcanogenic Massive Sulfide Deposits; and
13. Regional Settings of Mineral Deposits.

SEG Compilation 10

By far the greatest number of publications in SEG Nevada publications report on epithermal and Carlin-type deposits. In spite of the early silver dominance in mine production, the surge in gold production after 1965 led to the state's preeminence in world gold production from Carlin-type deposits (Fig. 1) along 5 linear trends (Fig. 2) related to deep-seated structures and the cratonic margin as defined by the Sr_i 706 line.

Porphyry Deposits. The Ruth and Yerington districts' porphyry copper deposits have had a long history of exploration and production. Numerous papers are in the Society's publications and are listed in the Appendix below.

Carlin-type Deposits. Gold was produced from the Getchell and Cortez mines long before the Carlin mine was discovered; subsequently, these mines were recognized as being Carlin-type gold deposits. The Joralemon (1951) and Well et al. (1969) papers, respectively, describe Getchell and Cortez. Subsequent papers refer to the gold-bearing, disseminated arsenian pyrite and marcasite deposits as Carlin-type.

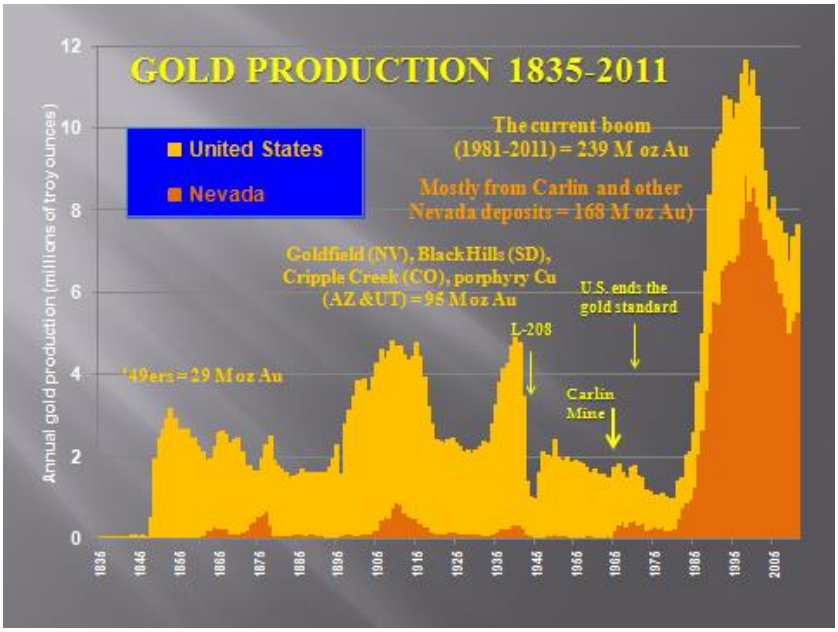

Figure 1. Gold production from the United States and Nevada (Jon Price, State Geologist Emeritus, pers. commun.).

