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Supplement to

Carlin-Type Gold Deposits in Nevada: Critical Geologic Characteristics and Viable Models

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APPENDIX

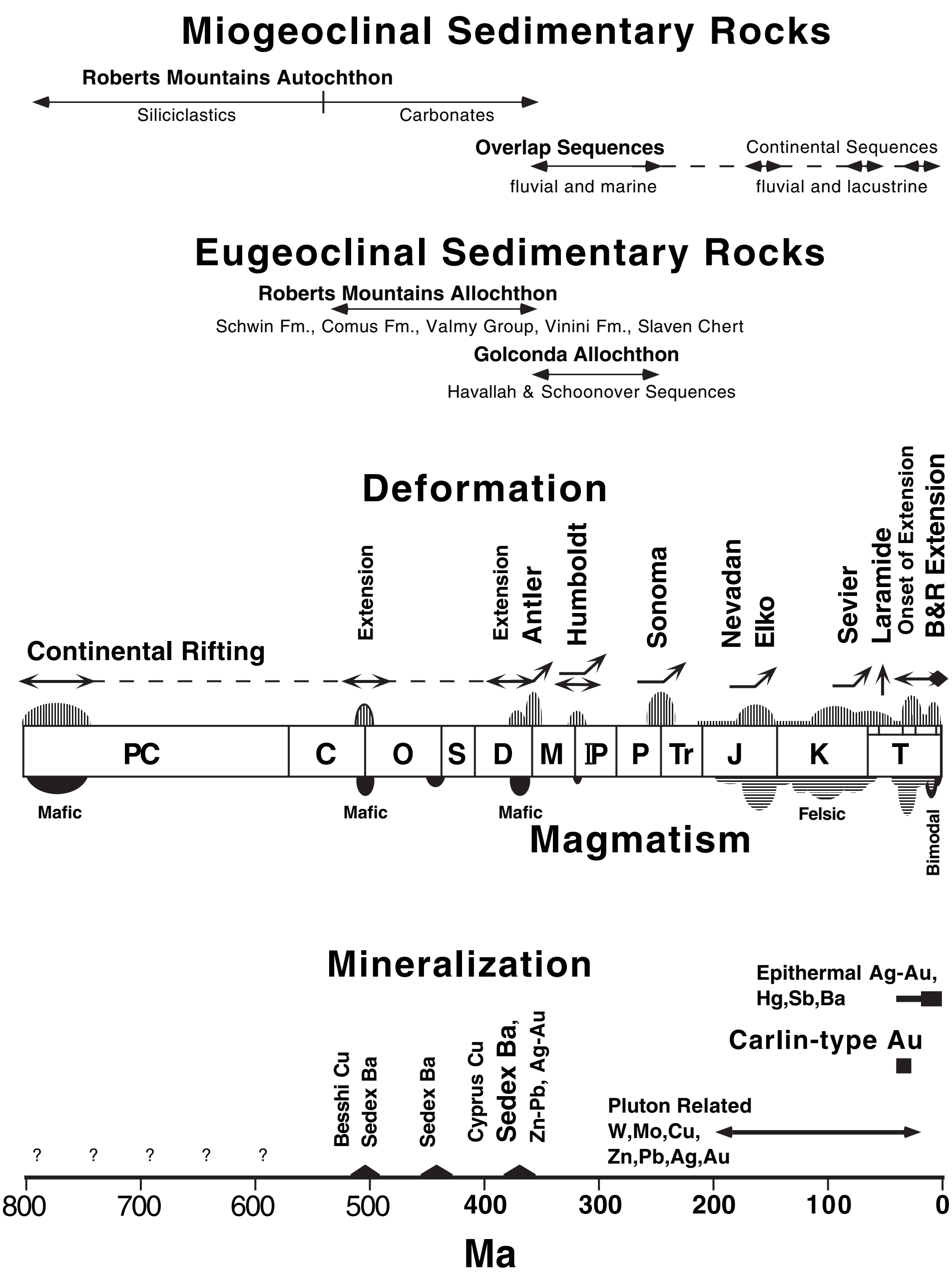

Fig. A1. Summary of the tectonic history of western North America with an emphasis on northern Nevada and northwest Utah. Adapted from Burchfiel et al. (1992), Barton (1996), Emsbo et al. (1999), and John et al. (1999). See text for further description (from Hofstra and Cline, 2000).

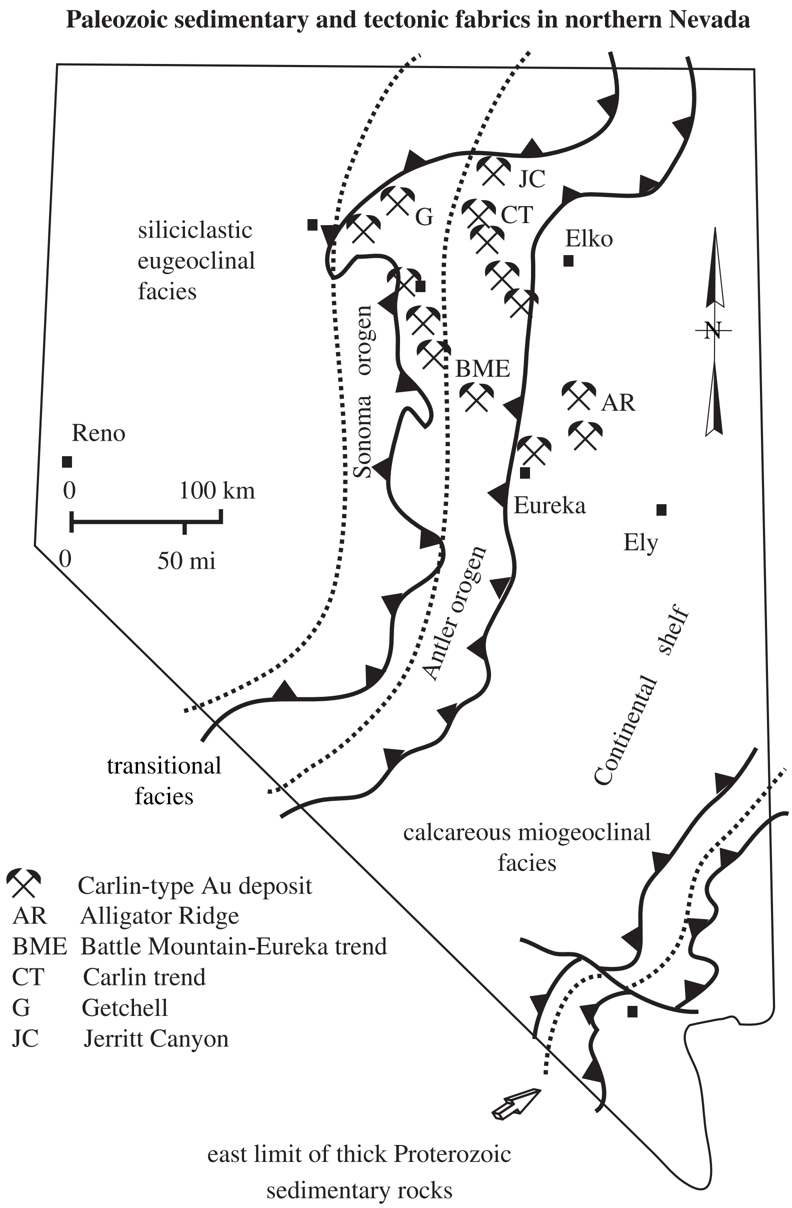

FIG. A2. Illustration of spatial relationships between Carlin-type gold deposits and the Antler and Sonoma orogens, which produced the Roberts Mountains and Golconda allochthons, respectively.

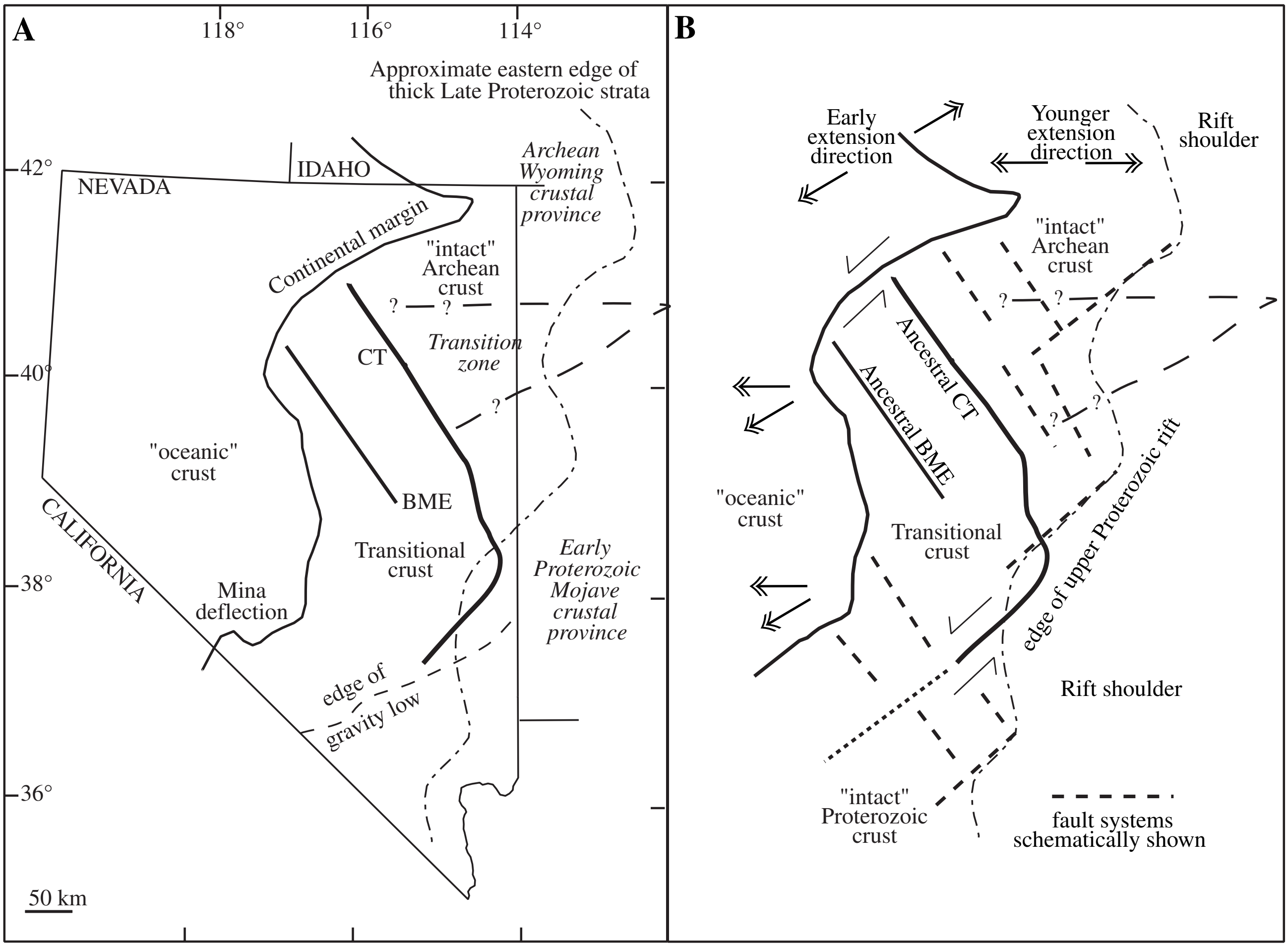

Fig. A3. a. Present-day distribution of continental margin, Carlin trend (CT) and Battle Mountain-Eureka trend (BME) and their relationship to Archean and Proterozoic crustal blocks. Also shown is the edge of thick Neoproterozoic and Cambrian clastic strata deposited during the rifting stage (Stewart, 1980; Levy and Christie-Blick, 1989). The contact between the Archean and Proterozoic crustal domains is well defined in the Cheyenne belt in Wyoming but becomes more diffuse westward into Nevada where it is poorly exposed in outcrop and only mapped using Pb isotope data for Mesozoic and Eocene igneous rocks (Tosdal et al., 2000). Lead isotope data (Castor et al., 2003) detects the presence of Archean rocks only as far west as the Tuscarora Mountains, immediately north of the northern Carlin trend. Geochronologic data from the Ruby Mountains indicates the presence of Archean rocks much farther south than indicated by Pb isotope data from Mesozoic and Eocene plutons (Lush et al, 1988; Berger et al., 2000). b. Interpreted basement fault geometry derived from Pb and Sr isotope mapping of Mesozoic and early Tertiary plutons. Direction of Neoproterozoic rifting inferred from geologic data on the continent is included. Adapted from Tosdal et al. (2000, and references therein).

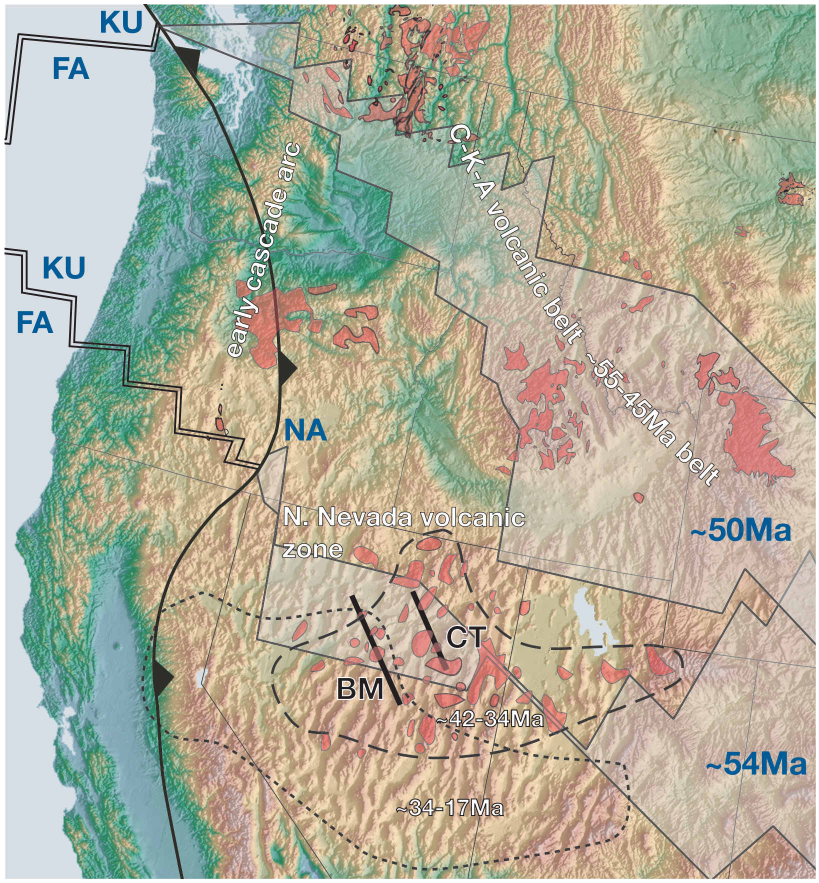

FIG. A4. Shaded relief map of western North America, showing the location of Paleogene igneous complexes and the position of the slab window (opaque areas between jagged lines) between the Farallon (FA) and Kula (KU) plates at 54 and 50 Ma (modified from Stewart and Carlson, 1978; Gans et al., 1989; Henry and Ressel, 2000; Breitsprecher et al., 2003; Dostal et al., 2003). From the Late Cretaceous to ~middle Eocene, the Farallon and Kula plates were spreading apart while subducting beneath North America (NA). The resulting slab window is thought to have passed northward under Nevada by ~54 Ma (Breitsprecher et al., 2003). The Farallon plate is thought to have a "flat-slab" geometry hugging the base of western North America as far east as Colorado, being responsible for the lack of Upper Cretaceous-Paleocene magmatism in the western Cordillera and the development of basement-involved thrusts of the Laramide deformation in the eastern Cordillera (Dickinson and Snyder, 1978; Christiansen and Yeats, 1992). In the early Eocene, high K calc-alkaline to ultrapotassic alkaline plus minor adakite magmatism initiated in the broadly coeval ~55 to 45 Ma Kamloops-Challis-Absaroka (C-K-A) volcanic belts of southern British Columbia, western Washington, Idaho, and Wyoming (Breitsprecher et al., 2003). Magmatism was probably linked to high heat flow in the widening FA-KU slab window (Breitsprecher et al., 2003; Dostal et al., 2003). Volcanic deposits in Oregon suggest that Cascade forearc volcanism was also active from the early Eocene. High K calc-alkaline magmatism within the northern Great Basin area of Nevada and Utah initiated at ~42 Ma and swept southward with time, culminating in Oligocene-Miocene volcanic activity in central Nevada (dashed and dotted lines show approximate distribution of ~42–34 and ~34–17 Ma magmatism; Stewart and Carlson, 1978; Armstrong and Ward, 1991; Brooks et al., 1995; Mueller et al., 1999; Henry and Ressel, 2000; Gans et al., 2001; Rahl et al., 2002). The initiation and southward younging of calc-alkaline magmatic activity is thought to represent the progressive removal of the northern margin of the Farallon plate from the base of the overriding North American lithosphere, bringing the asthenosphere into contact with the base of the North American lithosphere. Factors likely to have been responsible for the removal include reduction in the rate of relative plate convergence and, possibly, melting of the buoyant edge of the Farallon plate at the boundary of the slab window. Carlin-type deposits in northern Nevada are spatially and temporally associated with the Eocene magmatism at a regional scale. BM = Battle Mountain-Eureka trend; CT = Carlin trend.