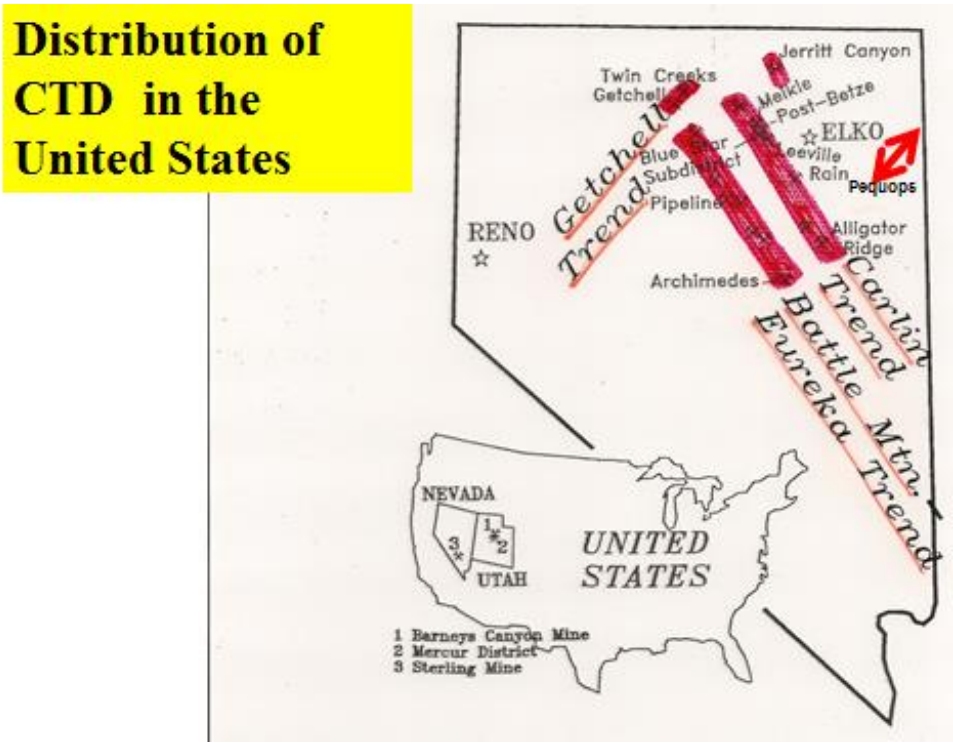

Figure 2. Carlin-type deposits (CTD) in the United States.

Epithermal Deposits. Goldfield, Tonopah, and Comstock vein deposits were in production in the mid-19th century, and they received early reporting efforts by U.S. Geological Survey and university scientists. Later, epithermal systems such as Taylor, Rochester, Rawhide, Midas, and Sleeper are reported. Some very high grade epithermal vein gold deposits are localized along distinct linear magnetic trends (Fig. 3).

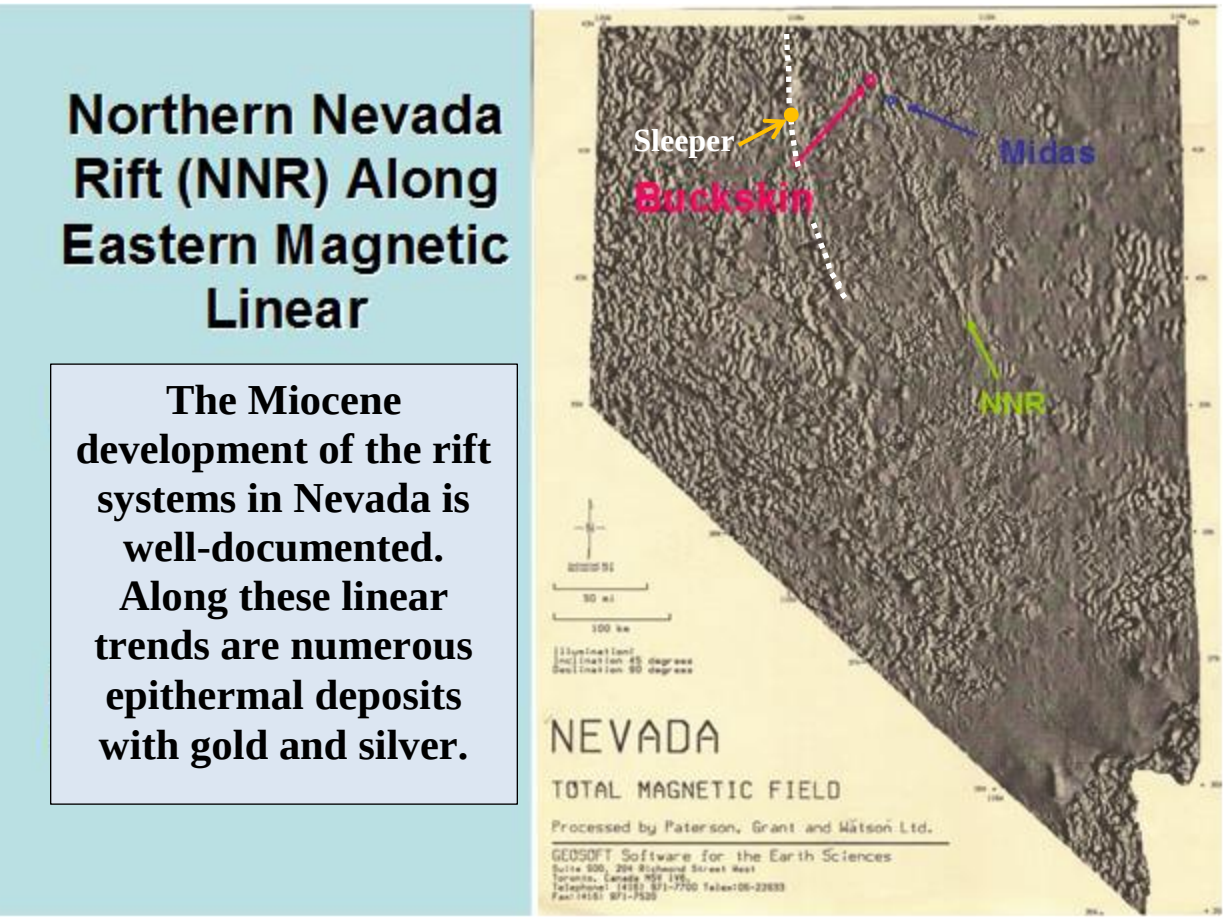

Figure 3. Total magnetic field map of Nevada showing the Northern Nevada Rift (NNR) and position of the Midas and Buckskin (National Mining District) mines. Note the presence of a second magnetic linear west of the NNR; the Sleeper mine and other epithermal deposits are located along this second trend.

The Society of Economic Geologists' publications on Nevada mineral deposits are listed in the following Appendix by the 13 categories indicated above. SEG sources reviewed include *Economic Geology*, SEG Guidebook Series, Reviews in Economic Geology, *SEG Newsletter*, the *Economic Geology 100th Anniversary Volume*, Monographs, and Special Publications.

Appendix: SEG Publications with References to Nevada Mineral Deposits

(arranged chronologically under topic)

Porphyry Deposits

Turner, H.W., 1908, On the Ray mining district, Nevada: Economic Geology, v. 3, p. 538-539, doi:10.2113/gsecongeo.3.6.538

Knopf, A., 1916, Wood tin in the Tertiary rhyolites of northern Nevada: Economic Geology, v. 11, p. 652-661, doi:10.2113/gsecongeo.11.7.652

Boydell, H,C., 1925, Wood tin in the Tertiary rhyolites of northern Nevada (discussion): Economic Geology, v. 20, p. 768-770, doi:10.2113/gsecongeo.20.8.768

Michell, W.D., 1945, Oxidation in a molybdenite deposit, Nye County, Nevada: Economic Geology, v. 40, p. 99-114, doi:10.2113/gsecongeo.40.2.99

Stringham, B.F., 1958, Relationship of ore to porphyry in the Basin and Range Province, U.S.A: Economic Geology, November 1958, v. 53, p. 806-822, doi:10.2113/gsecongeo.53.7.806

Bichan, W.J., 1959, Relationship of ore to porphyry in the Basin and Range Province: Economic Geology, v. 54, p. 329-333, doi:10.2113/gsecongeo.54.2.329

Fournier, R.O., 1967, The porphyry copper deposit exposed in the Liberty open-pit mine near Ely, Nevada; Part 1, Syngenetic Formation: Economic Geology, v. 62, p. 57-81, doi:10.2113/gsecongeo.62.1.57

Fournier, R.O., 1967, The porphyry copper deposit exposed in the Liberty open-pit mine near Ely, Nevada; Part 2, The formation of hydrothermal alteration zones: Economic Geology, v. 62, p. 207-227, doi:10.2113/gsecongeo.62.2.207

McDowell, F.W., and Kulp, J.L., 1967, Age of intrusion and ore deposition in the Robinson mining district of Nevada: Economic Geology, v. 62, p. 905-909, doi:10.2113/gsecongeo.62.7.905