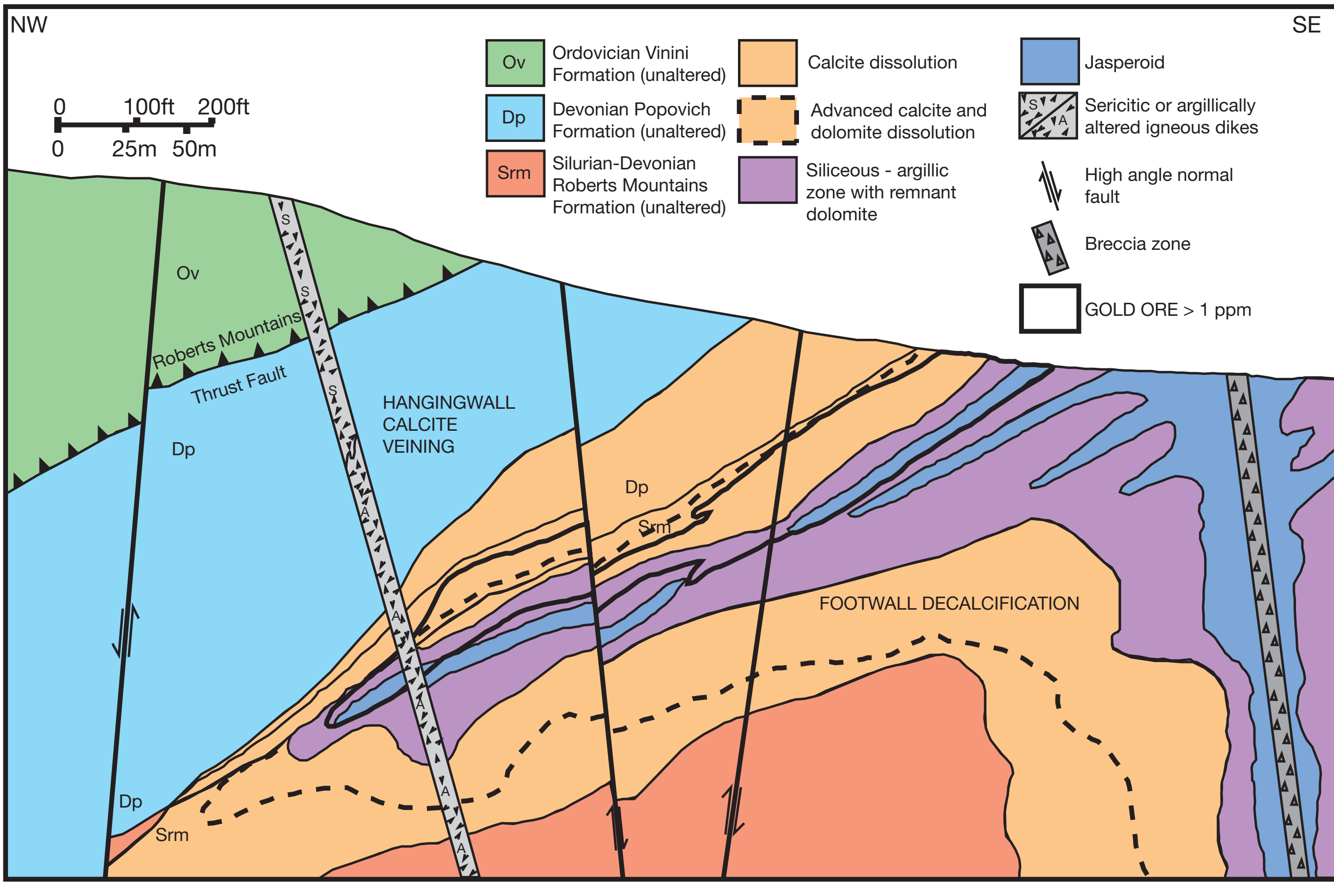

Fig. A5. Cross section through ore zone, illustrating spatial relationship between ore zone and alteration assemblages at the Carlin deposit. See text for discussion. Modified from Kuehn and Rose (1992).

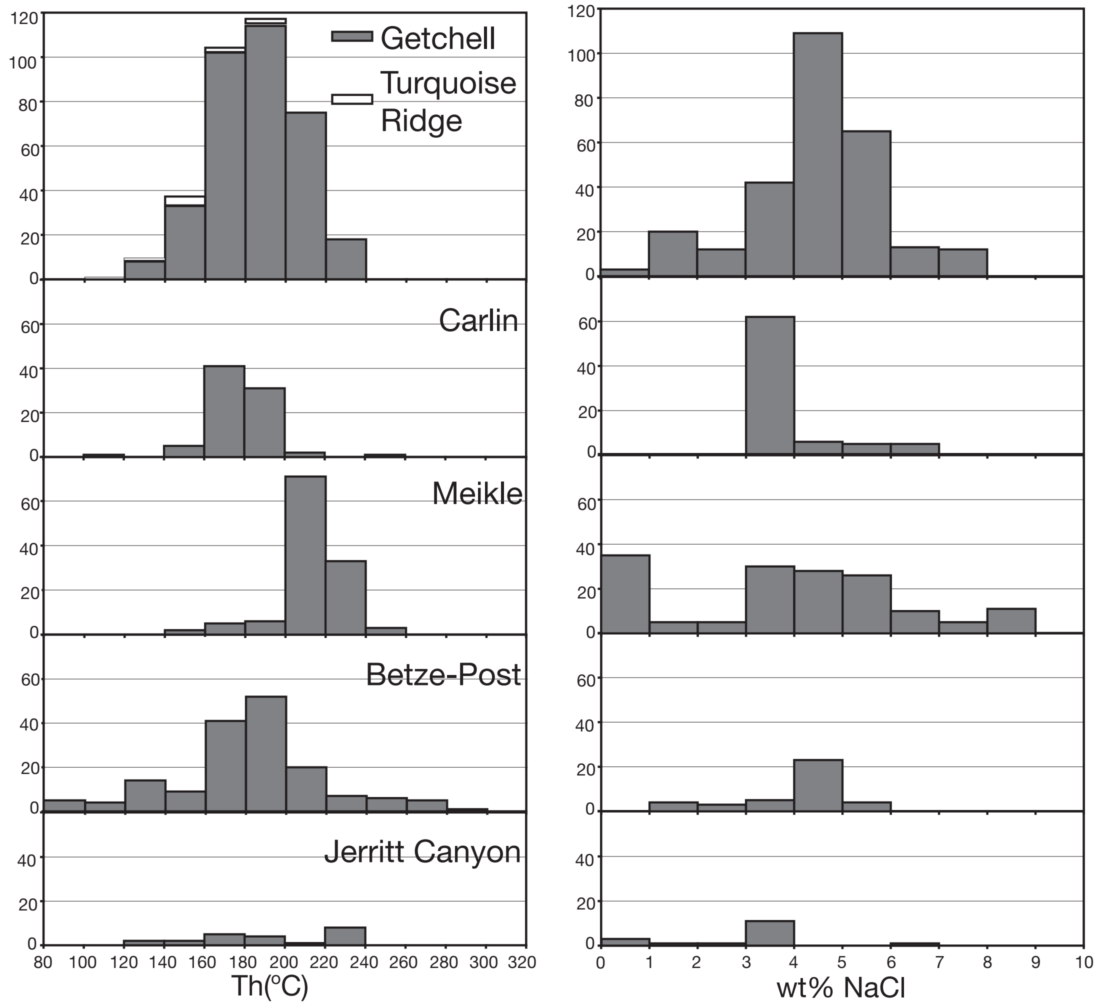

FIG. A6. Fluid inclusion homogenization temperatures and salinities for inclusions in ore-stage quartz, determined at the Getchell (Cline and Hofstra, 2000), Turquoise Ridge (Shigehiro, 1999), Carlin (Kuehn and Rose, 1995), Jerritt Canyon (Hofstra, 1994), Meikle (Lamb, 1995), and Betze-Post (Lubben, 2004) deposits.

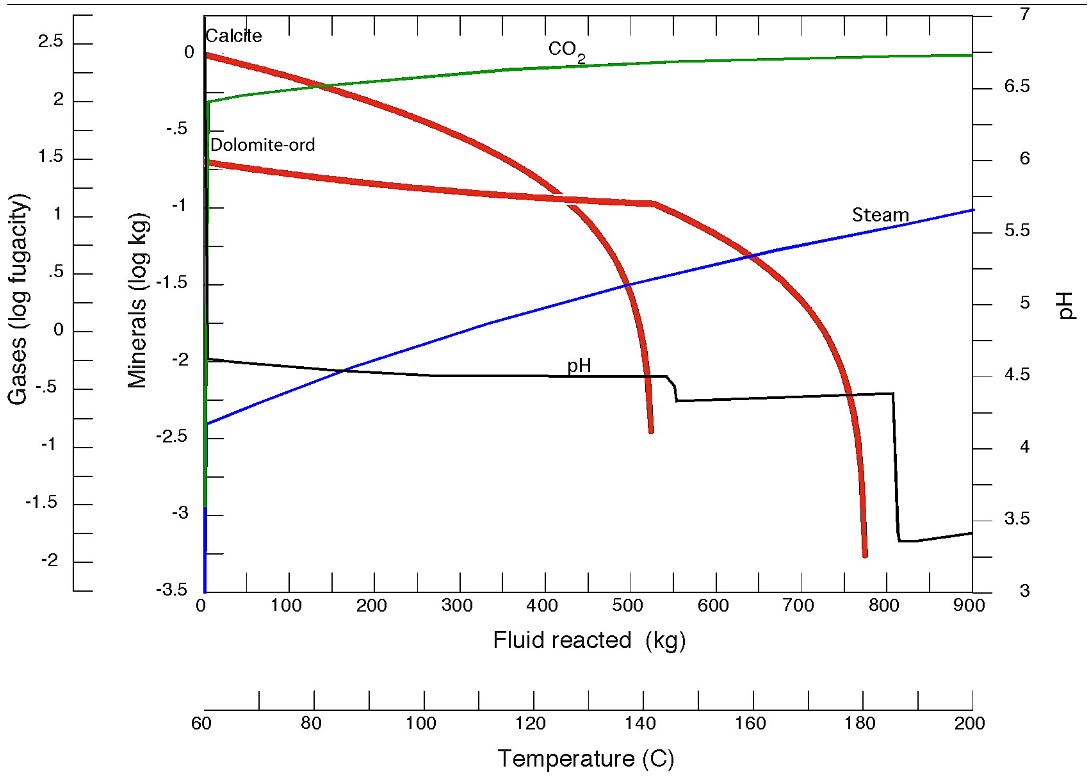

FIG. A7. Numerical model illustrating amount of hydrothermal fluid needed to dissolve 1 kg of calcite and 0.2 kg of dolomite. Model shows how pH varies and the fugacity of steam and CO_2 generated during the reaction. See text for discussion.

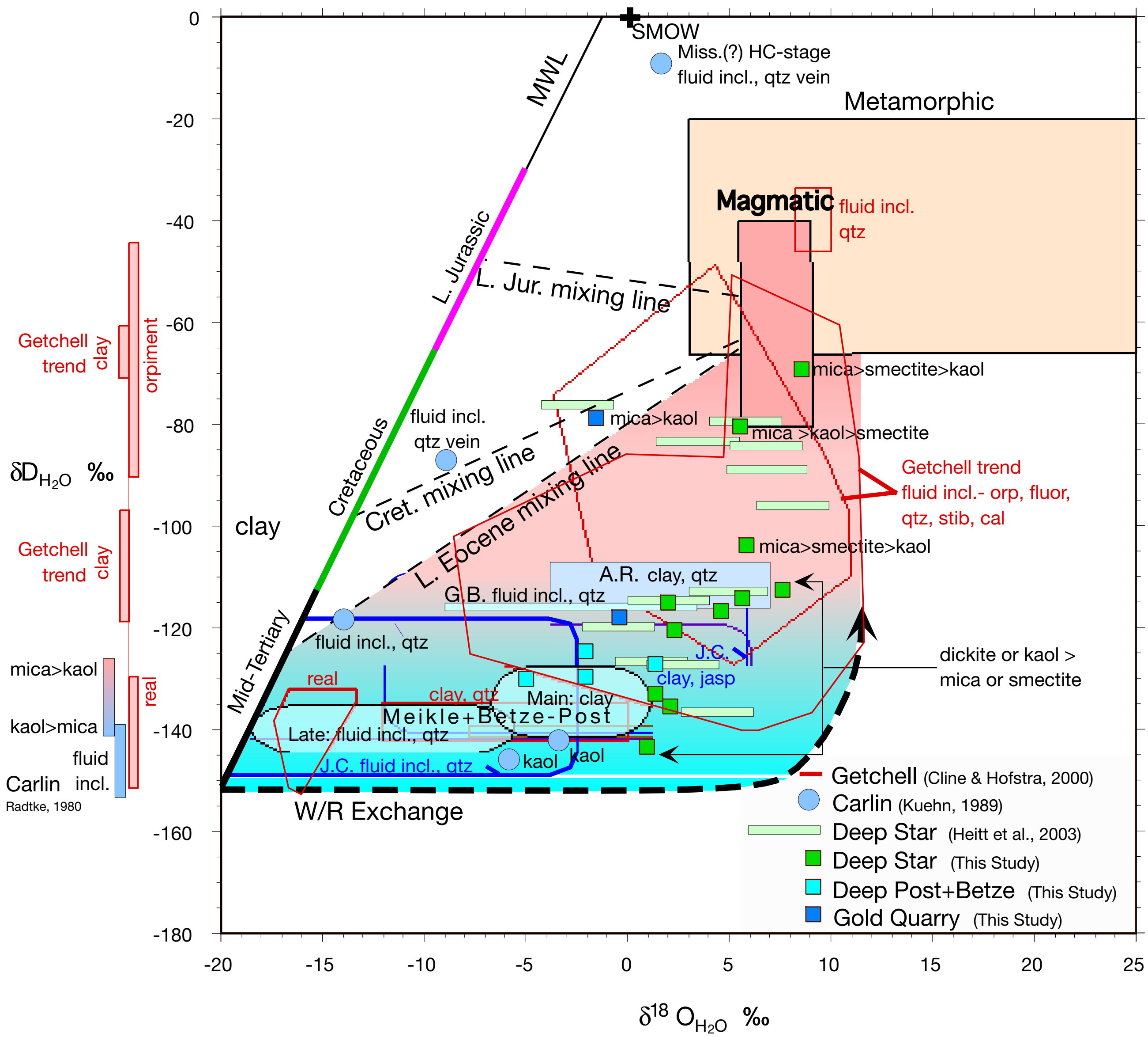

FIG. A8. Hydrogen and O isotope compositions of hydrothermal fluids based on new and published data relative to traditional references (meteoric water line and the fields for magmatic and metamorphic water). The approximate ranges for mid-Tertiary, Cretaceous, and Late Jurassic meteoric water are from Hofstra et al. (1999). New δD_{H_2O} and $\delta^{18}O D_{H_2O}$ values on clay minerals from Gold Quarry (blue squares), Deep Star (green squares), Deep Post and Betze (light blue squares) are shown relative to published values from Carlin (blue circles, Kuehn, 1989), Deep Star (green rectangles, Heitt et al., 2003), Meikle and Betze-Post (light blue elipse, Emsbo et al., 2003). The δDD_{H_2O} and $\delta^{18}OD_{H_2O}$ values of fluid inclusions in late ore-stage sulfides and drusy quartz from Meikle and Betze-Post (blue elipse, Emsbo, et al., 2003) and the δDD_{H_2O} values of fluid inclusions and mixtures of white mica and kaolinite from Carlin (rectangles near the vertical axis, Radtke et al. (1980) are also shown. The samples with higher δDD_{H_2O} values contain a greater proportion of white mica and smectite and the samples with more dickite or kaolinite have lower δDD_{H_2O} values. Fluid inclusions also have uniformly low δDD_{H_2O} values. See text for further discussion. Abbreviations: A.R. = Alligator Ridge, cal = calcite, Cret = Cretaceous, f.i. = fluid inclusion, fluid incl. = fluid inclusion, fluor = fluorite, G.B. = Gold Bar, HC = hydrocarbon, J.C. = Jerritt Canyon, jasp = jasperoid, kaol = kaolinite, L. Jur. = Late Jurassic, MWL = meteoric water line, orp = orpiment, qtz = quartz, real = realgar, stib = stibnite, W/R = water rock.

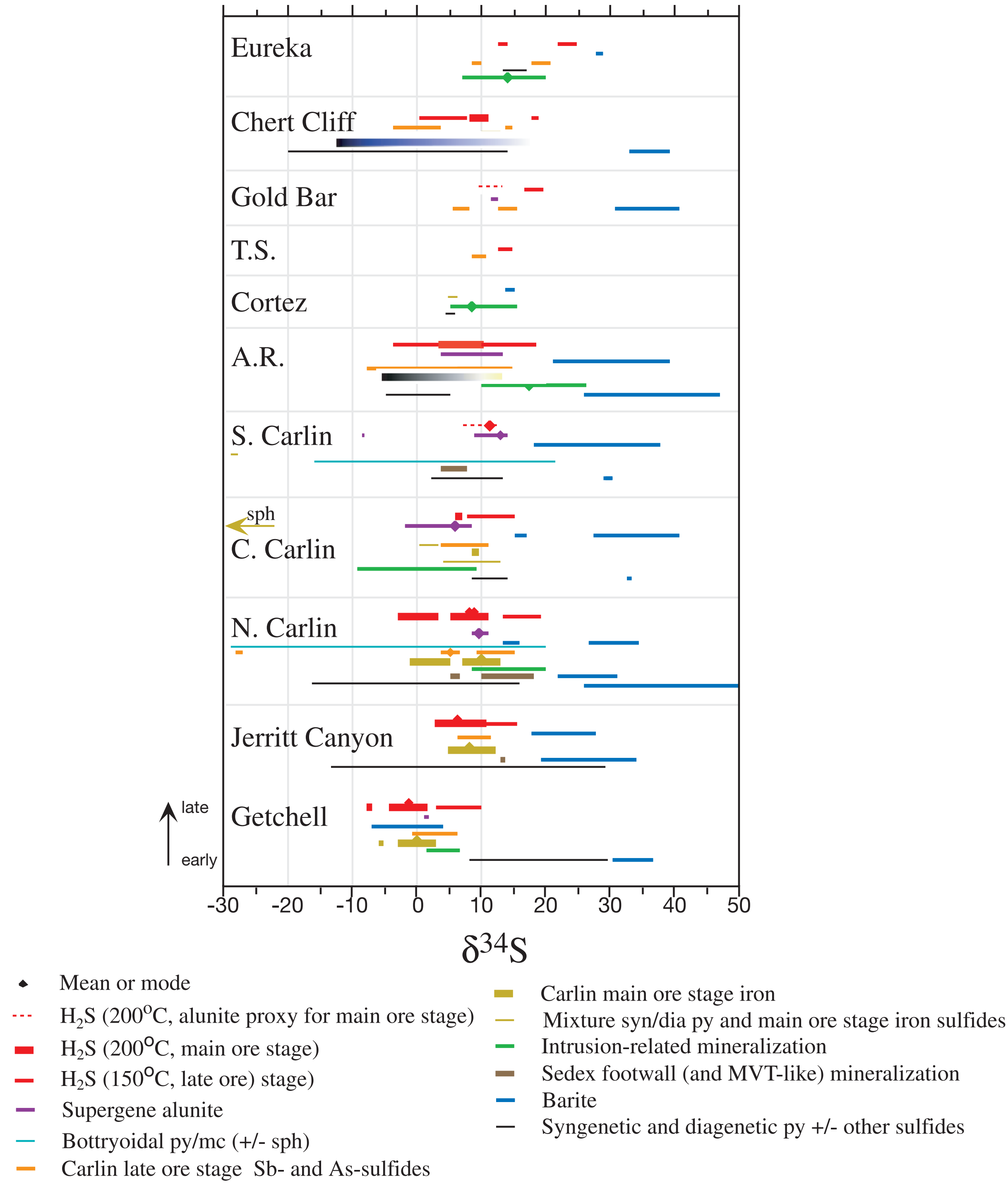

FIG. A9. Sulfur isotopes of sulfide minerals, barite, alunite, and H_2S in ore fluids in each district based on data compiled in Table A2. Data range bars of Carlin-type ore minerals are portrayed relative to those for pre- and postore minerals, using different colors (see key) from early (bottom) to late (top) in the paragenesis for each district. Lines showing color gradation represent samples that were a mixture of pyrite types and colors reflect the amount of types present. The $\delta^{34}S_{H_2S}$ range bars were calculated using fractionation factors for pyrite H_2S at 200°C and stibnite H_2S at 150°C (Ohmoto and Rye, 1979); the temperatures based on typical fluid inclusion homogenization temperatures of main- and late ore-stage minerals (Hofstra and Cline, 2000). The pyrite H_2S fractionation factor was applied to marcasite and arsenopyrite and the stibnite H_2S fractionation factor was applied to orpiment and realgar as per Hofstra (1997). The pyrite H_2S fractionation factor was also applied to supergene alunite, which can be a proxy for main ore-stage iron sulfides. If the iron sulfide and Sb or As sulfide minerals were deposited from the same fluid at 200° and 150°C, respectively, their $\delta^{34}S$ values would differ by 6 per mil. Abbreviations: A.R. = Alligator Ridge, dia = diagenetic, mc = marcasite, py = pyrite, sph =phalerite, syn = syngenetic, T.S. = Tonkin Springs.

TABLE A1. Geologic History of Districts Containing Carlin-Type Au Deposits

Districts/ subdivisions/deposits	Physiographic location	Age of Carlin-type mineralization	Relationship of mineralization to magmatism
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Tuscarora Mountains	Late Eocene: after (± during) emplacement of 40.1-37.3 Ma dikes; late ore-stage galkhaite Rb/Sr age of 39.8 ± 0.6 Ma [Rodeo], mean pooled AFT age of 37.3 ± 1.5 Ma [Carlin, Post/Betze]; West Leeville-Carlin within zone of broad apatite resetting; Beast to Goldstrike within narrow zone of resetting along Gen and Post fault; 37-40 Ma dikes host gold; mineralization before fresh biotite and postmineral rhyolite (38.05 ± 0.09 Ma, 38.98 ± 0.26 Ma, [Deep Star], and after premineral altered dikes: 39.67 ± 0.21 Ma, Ar-Ar, [Deep Star]; 40.1 ± 0.3, [Genesis]; 39.21 ± 0.3, [Griffin]; 39.3 ± 0.8 Ma [Post-Betze]; 37.31 ± 0.14 Ma [Beast], and 37.64 ± 0.21 Ma [Dee]	Immediately following and/or during southward sweeping calcalkaline magmatism related to delamination; close temporal (pre- and postmineral dikes) and spatial relationship to numerous Eocene dikes (37-40 Ma) ranging in composition from basalt to rhyolite
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Tuscarora Mountains	Late Eocene based on a pooled AFT age of 37.9 ± 4.1 Ma and similarity to dated deposits further north; younger than Early Cretaceous (K-Ar 111-107 Ma) intrusion-related potassic alteration and mineralization; older than Oligocene (K-Ar 30-26 Ma) supergene alunite	Immediately following and/or during southward sweeping calcalkaline magmatism; late Eocene Emigrant Pass volcanic field (35.9-37.8 Ma, Ar-Ar) is ~3-4 km to the southwest; Welches Canyon diorite stock (37.2-38.3 Ma, Ar-Ar) is 2 km to the west
South Carlin trend - Rain subdistrict (Rain, Emigrant)	Northern Pinon range	Late Eocene: older than 22 Ma supergene alunite; younger than 37.5 ± 0.8 Ma monzonite dike [Emigrant Springs] and 38.89 ± 0.20 Ma biotite dike [Saddle] and 33-36 Ma Bullion stock and related? rhyolite porphyry dikes [Railroad], hydrothermal AFT age of 31.7 ± 10.3 Ma	Immediately following and/or during southward-sweeping calc-alkaline magmatism; Eocene dikes at Saddle and Emigrant
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Shoshone and Cortez ranges	Gold mineralization at Cortez pits likely predates 35.2 Ma quartz porphyry dikes, U-Pb; the dikes are apparently "barren" of gold but have smectite(?)-altered margins	Tenabo granodiorite stock, 39-37 Ma K-Ar, 5 km N of Pipeline, Au-bearing skarn (5:1 Ag:Au) and quartz-base metal sulfide veins (20:1 Ag:Au) associated with sericitic alteration; similar mineralization associated with Eocene intrusions to the northwest at Hilltop
Tonkin Springs deposit-Battle Mountain-Eureka trend	Simpson Park range	May be younger than altered rhyolite tuff dated at 37.5 ± 0.4 Ma (K-Ar); older than unaltered andesite flow dated at 33.4 ± 2.6 Ma (K-Ar)	Several postmineral magmatic centers
Chert Cliff Resource-Battle Mountain-Eureka trend	Roberts Mountains	>33.9 Ma; unmineralized 33.9 Ma dacite dome intrudes Au mineralization in Webb similar to Chert Cliff Au mineralization, 8000' to NE, K-Ar, biot; unmineralized gabbro dikes cut mineralization, 17.6 my, K-Ar, whole rock	
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Roberts Mountains	Late Eocene?; poorly constrained, older than unaltered 24.7 Ma rhyolitic welded tuff	Approximately contemporaneous with regional magmatism; dikes and other geologic or geophysical evidence for a magmatic center are absent
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Fish Creek range	Not well constrained. May be younger than ~35-38 Ma Ratto Springs rhydacite dikes and older than block and ash deposits of the Ratto Springs rhyodacite (~37.8 Ma K-Ar [Lookout Mtn]) that unconformably overlies jasperoid and disseminated gold mineralization at Ratto Canyon.	Approximately contemporaneous with local/regional magmatism; late Eocene (postmineral?) dikes and sills
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	NE side of the Osgood Mountains	~39-42 Ma; Rb-Sr on late ore stage galkhaite that contains gold [Getchell]; Ar-Ar on late ore stage adularia associated with orpiment [Twin Creeks]; no paragenetic evidence of major time gap between main gold-bearing arsenian pyrite ore event and later galkhaite and orpiment.	No intrusions of the same age as mineralization have been identified; nearest Eocene igneous rock is 7 km NE of Chimney Creek (38.3 Ma, whole-rock K-Ar, dacite tuff
Jerritt Canyon	Independence range	Late Eocene: younger than 40.8 ± 0.1 Ma basalt dikes (pre-ore, similar dikes are altered and mineralized); lies within zone of Eocene AFT, single grain AFT = 36+8 Ma; δD values of ore fluids are consistent with cool Late Eocene climate.	Approximately contemporaneous with local/regional magmatism; near unmineralized Eocene felsic volcanic rocks and 39.2 Ma quartz monzonite dike; 40.1 Ma basalt is altered
Alligator Ridge	Alligator Ridge, Mooney basin	Late Eocene: after ca. 45 Ma (fossil data) fluvial and lacustrine sedimentary rocks, before 34.99 ± 0.08 Ma, Ar-Ar sanidine on volcanic rocks	Older than 35-34 Ma rhyolite dikes and flows, dacite flows, and volcaniclastic rocks

Table A1. *(Cont.)*

Districts/ subdivisions/deposits	Inferred basement	Evidence for basement faults	Tectonostratigraphic Host Unit -
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Archean or within transitional zone between Archean and Proterozoic basement blocks	Carlin trend along discontinuity in Pb isotopic compositions of Mesozoic and Teritary intrusions (39.7 $^{208}Pb/^{204}Pb$ isopleth) that marks inferred transition from thick Archean basment to the the east and thinned transitional crust to the west	Lower plate to Roberts Mountain thrust (though minor fault hosted gold in upper plate siliciclastic rocks).
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Archean or within transitional zone between Archean and Proterozoic basement blocks	Carlin trend along discontinuity in Pb isotope compositions of Mesozoic and Teritary intrusions (39.7 $^{208}Pb/^{204}Pb$ isopleth) that marks inferred transition from thick Archean basement to the the east and thinned transitional crust to the west	Lower plate to the Roberts Mountain thrust
South Carlin trend - Rain subdistrict (Rain, Emigrant)	Archean or within transitional zone between Archean and Proterozoic basement blocks	Carlin trend along discontinuity in Pb isotopic compositions of Mesozoic and Teritary intrusions (39.7 $^{208}Pb/^{204}Pb$ isopleth) that marks inferred transition from thick Archean-Proterozoic basment to the the northeast and thinned Archean-Proterozoic crust unlerlain by mafic igneous rocks to the southwest	Lower plate to the Roberts Mountain thrust; in triangle zone at toe of Antler fold and thrust belt
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Within transition zone between Archean and Proterozoic basement blocks	NW-trending domain boundaries in Pb and Sr ~20-40 km to the west; Magnetotelluric anomaly (~10 km wide conductive zone extends to ~20 km depth), gradient in basment gravity (although this gradient shows greater correspondence to the northern Nevada rift)	Lower plate to the Roberts Mountain thrust
Tonkin Springs deposit-Battle Mountain-Eureka trend	Archean?? - near Archean-Proterozoic boundary	Magnetotelluric anomaly (~10 km wide conductive zone extends to ~20 km depth)	Upper plate of Roberts Mountain thrust
Chert Cliff Resource-Battle Mountain-Eureka trend	?? - near Archean-Proterozoic boundary		Lower plate to the Roberts Mountain thrust
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Near Archean-Proterozoic boundary	Magnetotelluric anomaly (~10 km wide conductive zone extends to ~20 km depth)	Lower plate to the Roberts Mountain thrust
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Proterozoic?? - near Archean-Proterozoic boundary?		Carbonate shelf just east of Roberts Mountain allochthon
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Near edge of Archean craton	Sr and Pb isotope data suggest NE trending margin of the Precambrian craton in the vicinity of Getchell/Twin Creeks/Pinson; interpreted as major left-lateral transfer zone to rifting continent	Getchell/Rabbit Creek/Pinson in lower plate to Roberts Mountain thrust; Chimney Creek in Antler overlap/lower plate to Golconda thrust (the Roberts Mountain thrust is not as readily identified on the Getchell trend as in other districts)
Jerritt Canyon	Archean or within transitional zone between Archean and Proterozoic basement blocks	Sr and Pb isotope data suggest NE-trending margin of the Precambrian craton in vicinity of Jerritt Canyon; interpreted as major left-lateral transfer zone to rifting continent	Lower plate to the Roberts Mountain thrust.
Alligator Ridge	Proterozoic - near Archean-Proterozoic boundary	A magnetotelluric survey detected a north-striking crustal fault below the district	Carbonate shelf east of Roberts Mountain allochthon.