Nash, J.T., and Theodore, T.G., 1971, Ore fluids in the porphyry copper deposit at Copper Canyon, Nevada: Economic Geology, v. 66, p. 385-399, doi:10.2113/gsecongeo.66.3.385

Clark, K.F., 1972Stockwork molybdenum deposits in the Western Cordillera of North America: Economic Geology, v. 67, p. 731-758, doi:10.2113/gsecongeo.67.6.731

Nash, T.N., 1973, Geochemical and fluid zonation at Copper Canyon, Lander County, Nevada: Economic Geology, v. 68, p. 565-570, doi:10.2113/gsecongeo.68.4.565

Silberman, M.L., Berger, B.R., and Koski, R.A., 1974, K-Ar Age Relations of Granodiorite Emplacement and Tungsten and Gold Mineralization near the Getchell Mine, Humboldt County, Nevada: Economic Geology, v. 69, p. 646-656, doi:10.2113/gsecongeo.69.5.646

Joralemon, P., 1975, K-Ar relations of granodiorite emplacement and tungsten and gold mineralization near the Getchell Mine, Humboldt County, Nevada [discussion]: Economic Geology, v. 70, p. 405-406, doi:10.2113/gsecongeo.70.2.405

Berger, B.R., Silberman, M.L., and Koski, R.A., 1975, K-Ar relations of granodiorite emplacement and tungsten and gold mineralization near the Getchell Mine, Humboldt County, Nevada: Economic Geology, 70, p. 1487-1491, doi:10.2113/gsecongeo.70.8.1487

James, L.P., 1976, Zoned alteration in limestone at porphyry copper deposits, Ely, Nevada: Economic Geology, v. 71, p. 488-512, doi:10.2113/gsecongeo.71.2.488

Batchelder, J., 1977, Light stable isotope and fluid inclusion study of the porphyry copper deposit at Copper Canyon, Nevada: Economic Geology, v. 72, p. 60-70, doi:10.2113/gsecongeo.72.1.60

Westra, G., 1982, Alteration and mineralization in the Ruth porphyry copper deposit near Ely, Nevada: Economic Geology, v. 77, p. 950-970, doi:10.2113/gsecongeo.77.4.950

Burt, D.M., Sheridan, M.F., Bikun, J.V., and Christiansen, E.H., 1982, Topaz rhyolites; distribution, origin, and significance for exploration: Economic Geology, v. 77, p. 1818-1836, doi:10.2113/gsecongeo.77.8.1818

Carten, R.B., 1986, Sodium-calcium metasomatism; chemical, temporal, and spatial relationships at the Yerington, Nevada, porphyry copper deposit: Economic Geology, v. 81, p. 1495-1519, doi:10.2113/gsecongeo.81.6.1495

Dilles, J.H., 1987, Petrology of the Yerington batholith, Nevada; Evidence for evolution of porphyry copper ore fluids: Economic Geology, v. 82, p. 1750-1789, doi:10.2113/gsecongeo.82.7.1750

Davies, J.F., 1989, Some temporal-spatial aspects of North American porphyry deposits: Economic Geology, v. 84, p. 2300-2306, doi:10.2113/gsecongeo.84.8.2300

Dilles, J.H., Solomon, G.C., Taylor, H.P., and Einaudi, M.T., 1992, Oxygen and hydrogen isotope characteristics of hydrothermal alteration at the Ann-Mason porphyry copper deposit, Yerington, Nevada: Economic Geology, v. 87, p. 44-63, doi:10.2113/gsecongeo.87.1.44

Dilles, J.H., and Einaudi, M.T., 1992, Wall-rock alteration and hydrothermal flow paths about the Ann-Mason porphyry copper deposit, Nevada; a 6-km vertical reconstruction: Economic Geology, v. 87, p. 1963-2001, doi:10.2113/gsecongeo.87.8.1963

Kizis, Jr., J.A., Bruff, S.R., Christ, E.M., Mough, D.C., and Vaughan, R.G., 1997, Empirical geologic modeling in intrusion-related gold exploration: An example from the Buffalo Valley area, northern Nevada, SEG Newsletter no. 30.