Table A1. *(Cont.)*

Districts/ subdivisions/deposits	Depositional environment of host rocks
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Shelf-slope margin, Devonian reef and shoal faces [Bootstrap limestone bioherm] deposited on a shallow-water platform [Roberts Mountain-Popovich Fms.]; instability of platform reflected by time-equivalent debris flow breccias [in Popovich Fm.]; overall rise in seawater in Devonian drowned carbonate shelf, culminating in deposition of Rodeo Creek, which represents onset of anoxic basin conditions and likely initial foredeep deposits in front of Roberts Mountain allochthon
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Shelf-slope margin; overall rise in seawater in Devonian drowned carbonate shelf [Roberts Mountain-Popovich Fms.], culminating in deposition of Rodeo Creek, which represents onset of anoxic basin conditions and likely initial foredeep deposits in front of Roberts Mountain allochthon
South Carlin trend - Rain subdistrict (Rain, Emigrant)	Foredeep rocks of Early Mississippian [Webb Fm.] deposited in front of advancing Roberts Mountain allochthon; Webb deposited disconformably on karst surface on top of reefal facies [Devils Gate ls]
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Shelf-slope margin; shallowing up sequence from deep basinal plain facies to just beyond edge of the slope to carbonate shelf [Roberts Mountain to lower Wenban Fms.]; followed by deepening event [mid-Wenban] and input of clastic material (from the Antler highlands?) [Horse Canyon mem] into foreland basin (similar to Rodeo Creek)
Tonkin Springs deposit-Battle Mountain-Eureka trend	Deep water marine
Chert Cliff Resource-Battle Mountain-Eureka trend	Early Mississippian foredeep rocks [Webb Fm.] deposited in front of advancing Roberts Mountain allochthon; Webb deposited disconformably on karst surface on Devonian reefal facies [Devils Gate ls]
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Near shelf slope boundary
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Carbonate shelf?
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Getchell/Rabbit Creek/Pinson: continental slope deposits with local tectonic basins and basaltic volcanic centers. Chimney Creek: small tectonic shallow marine basins
Jerritt Canyon	Shallowing upward of carbonate shelf(?) [Hanson Creek Fm] followed by exposure, erosion and karsting; subsequent deepening event [Roberts Mountain Fm] followed by deposition of foredeep deposits of Roberts Mountain allochthon [Mwpc]
Alligator Ridge	Late Devonian-Early Mississippian foredeep rocks [Pilot sh] deposited on carbonate shelf [Devils Gate ls]

Table A1. *(Cont.)*

Districts/ subdivisions/deposits	Host rocks and stratigraphic ore controls
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	1. Silty dolomitic limestone and limestone breccia that is variably carbonaceous, pyritic, bioturbated, fossiliferous [Roberts Mountain and Popovich Fms.]; 2. Hornfels [Roberts Mountain and Popovich Fms.]; 3. Locally calcareous fine-grained siliciclastic rocks [Rodeo Creek]; 4. Igneous rocks; ore controls include bioturbated and laminated horizons, fossil debris flows, calcarenite interbeds, turbidites, contourites, and lime muds; Betze-Post localized at facies change between Bootstrap ls (shelf facies) and Popovich Fm. (slope facies)
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	1. Silty limestone with bioturbated and wispy texture [Roberts Mountains and Popovich Fms., Main Mike, Tusc, Gold Quarry (Chukar Footwall)]; 2. Silty limestone and calcarenite [Upper Devonian Popovich, Gold Quarry (Deep West) and West Mike (Lower zone)]; 3. Siliceous mudstone, limey siltstone, cherty siltstone, siliceous mudstone [Rodeo Creek unit, Gold Quarry (Main, parts of Deep West, Deep sulfide feeder) Tusc, West Mike (upper zone), and Mac]; 4. Limey mudstone and sandstone at base of Roberts Mountain allochthon [parts of Gold Quarry main]; 5. Less ore in Mesozoic(?) dikes; ore controls include bioturbated rock (wispy texture), turbidites, and calcarenites; Gold Quarry: ore at top of Popovich beneath Rodeo Creek
South Carlin trend - Rain subdistrict (Rain, Emigrant)	1. Thin bedded to finely-laminated calcareous/dolomitic? carbonaceous mudstone and siltstone with minor discontinuous sandstone and conglomerate [Webb Fm. (some question about unit identification)]; 2. Silty limestone [Tripon Pass mem, Webb Fm., Emigrant prospect]; 3. Brecciated micritic limestone [Devil's Gate Fm., Saddle and BJ Hill]; 3. Dolomitic sandstone [Oxyoke Canyon Fm., below Rain (uneconomic)]; 4. Jurassic lamprophyre (tuffisite) dikes; ore controls include breccias in Devils Gate ls below unconformable contact with Webb Fm., marl rocks immediately above reef ls of Devils Gate ls, brecciated Devils Gate ls along fault [Saddle], tuffisite dikes [Rain]
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	1. Interbedded silty limestone and micrite with lessor bioclastic and debris flow limestone [Lower Wenban, parts of Pipeline, Cortez Hills, Gold Acres]; 2. Thinly interbedded silty limestone and black chert that grades upward into thinly laminated calcareous siltstone [Horse Canyon mem, Upper Wenban, bulk of ore at Cortez Hills and Horse Canyon, parts of Pipeline]; 3. Thin-bedded dolomitic silty limestone with pervasive planar laminations [upper Roberts Mountain Formation, bulk of ore at Cortez, Gold Acres; parts of Pipeline]
Tonkin Springs deposit-Battle Mountain-Eureka trend	1. Thin-bedded dirty ls [Telegraph mem, Vinini Fm]; 2. Minor ore in igneous rocks and siliceous cherts, shales and argillites; ore controls include contact of ls with interbedded impermeable clay-altered tuffs and greenstones
Chert Cliff Resource-Battle Mountain-Eureka trend	Calcareous, pyritic, carbonaceous, and dolomitic siltstone [Webb Fm]
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	1. Laminated, thin-bedded, locally carbonaceous, nonfossiliferous, lime mudstone, wackestone, or packstone [Unit 2, upper Denay Fm.]; 2. Thin- to medium-bedded, medium to dark gray, fossiliferous wackestone and packestone [Bartine mem, McColley Canyon Fm.]. 3. Medium- to thin-bedded siltstone and sandstone [Mississippian Webb Fm]; stratigraphic-controlled ore is in unit 2 in the Upper member of the Denay Fm.; lesser structurally controlled ore in the Bartine member of the McColley Canyon Fm; the basal brecciated part of the Mississippian Webb Fm. is silicified and locally mineralized; basal strata-bound jasperoid in unit 1 of Denay Fm
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	1. Thin-medium bedded chert-bearing calcsiltite and calcarenite [upper Goodwin ls (Unit 2)] below shaley ls [Ninemile ls] [Archimedes and numerous prospects in north half of district]; 2. Dunderburg Shale/Hamburg Dolomite contact [Dunderburg sh and ls: Ratto, Windfall, Ratto Canyon, Deep Archimedes]; 3. Thin-bedded platy silty limestone [Windfall Fm., Deep Archimedes]; ore controls include shale over ls contacts [Goodwin/Ninemile], reactive ferroan zebra dolomite [Hamburg], reactive ls [Windfall]
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	1. Thin-bedded carbonaceous, calcareous, pyritic siltstones/shales and silty limestones that are locally metamorphosed [Preble and Comus Fms., Getchell/Rabbit Creek/Pinson]; 2. Medium-bedded, sandy dolomitic pyritic limestone [lower Etchart ls, Valmy basalt, Chimney Creek]; 3. Mafic tuffs and flows [Lower Cambrian to Lower Ordovician Preble-"Comus" Fms., Getchell/Rabbit Creek/Pinson (secondary hosts)]
Jerritt Canyon	1. Rhythmically interbedded, (locally fossiliferous) carbonaceous micrite and calcareous/dolomitic carbonaceous siltstone [Hanson Creek Fm. unit 3]; 2 Carbonaceous, finely laminated platy calcareous/dolomitic siltstone (lower Roberts Mountain Fm.]; 3. Interbedded chert, limestone, dolostone [upper Hanson Creek Fm]; 4. Fine-grained, thin-bedded, locally dolomitic limestone [Hanson Creek Fm.]; 5. Chert, siltstone, argillite [minor, upper plate rocks]; 6. Basalt and andesite [minor]; ore controls include alternating thin beds of micritic limestone and carbonaceous argillaceous, dolomitic, calcareous laminated siltstone, local debris flows and bioclastic horizons
Alligator Ridge	1. Carbonaceous, dolomitic siltstone and silty limestone major host [Pilot sh]; 2. Micritic ls [Guilmete Fm.], secondary host; 3. Late Jurassic felsic dike hosts some ore [Horseshoe deposit]; 4. Cherty crinoidal limestone [Joanna ls, Winrock deposit]; ore controls include sh/ls contact

Table A1. *(Cont.)*

Districts/ subdivisions/deposits	Metalliferous black shales-age, host, presence absence proximity	Diagenetic features
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Ordovician Vinini Fm. (RMA); Devonian Popovich and Rodeo Creek Fms.	Dolomitiziation of Bootstrap ls, Roberts Mountain and Popovich Fms. (Some dolomitization related to mineralization?)
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Ordovician Vinini Fm. (RMA); Devonian Popovich and Rodeo Creek Fms.	Dolomitization?
South Carlin trend - Rain subdistrict (Rain, Emigrant)		
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Upper plate Ordovician Valmy (minor); sedex deposits in upper plate Devonian Slaven chert	
Tonkin Springs deposit-Battle Mountain-Eureka trend	Ordovician metalliferous black shales in the Vinini Fm.	
Chert Cliff Resource-Battle Mountain-Eureka trend		Dolomitization?
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Black shales in the Denay are locally metalliferous (factor analysis: Cd, Zn, Ag, P, Ni and Tl)	An occurrence of brecciated hydrothermal dolomite alteration with up to 1.4% Zn is present near a NW fault
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)		
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)		
Jerritt Canyon		Dolomitization from subaerial exposure during periods of uplift (due to synsedimentary faulting?); minor occurrences of hydrothermal dolomite, anhydrite, sphalerite, and bitumen in the Hanson Creek Fm.
Alligator Ridge	Portions of the Chainman and Pilot shales have anomalous Ba, Hg, Se, Ni, Mo, Ag and base metals	Regional diagenetic dolomitizaton of the Simonson, Sevy, and Laketown dolomites; the top of the Guilmette Fm. frequently contains crystals and rossetes of diagenetic barite and a few isolated occurrences of hydrothermal zebra dolomite

Table A1. *(Cont.)*

Districts/ subdivisions/deposits	Evidence for synsedimentary faults-age unit
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Abundant debris flows likely generated by synsedimentary fault slip along abrupt WNW-trending facies change (<800 m lateral distance) between the shelf [Bootstrap ls] and slope [Popovich Fm.]; abrupt facies change, slumps, thickness vartiations, gravity anomalies [Roberts Mountain and Popovich Fms. (Bootstrap)]
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	None reported, but unconformity at base of Roberts Mountain Fm. suggests erosion and uplift; debris flows suggest unstable positive relief
South Carlin trend - Rain subdistrict (Rain, Emigrant)	1. Sequence of lower plate early Mississippian siliciclastics overlying Devonian carbonates beneath regional thrust fault are cut by the inverted Rain fault, which shows early normal slip followed by late Paleozoic inversion and reverse movement; total of 2,000 feet of stratigraphic separation; the Paleozoic sequence and the Rain fault are truncated by an erosional unconformity and this erosional surface is overlain by Mississippian-Pennsylvanian Tonka Fm. (Antler overlap sequence), with apparent continuity across the Rain fault, suggesting large displacement faulting, uplift, and erosion during a Mississippian interval between the Antler orogeny and overlap sedimentation
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Depositional hiatus (likley associated with uplift and erosion) between middle Cambrian and middle Ordovican; NW trend to regional isopach contours suggest relationship to pre-Antler NW normal faults; debris flows in the lower Wenban
Tonkin Springs deposit-Battle Mountain-Eureka trend	
Chert Cliff Resource-Battle Mountain-Eureka trend	
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Getchell: abrupt 300, NE-facing boundary to ~150-m-thick sequence of synrift Cambrian-Ordovician pillowed basalts and sedimentary breccias on its hanging wall; boundary separates underlying prerift calcareous rocks from overlying postrift, generally noncalcareous tuffaceous rocks; seismic data show local growth sequences in the hanging walls of 330-360 faults; Pennsylvanian-Permian Etchart ls is thicker in direct hanging wall of the northern projection of NNW Getchell fault and contains abundant quartzite pebble conglomerate layers derived from Cambrian Preble Fm. in the footwall, suggesting Getchell fault as likely basin-bounding fault during deposition of the Etchart (also examples in Edna Mtns., unpub. Placer Dome data); Getchell and Rabbit Creek: local massive (sedex?) sulfide occurrences and nearby barite deposits hosted by Preble Formation, both of which are permissive evidence for synsedimentary faulting
Jerritt Canyon	Saval discontinuity in Silurian unconformity likley associated with uplift and erosion (caused by normal faulting?)
Alligator Ridge	

Table A1. *(Cont.)*

Districts/ subdivisions/deposits	Petroleum/hydrocarbons-timing, source rock, passing through, reservoir
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Hydrocarbon generation, migration into anticlines, and catagenesis in response to burial associated with emplacement of Roberts Mountains allochthon (Antler orogeny); hydrocarbon-rich zones (typically ~0.5 wt % total org C) spatially associated with gold but inferred to be older
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Hydrocarbon-rich zones spatially associated with gold but inferred to be older (see No. Carlin trend); total org C at Gold Quarry ~ 0.5 wt %
South Carlin trend - Rain subdistrict (Rain, Emigrant)	None, rocks are carbonaceous, no known evidence of hydrocarbon introduction
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Little study; Carbonaceous matter appears to be pyrobitumen and amounts vary at deposits; timing of migration and maturation is unknown, though may be the same as for N. Carlin; however, carbon appears to have been mobilized into Tertiary extensional faults with no apparent relationship with ore
Tonkin Springs deposit-Battle Mountain-Eureka trend	Black oily film and C masses concentrated at supergene redox boundary; commonly coating sulfides and late fractures
Chert Cliff Resource-Battle Mountain-Eureka trend	Preore veinlets cut by bedding plane slipswith hydrocarbons, which are cut by qtz, bar, dol, wall-rock breccia
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Upper Denay carbonates are carbonaceous; strongly decalcified ore zones contain high carbon, probably due to residual enrichment during volume loss
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Pyrobitumen migrated into areas and rendered immobile prior(?) to Eocene mineralization; apparent relationship between removal of carbonate and "remobilization/ enrichment" of hydrocarbon; C appears to be remobilized along fractures; C in both ore and nonore and appears unrelated to Au
Jerritt Canyon	Pyrobitumen migrated into areas and rendered immobile prior(?) to Eocene mineralization; C appears to be remobilized along fractures; C in both ore and nonore (no difference in maturity) and appears unrelated to Au
Alligator Ridge	TOC = 0.75-2.8%; amorphous mature kerogen (disseminated, original organic matter) and lesser pyrobitumen (commonly fills fracture), found in mineralizad and unmineralized Pilot sh; hydrogen index contours increase concentrically away from gold particularly in pyrobitumen-free samples; hydrogen index increases with increasing pyrobitumen; contours show large component of lateral hydrothermal fluid flow in Pilot sh host rocks; Qtz-kaol veinlets crosscut pyrobitumen; other textures indicate pyrobitumen is older than Au mineralization; interpretation: hydrothermal activity increased maturity of preexisting kerogen which previously was at "wet gas" stage of catagenesis; Yankee: ore-related calcite-realgar-marcastie veins contain pyrobitumen; postore calcite contains liquid petroleum inclusions and oil is present in fractures and pores

Table A1. *(Cont.)*

Districts/ subdivisions/deposits	Description and interpretation of pre-Carlin deformation and fault reactivation history
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	1) Continental rifting, establishment of NW striking basement fabric including reactivation of pre-existing middle Proterozic WNW fabrics; 2) deposition of calcareous rocks, establishment of WNW-trending reef facies immediately NE of most gold deposits; slumping on reef slope and drowning of reef in upper Devonian; some synsedimentary faulting (N Carlin trend) with deposition bedded barite and possible Au (Rodeo); subaerial exposure and karst formation (Bootstrap ls); 3) eastward thrusting of RMA (Antler orogeny) with imbrication and folding of footwall (Rodeo Creek); likely inversion of NNW faults and formation of anticlines (Tuscarora, Post); 4) southward thrusting (Humboldt orogeny) and inversion of WNW faults (Betze anticline/Dillon deformation zone, W Bazza "flower" structure) forming structural culminations, windows, and domes; 4) Formation(?) of NE striking faults (timing not well constrained) ; 5) Extension along mostly NNW faults and emplacement of Jurassic lamprophyre dikes and Goldstrike stock; 6) uncertain deformation history during Cretaceous, Paleocene and early Eocene; 7) uplift of Goldstrike stock, ~60 Ma.
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	1. Continental rifting, establishment of NW-striking basement fabric including reactivation of preexisting middle Proterozic WNW fabrics; 2. Deposition of calcareous rocks; potential reactivation of basement faults (310 Good Hope fault as evidenced by debris flow breccias); 3. Eastward thrusting of RMA (Antler orogeny, formation of NNW folds; 4. Southward thrusting (Humboldt orogeny), inversion of Good Hope fault, and formation of 300-310 folds, which refold NNW folds (footwall, Good Hope fault); likely formation of NE Gold Quarry Fault system and of Maggie Creek window; 5. Emplacement of Mesozoic dikes along Good Hope fault zone; 6. Post-Richmond stock uplift(?)
South Carlin trend - Rain subdistrict (Rain, Emigrant)	1. Continental rifting, establishment of northwest-striking basement fabric including reactivation of preexisting Proterozoic fault fabrics; 2. Deposition of calcareous rocks, establishment of reef facies and deepening basin to west (filled by upper Devonian Woodruff Fm); subaerial exposure and erosion(?) in forebulge; submerging and influx of siliceous and calcareous detritus (Webb Fm) and subsequent turbidites (Early Mississippian); 2) eastward encroachment of Antler fold and thrust belt, formation of triangle zone composed of oppositely dipping shallow and steeply (60°) dipping thrust faults cored by anticline in Early Mississippian; 3. Mid-Mississippian normal faulting along 290-330 strike that juxtaposes different levels of fold and thrust belt; 4. deposition of quartz-rich overlap clastic rocks Late Mississippian to Early Pennsylvanian; 5. deformation of uncertain origin, erosion of overlap sequence followed by deposition of Strathearn equivalent calcareous siltstone, conglomerate and ls; 6. Inversion of NW-striking normal faults during late Paleozoic (during Humboldt orogeny) and formation of hanging wall anticlines (this post-dates the Pennsylvanian-Mississippian overlap sequence); 7. Intrusion of Eocene dikes
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	1. Continental rifting; 2. Intermittent rifting (Camb and Ordovician); 3. East-directed RMA (Antler orogeny, early Mississippian): a. emplacement of Roberts Mountain thrust, NNE folds and penetrative shear in upper plate NW of Gold Acres window (thin-skinned tectonics) b. folding of lower plate (thick-skinned tectonics) and Roberts Mountain thrust, 330-340 assymetric folds W of Pipeline, (hangingwall of Cortez fault and Horse Canyon) that are likely from inversion of high-angle normal faults at depth, formation of duplex zone in the Pipeline pit; 4. S-directed Humboldt orogeny in Pennsylvanian-Permian (thick-skinned tectonics); formation of 290-310 folds at Gold Acres-Pipeline in lower plate that are likely result of inversion of high-angle normal faults (330-350, 290-310) at depth; appear to postdate 330-340 folds resulting in culmination in Pipeline area; 5. Emplacement of Jurassic Mill Canyon and Cretaceous Gold Acres stocks along 290-310 structures (folds above deep-rooted faults) and related volcanism, compressional events in Mesozoic resulting in folding of Tr rocks NW of pipeline; 6. Likely uplift between 98 and 40 Ma
Tonkin Springs deposit-Battle Mountain-Eureka trend	Antler orogeny and emplacement of RMA , possible inversion of pre-Antler high-angle faults during Antler and subsequent orogenies but no data.
Chert Cliff Resource-Battle Mountain-Eureka trend	
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	1. Continental rifting (Late Precambrian); 2. East-directed RMA (Antler orogeny, early Mississippian): a. emplacement of Roberts Mountain thrust (upper plate Vinini Fm above lower plate Webb and Devils Gate Fms); b. formation of NNW folds in upper plate; 3. Likely inversion along preexisting NW faults (fault propagation fold in Gold Canyon deposit); 4. Formation of 290-310 folds along Gold Canyon-Gold Pick trend of deposits resulting in structural culmination and eventual window (during S-directed Humboldt orogeny in Pennsylvanian-Permian(?); 5. Permian coarse clastic rocks overlap upper and lower plates of RM thrust; 6. Tert(?) NW normal faults cut rock package
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	1. No definitive evidence for Paleozoic faulting; 2. Formation of the Hoosac thrust and Prospect Mountain Duplex in Early Cretaceous(?): a. Hoosac thrust places Camb-Ordovician rocks over Mississippian-Permian rocks, b. Early Cretaceous Newark Canyon Fm. is locally folded (interpreted as syn-tectonic with the Hoosac, but poorly dated); c. Hoosac thrust strikes ~NS and dips >45-60 W parallel to several major steeper high-angle faults; d. Prospect Mountain duplex is bounded on the N by the 315 Ruby fault and likely bounded on the S by subparallel WNW faults; cryptic WNW fault/fracture zones occur in several places in the district; e. Prospect Mtn duplex (assymeteric hanging wall anticline over an inverted high-angle normal faullt, now the Spring Valley-Sharp-Grays Canyon fault) and the Hoosac thrust and other thrusts as a radiating array of short-cut thrusts; 3) post 84 Ma low-angle normal faulting; 4) normal faulting (<30 Ma) along the NS fault zones (likely normal reactivation).
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	1. Continental rifting in late Precambrian; 2. Intermittent (Ordovician) rifting and eruption of basalts (local growth faults, WNW and NNW [Getchell] fault, E dips); 3. Antler orogeny in early Mississippian (imbrication of "lower plate" and uplift along continental margin causing eastward gravity sliding of RMA): a. thin-skinned tectonics, heterogeneous polyphase deformation, mostly W-, but also N- and E-verging inclined to recumbent isoclinal folds and thrust faults in "lower plate" Preble and "Comus" Fms; b. Emplacment of "upper plate" Valmy Fm., mostly E-verging, c. Inversion of E-dipping basement fabric and Getchell fault system and formation of W-verging hangingwall anticlines and refolding of earlier folds and thrusts, (part of Osgood Mountain anticlinorium); d. back-thrusting during inversion and formation of Lopear thrust and Conelea anticline (Twin Creeks); e. Continued emplacment of "upper plate" Valmy Fm. and truncation of Conelea anticline; 4) Pennsylvanian-Permian extension along reactivated Getchell fault system and deposition of shallow marine ls (Etchart Fm); 5) Sonoma orogeny and emplacement of Golconda thrust and Mesozoic thrusting; further inversion of NNW faults and formation of NNE open folds in Etchart Ls, unknown amount of strike slip faulting; 6) Emplacement of Osgood stock (114-90 Ma); controlled in part by NNW Getchell fault and possible right-lateral movement; stocks likely pin subsequent Getchell fault deformation along along accomodating structures formed along intrusion margins; sill-like intrusions emplaced along low-angle thrust faults; 7) Uplift between emplacement of Osgood stock and ~40Ma Carlin-type mineralization (≥~5km depth at ~80-100 Ma to ≤~3km at 40 Ma).
Jerritt Canyon	1) Continental rifting in late Proterozoic, including reactivation of pre-existing middle Proterozoic WNW fabrics(?) and formation of NE faults(?); 2) Intermittent faulting during deposition of passive margin carbonate rocks (Silurian "Saval discontinuity" unconformity); 3) Antler orogeny: a. deposition of Early Mississippian Water Pipe Canyon clastics into localized foredeep basin ahead of RMA; b. possible inversion along pre-existing NE faults (NE alignment of windows and folds); c. SE-directed thrusting, emplacement of upper plate Snow Canyon Fm, formation of NE folds and local imbrication of lower plate, duplexing compartmentalized by WNW lateral ramps; 4) Humboldt orogeny: inversion along WNW faults (fault propagation folds, short-cut thrusts with floating island geometries) forming domes, formaton of ENE to WNW folds, and emplacement of 324 Ma andesite dikes; 5) unknown amount of Mesozoic deformation.
Alligator Ridge	1) Continental rifting in late Proterozoic; 2) Deposition of passive margin carbonate rocks; 3) 310-300 faults (Buck Pass fault zone, subparallel Bida WNW fault zone) controls emplacement of Jurassic dikes at Bald Mtn (WNW zones likely reactivated Precambrian fabric, WNW folds at Bald Mtn); 4) low-angle normal faulting, locally folded and cut by Jurassic intrusions; 5) NNE reverse faults (possible inverted Paleozoic normal faults) and NNE-trending folds, Mesozoic to early Tert; 6) NW-trending folds affect middle Eocene lacustrine sediments; related to transpressional strike-slip faulting along NW faults, refold the earlier NNE folds; strike-slip motion probably caused by inital uplft of Ruby Mtns. poorly constained between 63-49 Ma by hornblende ages; 7) most high-angle faults show late normal reactivation.

TABLE A1. *(Cont.)*

Districts/ subdivisions/deposits	Regional thrust faults - presence, absence, proximity	High-angle structural ore controls
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Most deposits and vast majority of gold occur within 250 m of the overlying Roberts Mountain thrust.	1) NNW-striking (330-350) faults (e.g. Post-Gen fault system, Leeville fault NW). 2) WNW-striking (300-310) faults (e.g. Castle Reef and Dillon and West Bazza reverse faults). 3) NE-striking steeply dipping faults (e.g., Hardie fault). 4) margin of Goldstrike stock and thermal aureole; mineralization especially at releasing bends, intersections of NW, N, and NE faults.
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Top of most ore occurs along the base of the Roberts Mountain thrust.	NE-striking faults (all deposits) with NW (300 -310°) striking reverse (45-70° N) faults. NW striking Good Hope fault and subparallel faults (Mike, Tusc, Mac). Deposits along margins of structurally uplifted Carlin window. Gold Quarry: mineralization spatially related to 300-310, 45-75 E dipping Good Hope reverse flt; high grade along NE striking faults; secondary flt: NE deep feeder flt. Gold has NE elongation (Gold Quarry and Mac); NW trend (along Good Hope fault in Tusc and Little Hop). Main Mike at intersection of Soap Creek and Good Hope flts.
South Carlin trend - Rain subdistrict (Rain, Emigrant)	Thrust fault lies 500 ft (~160 m) above deposits.	Mineralization extends for 990 m along 300-330-striking, moderate to steep dipping, inverted normal fault (Rain). Increased ore and grade where 300° structures more strongly developed. Zone 4 orebody at intersection N fault with Rain fault. 000-, 030- and 300- faults cut Rain fault. Northerly striking moderate dipping thrust faults of triangle zone host Emigrant deposit
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Ore at Gold Acres occurs directly below the Roberts Mountain thrust; the presence and distance of the thrust above the other deposits are unknown.	1) 330-340 faults (all deposits except Gold Acres). 2) NE faults (all deposits). 3) 290-310 faults/folds (Pipeline, Cortez Hills).
Tonkin Springs deposit-Battle Mountain-Eureka trend	Roberts Mountain thrust is inferred to be below the orebodies.	1) NNW faults, especially, 340 normal faults, 75° dip, normal dip-slip w/ local minor right-lateral component. 2) ENE faults. 3) Strike-slip faullts, 60, 75° dip. Fault intersections control better grades. Grade has NNW pattern. Upright open anticline runs the length of TSP-1 pit.
Chert Cliff Resource-Battle Mountain-Eureka trend		1) NNW faults (350, 70° dip, normal faults). 2) EW faults (270, 75° dip normal faults).
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	As close as 30 m below Roberts Mountain thrust. Overturned asymmetric folds indicate the likely presence of low-dipping thrust faults.	Deposits along WNW and NW trends. NW faults, especially at intersections with NE faults.
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Deposits are just E of the leading edge of the Roberts Mountain allochthon.	Archimedes: intersection of WNW Blanchard fault and NS to NNE-striking faults (Bowman and Holly faults). Ratto Canyon and Windfall: intersections of NNW and NE faults.
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Getchell (Turquoise Ridge/N Zone) and Rabbit Creek: top of ore zones ~0-300 m below "Roberts Mountain thrust"; Chimney Creek: ~150 m below the Golconda thrust.	Getchell: 1) NNW, E-dipping (Getchell fault system). 2) NS, steeply W-dipping. 3) NE steeply west-dipping Turquoise Ridge fracture-fault system (minimal displacement). Mineralization largely controlled along fault intersections, particularly with the Getchell flt and related splays. Twin Creeks: NS E-dipping and NE faults. Pinson: NE and NS, E-dipping faults that are part of Getchell fault system.
Jerritt Canyon	Most deposits and vast majority of gold occurs within 500 m of the overlying Roberts Mountain thrust.	NE to ENE striking steeply dipping fault and fracture meshes. NW to WNW-trending steeply dipping faults and fracture meshes; fault intersections.
Alligator Ridge	Deposits are located East of Roberts Mountain thrust.	Mooney Basin N-striking fault system, intersections with NE and NW faults. Dominant ore controls are NNW-NE and NW fractures/faults with little offset. High-angle faults that may have acted as feeders locally have post-mineral movement and displace orebodies.