Dilles, J.H., Barton, M.D., Johnson, D.A., Proffett, J.M., and Einaudi, M.T. eds., 2000, Part I. Contrasting styles of intrusion-associated hydrothermal systems: SEG Guidebook Series v. 32, p. 1-162.

Carlin-type Deposits

Joralemon, P., 1951, The occurrence of gold at the Getchell Mine, Nevada: Economic Geology, v. 46, p. 267-310, doi:10.2113/gsecongeo.46.3.267

Wells, J.D., Stoiser, L.R., and Elliott, J.E., 1969, Geology and geochemistry of the Cortez gold deposit, Nevada: Economic Geology, v. 64, p. 526-537, doi:10.2113/gsecongeo.64.5.526

Radtke, A.R., and Scheiner, B.J., 1970, Studies of hydrothermal gold deposition, Part 1, Carlin gold deposit, Nevada, the role of carbonaceous materials in gold deposition: Economic Geology, v. 65, p. 87-102, doi:10.2113/gsecongeo.65.2.87

Radtke, A.S., Rye, R.O., and Dickson, F.W., 1980, Geology and stable isotope studies of the Carlin gold deposit, Nevada: Economic Geology, v. 75, p. 641-672, doi:10.2113/gsecongeo.75.5.641

Bagby, W.C., and Berger, B.R., 1985, Geologic characteristics of sediment-hosted, disseminated precious-metal deposits in the western United States: Reviews in Economic Geology, v. 2, p. 169-202.

Mehrtens, M.B., 1987, Case history and problem 1: The Tonkin Springs gold mining district, Nevada, U.S.A.: Reviews in Economic Geology, v. 3, p. 129-134.

Cunningham, C.G., Ashley, R.P., Chou, I-M., Zushu, H., Chaoyuan, W., and Wenkang, Li, 1988, Newly discovered sedimentary rock-hosted disseminated gold deposits in the People's Republic of China: Economic Geology, v. 83, p. 1462-1467, doi:10.2113/gsecongeo.83.7.1462

Bakken, B.M., Hochella, M.F., Marshall, A.F., and Turner, A.M., 1989, High-resolution microscopy of gold in unoxidized ore from the Carlin mine, Nevada: Economic Geology, v. 84, p. 171-179, doi:10.2113/gsecongeo.84.1.171

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Arehart, G.B., Foland, K.A., Naeser, C.W., and Kesler, S.E., 1993, $^{40}Ar/^{39}Ar$, K/Ar, and fission track geochronology of sediment-hosted disseminated gold deposits at Post-Betze, Carlin trend, northeastern Nevada: Economic Geology, v. 88, p. 622-646, doi:10.2113/gsecongeo.88.3.622

Christensen, O.D., ed., 1993, Gold deposits of the Carlin trend, Nevada: SEG Guidebook Series, v. 18, 102 p.

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Ilchik, R.P., 1995, $^{40}Ar/^{39}Ar$, K/Ar, and fission track geochronology of sediment-hosted disseminated gold deposits at Post-Betze, Carlin Trend, northeastern Nevada; Discussion: Economic Geology, v. 90, p. 208-210, doi:10.2113/gsecongeo.90.1.208

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Ilchik, R.P., and Barton, M.D., 1997, An amagmatic origin of Carlin-type gold deposits: Economic Geology, v. 92, p. 269-288, doi:10.2113/gsecongeo.92.3.269

Vikre, P., Thompson, T.B., Bettles, K., Christensen, O., and Parratt, R., eds., 1997, Carlin-type gold deposits field conference: SEG Guidebook Series, v. 28, 287 p.

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Teal, L., and Jackson, M., 1997, Geologic overview of the Carlin trend gold deposits and descriptions of recent deep discoveries: SEG Newsletter, no. 31, p. 1, 13-25.

Kizis, Jr., J.A., Bruff, S.R., Christ, E.M., Mough, D.C., and Vaughan, R.G., 1997, Empirical geologic modeling in intrusion-related gold exploration: An example from the Buffalo Valley area, northern Nevada: SEG Newsletter, no. 30, p. 1, 6-13.