TABLE A1. *(Cont.)*

Districts/ subdivisions/deposits	Low-angle structural ore controls including duplexing/folds	Other ore controls
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	NNW Post and Tuscarora anticlines; WNW Betze anticline.	Rheologic contrast between hornfels and unmetamorphosed rocks; fault, dissolution, and debris-flow breccias; lamprophyre dikes (aquitards and hosts).
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Gold Quarry: shallow (25-85°) dipping NE Chukar-Alunite (010-035) fault zone localizes the Deep West and Deep Sulfide feeder zones. N50-60W folds.	Best ore at intersections of NW- and NE-striking high angle faults, low angle faults, and NW-striking anticlines. Tabular subhorizontal oxide deposit in Mike may be supergene(?). Rheologic contrast between hornfels and unmetamorphosed rocks (Mike [mostly within aureole], Gold Quarry [just outside aureole], Mac and Tusc [along margins]).
South Carlin trend - Rain subdistrict (Rain, Emigrant)	Shallow-dipping faults structurally above the Rain deposit.	Dissolution collapse breccias in the Devils Gate Ls. The ls is dolomitized, silicified, and oxidized along inverted normal faults. Argillized dikes in faults (aquicludes) enhanced fluid/wallrock reaction.
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	(1) Duplex zones in lower plate Devonian Wenban at Pipeline, (2) Roberts Mountain thrust directly above ore at Gold Acres	Rheologic contrast of metamorphic contact aureole with host rocks (Pipeline, Cortez Hills, and Gold Acres within 150 m of metamorphic contact aureole); best ore at Pipeline controlled by low-angle duplex zone
Tonkin Springs deposit-Battle Mountain-Eureka trend	NNW trending thrust faults and anticlines are secondary ore controls relative to high-angle faults.	Best ore in footwall of low-angle faults at intersections of NNW and/or ENE high-angle faults and low angle fault zones adjacent to interlayered argillized tuffs (aquicludes).
Chert Cliff Resource-Battle Mountain-Eureka trend		Karsted (end Devonian) upper Devils Gate ls.
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Bedding plane shears	
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)		Ore (E Archimedes) along and underneath lip-like W margin of Graveyard Flat intrusion (quartz-feldspar granodiorite porphyry). Ore in footwall of Bullwhacker sill (Deep Archimedes).
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Getchell: extensionally reactivated low-angle shears and thrust faults, that are locally occupied by felsic sills. Low angle melange zone (related to Roberts Mountain thrust?) can be preferentially mineralized. Rabbit Creek: nose of Conelea anticline; small-scale duplex zones in limbs of Conelea anticline.	Getchell/Pinson: much of the ore is focussed at the edge of the metamorphic contact aureole. Getchell: Footwalls of felsic dikes and sills (intrusion-filled reactivated faults). Getchell (N Zone): Strong 300 control in footwall of Ordovician growth fault with pillowed basalt (Fe source) in hangingwall. Rabbit Creek: best grades in the footwalls of basalt flows and sills, and in hinge zones of anticlines below argillized basalt (aquitards). Chimney Creek: best ore in basal permeable sandy ls (lower Etchart) that overlies relatively impermeable Valmy basalts (Fe source); altered Cretaceous (?) dikes (aquitards) promoted fluid/rock reaction.
Jerritt Canyon	Saval discontinuity is a main control. Thrust faults within Hansen Creek. ENE to WNW (hanging wall of inverted faults) anticlines. Floating island geometries in footwalls of inverted faults.	± 324 Ma andesite dikes (aquitards) have minor widespread ~120 Ma QSP alteration. Collapse breccias.
Alligator Ridge		Ore bodies on flanks of eroded anticlines and in erosional windows through Chainman shale caprock.

Table A1. *(Cont.)*

Districts/ subdivisions/deposits	Relationship of deposits to coeval deformation/kinematics and ore controls	Reconstructed depth of mineralization	Stratigraphic interval mineralized
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Late Eocene NW-SE far field least principal stress; (no strong evidence for synmineral deformation); NE fault fabrics have demonstrable slip during ore formation outside of gold deposits and were probably dilatant; direction consistent with Eocene extension; NW-striking fabrics thought to be oblique slip zones; accommodation zones formed as extension transfered from different preexisting faults or around intrusions and their contact aureoles	< 2-3 km based on paleogeographic reconstruction and thermal modeling of apatite fission-track data	~800 m
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Late Eocene NW-SE far field least principal stress caused translation along NW faults and dilation (dip-slip) of NE faults	<1-2 km based on paleogeographic reconstruction and thermal modeling of apatite fission-track data	~1200 m
South Carlin trend - Rain subdistrict (Rain, Emigrant)	Late Eocene NW-SE far field least principal stress caused translation along 300 faults and dilation of 030 faults(?); strike-slip deformation proposed but evidence not compelling and proposed strike slip fault does not offset adjacent Eocene rocks	Poorly constrained but nearby Eocene Elko Formation suggests a shallow depth of formation	430 m
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Au associated with heterogeneous Eocene extension (~280-300): (1) prexisting 330-340 and 290-310 basement(?) faults formed boundaries between terranes undergoing different amounts of extension and served as strike-slip/oblique slip transfer zones; (2) composite Gold Acres-Mill Canyon stock pinned deformation along 290-310 and 330-350 faults and formed accommodating structures around the stock; fluids focused into low-pressure zones, especially at margins of contact aureoles; (3) dilated NE faults locally control ore; (4) extensional reactivation of low-angle shear zones (duplex, Pipeline) and thrust faults (e.g., Gold Acres); (5) 290-310 structures and especially 330-350 high-angle faults were primary conduits that fed ore fluids into extensionally reactivated NE faults, favorable low-angle strata, duplex zones, and thrust faults	Unknown	60–300 m
Tonkin Springs deposit-Battle Mountain-Eureka trend	Late Eocene NW-SE far field least principal stress caused dilation of N to NE faults(?) and translation along NW faults(?)	Not well constrained	150–200 m
Chert Cliff Resource-Battle Mountain-Eureka trend			~50 m
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Late Eocene NW-SE far field least principal stress caused dilation of NE faults and oblique slip along NNW faults (primary ore controlling structures); NNW-striking, steeply dipping, normal fault movement during mineralization indicated by jasperoid breccias with basal jasperoid offset by fault with later alteration	Poorly constrained; the fine grain size and jigsaw mosaic texture of some japeroids suggest amorphous silica precusor that implies low temperatures and shallow depths	~500 m
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Late Eocene NW-SE far field least principal stress caused dilation along N- to NE-striking faults, translation along WNW faults(?)	Poorly constrained	~600 m (narrow zones within this interval)
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Eocene extension ~290-110: Getchell: 1. Minimal displacement along antithetic NS faults and NE faults; 2. Extensional reactivation of low-angle shears and thrust faults; 3. Strike-slip motion along NNW Getchell fault (shallow N- and S-plunging mullions and slickenlines suggesting both right- and left-lateral motion); the Getchell fault system served as conduits for the ore fluids with NS and NE faults acting as channel ways to feed higher horizons, low-angle shear zones, and favorable stratigraphy		~1000 m
Jerritt Canyon	Late Eocene NW-SE far field least principal stress caused dilation of NE to ENE faults (late Eocene dikes have NE strikes), oblique strike-slip along NW to WNW faults	Reconstruction = 1.3 km, AFT closer to 2 km	600 m
Alligator Ridge	Late Eocene NW-SE far field least principal stress caused transtension along the N-striking Mooney Basin fault system, dilation of NE faults, and translation along NW faults	<300–800 m	~250 m

TABLE A1. *(Cont.)*

Districts/ subdivisions/deposits	Relationship to paleogeography (highlands, basins)	Pre-Carlin intrusions and metamorphic aureoles—presence, absence, size, proximity
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Lies in paleohigh west of the Elko basin and south of a major E-W trending middle Eocene paleovalley between the Carlin trend and Jerritt Canyon	Goldstrike granodiorite stock and associated monzonite porphyry dikes, 158 Ma, has metamorphic aureole (hornfels) extending up to 1500 m beyond margin within Genesis-Blue Star. Lamprophyre dikes generally poorly dated but appear to be 158 to 164 Ma (Turf deposit).
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Lies in paleohigh West of the Elko basin and north of a middle Eocene(?) basin in the Emigrant Pass area	Mike deposit occurs within metamorphic contact aureole that is elongated parallel to the Good Hope fault and is likely related to Richmond stock (112.4 Ma U-Pb,). Inferred from magnetics to be 1500 m to the NW (crops out ~7 km to the NW). Altered mafic to intermediate dikes of unknown age intrude upper and lower plate rocks and locally host Au ore in lower plate at Gold Quarry.
South Carlin trend - Rain subdistrict (Rain, Emigrant)	Lies near margin of middle Eocene Elko basin	Intensely clay altered plagioclase porphyry dikes, likely lamprophyric and assumed to be mid-Mesozoic in age. Altered 37.5 ± 0.8 Ma monzonite in Emigrant deposit similar in age to Bullion stock. 38.9 ± 0.2 Ma dike in Saddle deposit. Fragmental or tuffisites in Rain; Mesozoic or Tert dikes and tuffisites formed conduits for Au-bearing hydrothermal fluids.
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Sub-34 Ma erosion surface capped by Caetano Tuff exposed ~1–2 km NNW of Gold AcresPi; 34–16 Ma sedimentary rocks spatially associated with N Nevada rift host supergene(?) Pediment deposit	Mill Canyon quartz monzonite stock (and dikes(?), including lamprophyres(?)), 158 Ma U-Pb date, <10 m contact aureole. Gold Acres granite stock (and stocks and dikes in the Cortez Hills and Mill Canyon(?)), ~98-106 Ma K-Ar and U-Pb dates; ~500-1000 m contact aureole around stock (hornfels/marble with local metasomatic garnet-pyroxene skarn). Contact aureole around unknown intrusion in the area of Cortez Hills; stocks and contact aureoles are elongated in N50-70W direction. 39-37 Ma Tenabo Stock (and Granite Mountain). 35 Ma quartz porphyry dikes.
Tonkin Springs deposit-Battle Mountain-Eureka trend		None known
Chert Cliff Resource-Battle Mountain-Eureka trend		
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)		None
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)		106-107 Ma (U-Pb zircon) Ruby Hill pluton, Bullwhacker sill, and Graveyard Flat pluton (E Archimedes). East Archimedes lies along margin of narrow (<200m) skarn-marble aureole of Graveyard Flat intrusion.
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)		Osgood granodiorite stock, interpreted stocks and related dikes (<750 m from Getchell, Pinson, Chimney Creek; <3500 m from Twin Creeks), ~91-98 Ma Ar-Ar dates. Emplacement along NNW faults and low-angle fault zones. Stock emplaced at minimum of 705C and inferred depth of ~ 4.5 km. Contact metamorphic aureole extends as much as 3 km away from Osgood stock. Parts of Getchell and much of Pinson are hosted in contact metamorphosed rocks. Osgood stock probably part of a considerably longer period of intrusive and hydrothermal activity that lasted from 115-80 Ma based on Ar-Ar and U-Pb dates.
Jerritt Canyon	Lies in paleohigh north of a major E-W-trending middle Eocene paleovalley developed between the Carlin trend and Jerritt Canyon	324-Ma basalt dikes
Alligator Ridge	Below Paleogene sedimentary and volcanic rocks deposited in a north-striking basin	The northern part of the district is ~3 km east of Late Jurassic Bald Mountain stock and associated metamorphic aureole.

Table A1. *(Cont.)*

Districts/ subdivisions/deposits	Pre-Carlin alteration and mineralization
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Devonian sedex Au, Zn [Rodeo] and bedded barite in upper Popovich Fm., and related footwall dolomitization [Meikle], silicification, and bar, sph, py, boul, tet, cpy veinlets with Au. 158 Ma hornfels, skarn, QSP alteration, and polymetallic qtz-sph-gal-cpy-tet-frieb-bourn veins with minor Au. Multiple sericite ages.
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Devonian sedex stratiform Zn (brown-yellow sph with 0.3-3.0 mole % FeS), barite ± Au in up Popovich Fm. and related footwall alteration. Secondary Zn mineralization in Rodeo Creek unit in some deposits. Pb, Zn, Cu & Ni [Gold Quarry & Tusc]. Vein and replacement base metal sulfide mineralization spatially associated with Good Hope fault, Mike: qtz-coarse py-sph-(gal-cpy-moly) veins, qtz-carb veins with As-Bi-Pb-Ag sulfosalt minerals and dark sph (8-20 mole % FeS) spatially associated with hornfels and marble, and potassic (Kspar 107-111 Ma, K-Ar) and phyllic alteration; West Mike: sph-dominant replacement mineralization at Rodeo Creek/Popovich contact; diopside-garnet skarn with molybdenite, stibnite, scheelite, and powellite.
South Carlin trend - Rain subdistrict (Rain, Emigrant)	Dissolution collapse breccias in Devils Gate Ls. Pre-ore hydrothermal dolomitization, phosphoritization(?), brecciation, and silificication of up Devils Gate Ls with minor quartz, py, rutile and native Au. Webb Fm hosts qtz-bar-py-sph ± Au veinlets and small bedded barite deposits. Altered lamprophyre dikes and tuffisite (=exploded lamprophyre) dikes cut early jasperoids and veinlets. The 36.5-37.5 Ma Bullion stock and related polymetallic skarn, replacement and vein mineralization (Fe, Ba, Cu, Pb, Zn, Bi, Ag, Cd) surrounded by Carlin-like mineralization in north Bullion prospect; prospect lies at edge of thermal halo and distal edge of disseminated pyrite. Elsewhere, siliceous Webb hosts barite deposits.
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Numerous Devonian sedex bedded barite deposits in upper plate Slaven chert, Shoshone Range W of Pipeline (>7 km). Jurassic(?)-Cretaceous Au-Ag-Pb-Cu-Zn replacement bodies and veins at Cortez and Mill Canyon. Minor skarn likely related to Mesozoic intrusions (Gold Acres, Cortez Hills). Cu-Pb-Zn-Mo mineralization and numerous turquoise prospects associated with skarn and sericitic alteration, spatially associated with Gold Acres stocks and dikes west of Cortez Canyon. Fluid inclusions in quartz veins with calcite and pyrite (sericite age of 92 Ma) near Pipeline, probably associated with Gold Acres stock, indicate pressures of 2 kbars or ~8 km (lithostatic depth). Au-Ag skarn and distal disseminated mineralization (Tenabo, Hilltop) coeval with Eocene Carlin mineralization.
Tonkin Springs deposit-Battle Mountain-Eureka trend	
Chert Cliff Resource-Battle Mountain-Eureka trend	
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Brecciated sparry hydrothermal dolomite (Denay Fm) locally contains up to 1.4 % Zn. Two small barite deposits [Bat and Bar] mined from Devils Gate and Vinini Fms. The barite mineralization consists of bedded barite and barite –calcite ± sulfide veins. A few replacement Zn–Pb–Ag deposits and prospects may be related to concealed Mesozoic or Cz intrusions or to older basinal brines.
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	1. Stratabound hydrothermal dolomite (some zebra dol) in Eldorado Dolomite and up part of Hamburg Dolomite possibly from regional Devonian-Mississippian brine migration, or related to 84 Ma 2 mica granites. 2) Cretaceous 106 Ma Ruby Hill granodorite stock, associated quartz porphry sills and dikes, and related garnet-diopside skarn, qtz-microcline-sericite-sulfide veins, and polymetallic carb-hosted replacement deposits (mainly in Cambrian Hamburg and Eldorado Dolomite). Coeval QSP alteration is common in Cretaceous intrusions. Late Cretaceous McCullough Butte-Rocky Canyon (84 Ma) 2-mica granite cupolas, F-Zn-Be-W-Sn-Mo skarn, and Ag-Sb anomalies.
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Bedded barite deposits in Preble Fm <3 km W of Getchell and <5 km S of Pinson. Local massive sulfide occurrences (Ag-Pb-Zn) at Getchell and Rabbit Creek. Probable pre-Carlin Au propylitization of basalts (seawater alteration?). W-skarn and quartz-pyrite-arsenopyrite-base metal sulfide veins with insignificant Au spatially and temporally associated with the Osgood and stock and associated intrusions in the ~80-115 Ma thermal event. Cretaceous(?) quartz-sulfide veins with sericitic envelopes base metals and minor Au (Twin Creeks).
Jerritt Canyon	Isolated bedded barite and metalliferous shale (Cu, Au, Hg) in upper plate Ordovician Valmy Fm. Isolated bedded barite in upper plate Devonian Slaven Chert. Isolated discordant pods of coarse barite (± sphalerite, saddle dolomite, quartz, anhydrite, and bitumen) in the Ordovician-Silurian Hanson Creek Fm. Minor widespread ~120 Ma QSP alteration in 324 Ma mafic dikes.
Alligator Ridge	Disseminated barite in top of Devonian Guilmette Fm. Devonian Pilot metalliferous black shale. Bald Mountain - Late Jurassic reduced intrusion-related Au.

TABLE A1. *(Cont.)*

Districts/ subdivisions/deposits	Post-Carlin alteration and mineralization	Late Eocene magmatic centers/ relation to ore—time, space, source	Magnetic anomalies
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Miocene (16-14 Ma) low sulfidation Au-Ag and hot spring Hg. ~2Ma dissolution collapse breccias with sparry calcite and barite.	Numerous Eocene dikes (37-40 Ma) ranging in composition from basalt to rhyolite	Aeromagnetic high to SE related to Cretaceous Richmond Mountain and Eocene plutonic complex. Smaller, locallized aeromagnetic high associated with 158 Ma Goldstrike stock.
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Supergene Cu (0.2-0.6%) forms 2 layers above and parallel to present base of oxidation. Supergene Zn and Ag concentrated within top of sulfide zone at current sulfide-oxide interface. Supergene Au in and above oxide zone. Miocene opalline-chalcedonic sinter. Silicification and argillic alteration of Carlin Fm.	Late Eocene Emigrant Pass volcanic field (35.9–37.8 Ma, Ar-Ar) is ~3–4 km to the SW; Welches Canyon diorite stock (37.2–38.3 Ma, Ar-Ar) is 2 km to the W	Mike deposit lies along E margin of magnetic anomalies spatially associated with Richmond stock (112.4 Ma U-Pb) and Welches Canyon stock (37.2–38.3 Ma, Ar-Ar); anomalies: shallow-source annular-shaped (likely magnetite and pyrrhotite-bearing hornfels) and a deeper sourced, cylindicrical body of unknown age
South Carlin trend - Rain subdistrict (Rain, Emigrant)		Eocene dikes at Saddle and Emigrant.	No magnetic anomalies beneath or adjacent to deposits; magnetic high outlining Bullion stock (37.5–38.5 Ma) ~ 8 km south of Rain
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Low-sulfidation epithermal deposits at Mule Canyon, Buckhorn, and Fire Creek, 15-16 Ma. Present day geothermal activity.	Tenabo granodiorite stock, 39-37 Ma K-Ar dates, 5 km N of Pipeline; Au-bearing skarn (5:1 Ag:Au) and quartz-base metal sulfide veins (20:1 Ag:Au) associated with sericitic alteration. Similar mineralization associated with Eocene intrusions to the NW at Hilltop.	Anomalies associated with Mesozoic intrusions and their contact aureoles, especially the Cretaceous Gold Acres stock
Tonkin Springs deposit-Battle Mountain-Eureka trend	Post-ore rhyolite tuff is locally argillized and contains trace metals.	Several post-mineral centers.	Associated with Eocene-Oligocene volcanic rocks
Chert Cliff Resource-Battle Mountain-Eureka trend			Mag anomalies dominated by basalt dike; shallow and deep conductors coincide with alteration
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)		None recognized.	None
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)			Mag anomalies attributed to Cretaceous intrusive centers/skarns
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	None known.	Nearest Eocene igneous rock is 7 km NE of Chimney Creek; 38.3 Ma, whole rock K-Ar date on dacite tuff.	Magnetic anomalies associated with Mesozoic stocks and their contact aureoles
Jerritt Canyon		Eocene felsic volcanic rocks and 39.2 Ma quartz monzonite dikes near by; 40.1 Ma basalt is altered and mineralized.	None under the deposit but small anomaly associated with Mill Site volcanics; larger anomaly associated with Tuscarora volcanic complex to the west.
Alligator Ridge		Older than rhyolite dikes (35.9 Ma), domes, and flows in the northern part of the district.	

Table A1. *(Cont.)*

Districts/ subdivisions/deposits	Summary of postmineral geologic history (uplift/ exposure vs. subsidence/cover by volcanic and Neogene basins)
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	(1) Exhumation and supergene oxidation and enrichment; (2) Deposition of mid-Miocene Carlin Fm.; eruption of rhyolitic rocks (15 Ma) on Marys Mtn; (3) Basin and Range normal faults and reactivation of most steeply dipping faults
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	(1) Late Eocene Emigrant Pass volcanic field (35.9–37.8 Ma) erupted ~3–4 km to SW; (2) Exhumation and supergene oxidation and enrichment; (3) Deposition of mid-Miocene Carlin Fm.; eruption of rhyolitic rocks on Marys Mtn (~15 Ma); (4) Basin and Range normal faults and reactivation of most steeply dipping faults
South Carlin trend - Rain subdistrict (Rain, Emigrant)	39–37 Ma volcanic rocks of the Indian Well Fm. lie to E and W; deposits cut by NE-striking normal faults that jostle ore zone; oxidation
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	(1) Emplacement of quartz porphyry dikes, 35.2 Ma U-Pb; (2) Emplacement of Caetano tuff during extension, ~34 Ma Ar-Ar; (3) Local large-magnitude extension (>100%, directed toward 280–300), extensional reactivation of thrust faults, deposition of 34–16 Ma sediments spatially associated with northern Nevada rift and formation of the Pediment deposit (hosted mainly by gravels that overlie Caetano tuff); (4) 15–16 Ma, extension along 330-340 faults and eruption of basalts and lesser dacite along northern Nevada rift; (5) Low-magnitude extension (~10%) along mainly NE faults and deposition of <13 Ma gravels and Eocene-Oligocene erosion surface
Tonkin Springs deposit-Battle Mountain-Eureka trend	Postmineral rhyolitic tuff (37.5 Ma) and andesite flows (33.4 Ma); Miocene(?) and younger basin and range postmineral normal faults, NNW and ENE faults
Chert Cliff Resource-Battle Mountain-Eureka trend	NW normal faults (340, 65° dip) with small displacement (<30 m) cut mineralization and contain 10–16 Ma postmineral basalt and gabbro dikes related to northern Nevada rift; unmineralized dacite dome intrudes Au mineralization in Webb similar to Chert Cliff, 8000' to NE, 33.9 Ma, K-Ar, biot; unmineralized gabbro dikes cut mineralization, 17.6 my, K-Ar, whole rock
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Early Miocene (23.8 Ma) postore lava and tuffs deposited in the range to E but not within mine site; postmineral movement on NE faults; postmineral faulting on NW faults (e.g., range front fault); late Oligocene/early Miocene felsic volcanism
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Mid-Miocene and younger extensional reactivation on Getchell fault system (dip-slip kinematic indicators overprint strike-slip kinematic indicators) and NS faults at Twin Creeks; exposure and oxidation of Carlin-type mineralization, local burial by Miocene and younger alluvium/tuffs (up to 200 m at Rabbit Creek); Osgood Mountains tilted W along NE-trending range-front fault system on E side of the range, possibly explaining NE "Getchell trend" of Carlin-type deposits
Jerritt Canyon	Basin and Range normal faults reactivate older fabric
Alligator Ridge	1) Eruption of rhyolitic domes, flows and ash flow tuffs (36-35 Ma). 2) Minor normal faulting along ore-controlling faults.

TABLE A1. *(Cont.)*

Districts/ subdivisions/deposits	Postmineral supergene oxidation/karsting
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Oxidation of shallow parts of system forming Fe-oxides, argillic alteration, alunite, kaolinite, jarosite, karst with spelean calcite; Miocene ages on alunite
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Supergene alunite [Gold Quarry], 30.0 Ma, records oldest supergene mineralization in Carlin systems. 19.7 Ma alunite [Mike] cuts secondary chalcocite and covellite, argillic alteration, alunite-kaolinite veins and pods, variety of secondary Fe, Cu, Zn, Pb, and Ag minerals, notably framboidal sphalerite with 0.08–0.35 mol % FeS of bacteriogenic origin, diverse phosphates and vanadates; Mike deposit has 2 layers supergene Cu above and parallel to present base of oxidation, supergene Zn and Ag, and potentially supergene Au
South Carlin trend - Rain subdistrict (Rain, Emigrant)	Supergene alunite ages of 12.6–22.3 Ma; phosphates, chalcedony, hematite, geothite, jarosite, alunite, kaolinite, dussertite, scorodite, mansfieldite, willemite, other clays; breccia bodies are preferentially oxidized, oxidized rock commonly occurs underneath reduced rock; sulfur isotope ratios of alunite/jarosite identical to pyrite
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Blanketlike oxidation parallels topography, deeper along faults; some deposits are deeply oxidized (nearly 300 m at Pipeline); oxidation/erosion occurred after emplacement of the Caetano tuff and formation of the Pediment deposit (hosted by gravels that locally overlie the Caetano tuff, uncertain whether mechanical or hydromorphic); no supergene alunite dates; minor karsting at Horse Canyon and Pipeline; goethite, hematite, jarosite, azurite, melanterite
Tonkin Springs deposit-Battle Mountain-Eureka trend	Goethite, jarosite, scorodite, variscite
Chert Cliff Resource-Battle Mountain-Eureka trend	
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Goethite, earthy hematite, jarosite, stibiconite, scorodite, phosphates, minor argillic alteration and carbonate dissolution due to weathering of sulfides; blanketlike supergene alteration extending deeper along faults; hematite postdates limonite and represents more advanced oxidation; some postmineral faults contain oxidized rock indicating postsupergene faulting; karst cavities and breccias cemented with spelean calcite
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Deep weathering and oxidation of iron sulfides to oxides
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Blanketlike oxidation parallels topography, deeper along faults; Getchell: very little oxidiation; postmineral(?) karsting; Rabbit Creek and Pinson: oxidation to ~60 m below bedrock-alluvium contact; Chimney Creek: oxidation to ~100–200 m; supergene alunite at Rabbit Creek: 14–16 Ma; minerals include goethite, hematite, alunite, jarosite, anglesite, scorodite
Jerritt Canyon	Goethite, hematite, jarosite, stibiconite, scorodite, phosphates, minor argillic alteration and carbonate dissolution due to weathering of sulfides; karst cavities and breccia cemented with spelean calcite
Alligator Ridge	Argillic alteration, alunite, jarosite, barite, goethite, hematite, stibiconite; supergene alunite K-Ar ages of 3.6–12.4 Ma; karst with spelean calcite; irregular oxidized zones overlain by unoxidized zone; Alunite veins crosscut qtz-kaolinite veins

Table A1. *(Cont.)*

Districts/ subdivisions/deposits	References
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Kuehn, 1989; Kuehn and Rose, 1992, 1995; Brooks et al., 1995a, b; Drews-Armitage et al., 1996; Tosdal and Wooden, 1997; Armstrong et al., 1998; Griffin, 2000; Tosdal et al., 2000; Furley, 2001; Ressel et al., 2001; Arehart et al., 2003; Chakurian et al., 2003; Haynes et al., 2003; Heitt et al., 2003
Central Carlin trend-Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Heitt, 1992; Arehart and O'Neil, 1993; Brooks et al., 1995a, b; Rota 1996; Henry and Faulds, 1999; Tosdal et al., 2000; Harlan et al., 2002; Norby, 2002; Norby and Orobona, 2002; Bawden et al., 2003
South Carlin trend - Rain subdistrict (Rain, Emigrant)	Odekirk, 1989; Arehart et al., 1992; Williams et al., 2000; Tosdal et al., 2000; Moore, 2001; Tosdal, 2001; Longo et al, 2002
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Guilluly and Gates, 1965; Guilluly and Masursky, 1965; McKee and Silberman, 1970; Silberman and McKee, 1971; Ross, 1977; Hefner, 1992; Foo et al., 1996; McCusker, 1996; Leventhal and Giordano, 2000; Blamey and Norman, 2000; John et al., 2000; Mortensen et al., 2000; Tosdal et al., 2000; Muntean et al., 2001; Grauch et al., 2003; Cortez mine staff, unpub. data; Newmont, unpub. data; Placer Dome, unpub. data
Tonkin Springs deposit-Battle Mountain-Eureka trend	Gesick, 1988; Espell and Rich, 1991; Tosdal et al., 2000; Grauch et al., 2003; Placer/Homestake, unpub data
Chert Cliff Resource-Battle Mountain-Eureka trend	Maher et al., 1993; Tosdal et al., 2000
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Broili et al., 1988; Masinter, 1990; French et al., 1996; Tosdal et al., 2000; Grauch et al., 2003
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Nolan, 1962; Nolan and Hunt, 1968; Dilles et al., 1996; Vikre, 2000; Lisenbee, 1999; Tosdal et al., 2000
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Joralemon, 1951; Hotz and Willden, 1964; Silberman et al., 1974; Taylor and O'Neil, 1977; Berger and Taylor, 1980; Kretschmer, 1986; Osterberg, 1990; Bagby and Cline, 1991; Bloomstein et al., 1991; Madden-McGuire and Marsh, 1991; Osterberg and Guilbert, 1991; Wallace, 1991; Arehart et al., 1993a, b; Wallace and McKee, 1994; Groff, 1996; Cline et al., 1997; Groff et al., 1997; Hofstra, 1998; Stenger et al., 1998; Tosdal et al., 1998; Chevillon et al., 2000; Hall et al., 2000; McLachlan et al., 2000; Thoreson et al., 2000; Tretbar et al., 2000; Tosdal et al., 2000; Boskie and Schweikert, 2001; Cline, 2001; Ten Brink, 2002; Fortuna et al., 2003; Placer Dome, unpub. data; Cline, unpub. data
Jerritt Canyon	Birak and Hawkins, 1985; Hofstra, 1994; Phinisey et al., 1996; Dewitt, 1999; Hofstra et al, 1999; Dewitt, 1999; Tosdal et al., 2000; Peters et al., 2003
Alligator Ridge	Tapper, 1986; Ilchik, 1990a, b, 1991; Nutt, 1997; Nutt and Good, 1998; Nutt et al., 2000; Tosdal et al., 2000; Nutt and Hofstra, 2003

Table A2. Deposit Attributes in Districts Containing Carlin-Type Au Deposits

Districts/ subdivisions/deposits	Latitude	Longitude	Contained Au (Moz)	Average Au grade (g/t)	Areal extent of mineralization (km)	Number deposits/pits
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	40.96° N	116.37° W	90.1	5.86	6 x 20	More than 56
Central Carlin trend - Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	40.78°N	116.22°W	28.8	0.92	6 x 5	More than 9
South Carlin Trend - Rain subdistrict (Rain, Emigrant)	40.61°N	116.01°W	4.8	2.17	8 x 10	More than 9
Cortez subdistrict- Battle Mountain- Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	40.2°N	116.7°W	33.1	1.64	7 x 22	6 deposits (Pipeline, Gold Acres, Cortez, Horse Canyon, Pediment, Cortez Hills)
Tonkin Springs deposit- Battle Mountain- Eureka trend	39.91°N	116.45°W	1.4	1.54	2 x 6	More than 11
Chert Cliff resource - Battle Mountain- Eureka trend			56,000 oz	1.4	0.5 x 1	5 (resources)
Gold Bar district- Battle Mountain- Eureka trend (and satellite deposits- Gold Ridge, Gold Stone, Gold Canyon)	39.8°N	116.37°W	1.85	1.84	8 x 12	9
Eureka district- Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	39.52°N	115.98°W	1.35	2.44	16 x 4	4
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	41.22°	117.26°	25.6	2.61	21 x 7	15 deposits: Getchell (North pit, Main pit, Hansen Creek pit, Summer Camp pit, Getchell Underground, Turquoise Ridge, Powder Hill, North Zone); Twin Creeks (Rabbit Creek-Megapit, Chimney Creek-Vista pit); Pinson (Mag, ABC, CX, Felix Canyon pits)
Jerritt Canyon	41.36°W	115.98°N				
Alligator Ridge	39.76°N	115.52°W				
			7.1	6.9	10 x 10	More than 24
			1.44	1.75	5 x 40	More than 30