Stenger, D.P., Kesler, S.E., Peltonen, D.R., and Tapper, C.J., 1998, Deposition of gold in Carlin-type deposits; the role of sulfidation and decarbonation at Twin Creeks, Nevada: Economic Geology, v. 93, p. 201-215, doi:10.2113/gsecongeo.93.2.201

Simon, G., Kesler, S.E., and Chryssoulis, S., 1999, Geochemistry and textures of gold-bearing arsenian pyrite, Twin Creeks, Nevada; implications for deposition of gold in Carlin-type deposits: Economic Geology, v. 94, p. 405-421, doi:10.2113/gsecongeo.94.3.405

Hofstra, A.H., Snee, L.W., Rye, R.O., Folger, H.W., Phinisey, J.D., Loranger, R.J., Dahl, A.R., Naeser, C.W., Stein, H.J., and Lewchuk, M.T., 1999, Age constraints on Jerritt Canyon and other Carlin-type gold deposits in the Western United States; relationship to mid-Tertiary extension and magmatism: Economic Geology, v. 94, p. 769-802, doi:10.2113/gsecongeo.94.6.769

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Emsbo, P., 2000, Gold in Sedex deposits: Reviews in Economic Geology, v.13, p. 427–438.

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Ressel, M.W., Noble, D.C., Henry, C.D., and Trudel, W.S., 2000, Dike-hosted ores of the Beast deposit and the importance of Eocene magmatism in gold mineralization of the Carlin trend, Nevada: Economic Geology, v. 95, p. 1417-1444, doi:10.2113/gsecongeo.95.7.1417

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Hall, C.M., Kesler, S.E., Simon, G., and Fortuna, J., 2000, Overlapping Cretaceous and Eocene alteration, Twin Creeks Carlin-type deposit, Nevada: Economic Geology, v. 95, p. 1739-1752, doi:10.2113/gsecongeo.95.8.1739

Cline, J.S., 2001, Timing of gold and arsenic sulfide mineral deposition at the Getchell Carlin-type gold deposit, north-central Nevada: Economic Geology, v. 96, p. 75-89, doi: 10.2113/gsecongeo.96.1.75

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Groff, J.A., Campbell, A.R., and Norman, D.I., 2002, An evaluation of fluid inclusion microthermometric data for orpiment-realgar-calcite-barite-gold mineralization at the Betze and Carlin mines, Nevada: Economic Geology, v. 97, p. 1341-1346, doi:10.2113/gsecongeo.97.6.1341

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Peters, S.G., Armstrong, A.K., Harris, A.G., Oscarson, R.L., and Noble, P.J., 2003, Biostratigraphy and structure of Paleozoic host rocks and their relationship to Carlin-type gold deposits in the Jerritt Canyon mining district, Nevada: Economic Geology, v. 98, p. 317-337, doi:10.2113/gsecongeo.98.2.317

Hofstra, A.H., John, D.A., and Theodore, T.G., 2003, A special issue devoted to gold deposits in northern Nevada: Part 2. Carlin-type deposits: Economic Geology, v. 98, p. 1063-1067, doi:10.2113/gsecongeo.98.6.1063

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Kesler, S.E., J Fortuna, Ye, J.Z., Alt, J.C., Core, D.P., Zohar, P., Borhauer, J., and Chryssoulis, S.L., 2003, Evaluation of the role of sulfidation in deposition of gold, Screamer section of the Betze-Post Carlin-type deposit, Nevada: Economic Geology, v. 98, p. 1137-1157, doi:10.2113/gsecongeo.98.6.1137

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Johnston, M.K., and Ressel, M.W., 2004, Controversies on the origin of world-class gold deposits, Pt. I: Carlin-type gold deposits in Nevada, II. Carlin-type and distal disseminated Au-Ag deposits: Related distal expressions of Eocene intrusive centers in north-central Nevada: SEG Newsletter, no. 59, p. 12-14.

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