TABLE A2. *(Cont.)*

Districts/ subdivisions/deposits	Mining history	Mining method	Ore type mined	Deposit arrangement
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Historic Hg prospects; 1918 [Bootstrap Sb]; Genesis-Bluestar: turquoise discovered in 1925 and mined through 1954; 1957-1960 [Bootstrap Au], 1961 [Blue Star Au]; Carlin deposit discovered 1961; 1965 to present, disseminated Au	Open pit and underground 1962 to present	Minor oxide, major sulfidic and carbonaceous	Distributed along NW-striking fault system and extending east and west from the major fault along subsidiary faults
Central Carlin trend - Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	1870s initial prospecting eventually led to exploitation of small lead, silver, copper and barite veins between 1908-1935; gold exploration between 1960-1979 led to open-pit mining from 1980 to present	Open pit, 1980 to present	Major oxide, minor refractory carbonaceous and sulfidic	Distributed along NW-striking fault system; local alignment along and parallel to 300° striking Good Hope fault and along edge of Carlin window
South Carlin Trend - Rain subdistrict (Rain, Emigrant)	Prospect pits and small workings on bedded barite; 1987 to present; disseminated Au	Open pit 1987-1994, underground 1994 to present	Oxide, refractory sulfide	Distributed for > 900 m along 300° trend [Rain] or tabular at crest of anticline within triangle zone of fold-and-thrust belt [Emigrant]
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Gold Acres: discovered in 1922, mining began in 1935; Cortez: 1959-1966 U.S. Geological Survey discovered silicified limonite-stained ls with up to 3 oz/t Au; led to discovery by Placer Amex; mining began in 1968	Open pit	Oxide, minor carbonaceous	Deposits along margins of contact metamorphic aureoles associated with Mesozoic stocks
Tonkin Springs deposit-Battle Mountain-Eureka trend	1950s prospected for Hg and barite; Au exploration and development began in 1966, open-pit mining 1985-1990; bacterial oxidation-CIL 1989-1990	Open pit	Oxide (1985-1988), refractory sulfide	Stacked gently dipping tabular bodies along low-angle fault zones and footwall contacts of flows and tuffs; strong structural control
Chert Cliff resource - Battle Mountain-Eureka trend	Exploration and drilling between 1980-1989; no mining		Oxide and refractory material—none mined	Distributed along NNW-striking high-angle faults
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	1987-1994 disseminated Au; currently inactive	Open pit	Oxide; 20% of mineable reserves is carbonaceous	Distributed along NW-striking fault system exposed in isolated horst block forming tectonic window through the RMA + Webb parautochton
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Rustler-Windfall discovered in early 1970s, mined 1976-1984; Ratto Canyon (Lookout Mtn deposit) discovered in 1982, partially mined 1988-1989; Ruby Hill mine (W and E Archimedes deposits) discovered in 1992 and mined between 1997-2001	Open pit	Oxide, minor sulfide (Lookout Mountain)	Distributed along N-striking fault system that extends from Ratto Canyon, through Lookout Mountain, Prospect Ridge, Ruby Hill, and Adams Hill into Archimedes
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Getchell: Discovered in 1934, intermittent production from 1938 to present (mostly refractory sulfide ore along the Getchell fault); underground production began in 1994; Pinson: discovered in 1945 followed by small-scale production; "rediscovered" in 1971, put into production in 1981; Chimney Creek: discovered in 1984, production began in 1987; Rabbit Creek: discovered in 1987, production began in 1990	Open pit production to 1995; underground production began in 1994	Shallow oxide, deep carbonaceous and noncarbonaceous sulfide	Getchell and Pinson: Deposits localized along Getchell fault or at intersections with NE-trending faults along the margin of Osgood stock; Twin Creeks: NS
Jerritt Canyon	Prospect pits and small mine workings on bedded barite and vein stibnite prior to 1962; open-pit gold mining 1981-2001; underground gold mining 1991 to present	Open pit and underground	Oxide, refractory carbonaceous and/or sulfidic	WNW- to ENE-trending groups of deposits with overall NE trend
Alligator Ridge	Discovered in 1976, mining began in 1980	Open pit	Mainly oxide, minor carbonaceous	Distributed along N-striking fault system

TABLE A2. *(Cont.)*

Districts/ subdivisions/deposits	Deposit Form	Stratigraphic interval mineralized (m)	Alteration associated with ore
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Subhorizontal or gently dipping strata-bound deposits (e.g., Screamer); steeply dipping fault and fracture mesh controlled (e.g., Meikle)	~800	Decarbonatization; argillization (kaolinite, illite, I/S), sulfidation (pyrite, marcasite), silicification
Central Carlin trend - Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Irregular, discordant, and strata bound; both steeply dipping exhibiting fracture and fault mesh control in siliceous rocks, and shallowly dipping or tabular replacement deposits; NE elongation of ore zones in NW-trending deposit	~1,200	Decarbonatization, silicification, argillization (kaolinite, smectite), sulfidation; sericitic (2M1 and 1Md illite) may be relict of Cretaceous System
South Carlin Trend - Rain subdistrict (Rain, Emigrant)	Irregular, discordant, and strata bound	430	Decarbonitization, argillization (kaolinite), sulfidation, silicification, proximal organic carbon depletion and distal enrichment, and distal calcite veining
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Mostly low-angle stratiform bodies with high-angle tabular roots along fault zones; elongated zones parallel to faults; Cortez Hills is steeply plunging pipelike body	60–300	Decarbonatization followed by silicification, argillization (kaolinite to highly crystalline illite as approach ore)
Tonkin Springs deposit-Battle Mountain-Eureka trend	Tabular, irregular, discordant and concordant	150–200	Decarbonatization, silicification, argillization; sulfidation
Chert Cliff resource - Battle Mountain-Eureka trend	Lensoid disseminated replacement bodies	~50	Decarbonitization, silicification (jasperoid)
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Irregular pods (Gold Pick, Gold Ridge, Cabin Creek and Hunter), discordant breccia pipe (Gold Canyon), and strata bound (Gold Bar, Gold Stone, Mill Site and Pot Canyon); some forms related to intersection of favorable lithology and structure	500	Decarbonatization, argillization (smectite to illite; 1M or 2M illite in strongly altered decarbonatized zones), sulfidation, silicification
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Irregular, discordant, and strata bound	~600	Decarbonatization, silicificiation, argillization, dissolution of calcite and dolomite (sanding), sulfidation
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Getchell and Pinson: Steep tabular bodies associated with high-angle fault zones that have low-angle "branches" along low-angle stratigraphic and structural features, complex geometries resulting from intersection of high-angle faults, low-angle shears and thrusts, and favorable stratigraphy; minor stratiform disseminated mineralization; Twin Creeks: Mostly tabular stratiform [Rabbit Creek: mostly shallowly plunging tabular bodies along the nose of the Conelea and Tapper anticlines; Chimney Creek: Blanketlike stratiform bodies in the lower Etchart Limestone with roots along NE faults in the underlying Valmy basalt]	~1,000	Decarbonatization, silicification, argillization (Au correlates with illite [Getchell, Rabbit Creek], kaolinite and dickite coincident with Vista orebody [Chimney Creek]), sulfidation; very minor adularia [Rabbit Creek]
Jerritt Canyon	Irregular, discordant, and strata bound; fault controlled	600	Decarbonitization, silicification, argillization (kaol, I/S, illite), sulfidation
Alligator Ridge	Steeply dipping fault controlled and irregular strata bound	~250	Silicification, decalcification, argillization (illite, smectite, kaolinite), sulfidation; maturation of carbonaceous material; incipient graphitization is evident by ability of carbon to rob Au from cyanide solutions

Table A2. *(Cont.)*

Districts/ subdivisions/deposits	Residence of gold	Ore and late ore open-space filling minerals
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Most Au in arsenian pyrite or marcasite; Au also reported on illite and in quartz and cinnabar	Quartz, calcite, dolomite, barite, pyrite, marcasite, orpiment, realgar, stibnite, sphalerite, lesser galkhaite (Rodeo) and cinnabar
Central Carlin trend - Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Au in arsenian pyrite/marcasite in reduced ore; fine native Au in oxidized ore	Quartz, barite, botryoidal pyrite-marcasite, ± sphalerite calcite, orp, real, stib, chalcedony
South Carlin Trend - Rain subdistrict (Rain, Emigrant)	Native Au in oxidized ore; Au in arsenian py in refractory ore	Barite, orpiment, cinnabar, dolomite, calcite, late botryoidal pyrite, quartz, pyrite, apatite
Cortez subdistrict- Battle Mountain- Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Au in arsenian pyrite; <1μm native Au in quartz; fine ore pyrite grains or rims; Carbonaceous material does not appear to contain Au	Common quartz, calcite; minor to absent stibnite, orpiment, realgar, or botryoidal py/mc
Tonkin Springs deposit- Battle Mountain- Eureka trend	Au in arsenian pyrite and marcasite; native Au, free Au in silica veinlets and along fractures above and below redox boundary	Orpiment, realgar, arsenopyrite, sphalerite, stibnite; close spatial association between Au and orpiment/realgar
Chert Cliff resource - Battle Mountain- Eureka trend	Au-bearing arsenian pyrite or Au-bearing arsenian rims on pyrite; disseminated Au in undeformed and relatively unaltered dol siltstone (Webb, most Au here) and qtz-bar-siltstone/mdstone breccia (Webb/ Devils Gate contact	Quartz, pyrite, realgar, barite, dolomite
Gold Bar district- Battle Mountain- Eureka trend (and satellite deposits- Gold Ridge, Gold Stone, Gold Canyon)	Free native Au along fractures in jasperoid; highest grades in fault gouge with 3-10% Au-bearing pyrite	Orpiment, realgar, calcite in decarbonatized limestones; quartz, ±stibnite, ±barite in silicified limestones; calcite veining throughout and adjacent to Au mineralization
Eureka district- Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	As-pyrite, supergene Fe oxides	Quartz, calcite, chalcedony, pyrite, marcasite, arsenopyite, realgar, orpiment, cinnabar, barite, trace stannite
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Au in arsenian pyrite/marcasite; native Au in oxidized ore (Getchell), in bedded jasperoid (Chimney Creek)	Jasperoid, illite, drusy quartz, orpiment, minor fluorite, galkhaite, coloradoite, marcasite, pyrite, stibnite, realgar, calcite, barite
Jerritt Canyon	As pyrite, As marcasite, rare hypogene native gold in jasperoidal quartz; native gold in supergene Fe oxide pseudomorphs of pyrite	Orpiment, realgar, calcite, barite, ±cinnabar in decarbonatized limestones; quartz, stibnite, barite in silicified limestones; arsenopyrite and native arsenic appear in basalt dikes
Alligator Ridge	As-pyrite/marcasite, supergene Fe oxides	Quartz, calcite, chalcedony, kaolinite, barite, pyrite, marcasite, realgar, orpiment, stibnite, pyrobitumen

TABLE A2. *(Cont.)*

Districts/ subdivisions/deposits	Jasperoid: form and distribution, grain size, textures	Postore open-space filling minerals
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Mostly saccharoidal (T >180°C), locally jigsaw mosaic [Beast] (T = 180°-100°C)	~2 Ma cavernous vugs and breccias lined with calcite and barite crystals [Meikle] ± later perithermal marcasite
Central Carlin trend - Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Commonly localized by faults; also well developed in ls at the Roberts Mountains-Popovich Fms and Popovich Fm-Rodeo Creek unit contacts; common saccharoidal textures (T >180°C)	Alunite; barite with ~15‰ δ34S values is probably the same as Pliocene postore barite in cavernous vugs at Meikle
South Carlin Trend - Rain subdistrict (Rain, Emigrant)	Early jasperoids in up Devils Gate ls are strata bound; later jasperoid breccias in Webb Fm. and Devils Gate Ls. are discordant; Railroad/Devils Gate ls. grain size 1 to 1,500 μm; textures commonly jigsaw and xenomorphic mosaic, minor reticulate	Cavernous vugs and collapse breccias (lined with-calcite and barite crystals) in Devils Gate Ls
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Small, localized	Late calcite-barite veins cut mineralization; calcite veins generally peripheral to deposit
Tonkin Springs deposit-Battle Mountain-Eureka trend	Best developed along high- and low- angle faults; silicified calcareous siltstones in the Vinini Fm	Calcite, cinnabar, and barite are late or postore
Chert Cliff resource - Battle Mountain-Eureka trend	Weak footwall jasperoid has much greater aerial extent than overlying disseminated Au zones	
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Abundant; strata bound at the Webb/Devils Gate, upper part unit 1 (Denay [footwall])/unit 2 (Denay [ore]), and Bartine/Kobeh contacts of the McColley Canyon Fm; otherwise generally discordant to strata; grain size ranges from ~5 to 250 μm; textures from jigsaw mosaic and feathery chalcedonic (T = 180°–100°C) to saccharoidal (T >180°C)	Calcite, karst with spelean calcite
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Chalcedonic (T = 180°–100°C) and saccaroidal textures (T >180°C) jasperoid localized along a N-S fault system	Supergene Fe oxides
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	"Micro" jasperoid after limestone in fine limestone/mudstone couplets associated with turbidites or coarser limestone masses; reticulate texture, variable grain size, and fine solid calcite inclusions indicate quartz replacement of carbonate; jasperoids mostly in steep tabular bodies associated with fault zones, breccias; minor stratiform mineralization [Getchell]; tabular bedded jasperoids from 30 to 50 m thick generally footwall to orebody and extending beyond ore [Chimney Creek]	Calcite, barite; late calcite-dolomite veins [Rabbit Creek]
Jerritt Canyon	Strata bound in unit 2 and unit 3-4 contact in the Hanson Creek Fm; grain size 100-500 μm; textures generally saccharoidal [xenomorphic to reticulate] indicating T >180°C)	Calcite, karst with spelean calcite
Alligator Ridge	Abundant, mostly concordant to bedding, shallow to moderate depth; 35-m-thick massive jasperoid in Devil's Gate ls underlying orebodies is anomalous in Au; continues for almost a km away from the orebodies; 2 to 200 μm; shallow: jigsaw mosaic and feathery chalcedonic (T = 180°-100°C); deeper: saccharoidal (T >180°C)	Calcite with petroleum fluid inclusions, oil, barite veins crosscut kaolinite-bearing veins

Table A2. *(Cont.)*

Districts/ subdivisions/deposits	Breccias	Concentrations Au and trace metals in ore pyrite (LAICPMS: decreasing factor score)
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Sedimentary breccias in low Popovich-up Roberts Mountains Fm; tectonic breccias along some low- and high-angle faults in favorable hosts	EMP: Au up to 8,000 ppm, 1-6% As; pyrites from Post-Betze-Chris Henkleman's work?; SHRIMP: Au up to 5,000 ppm; LA-ICP-MS: Au 500-5,000 ppm, As 1-5%; LAICPMS: Au, Sb, As, Tl, Hg, Cu, (Te), (Ag), (Mo)
Central Carlin trend - Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Sedimentary breccias in low Popovich-up Roberts Mountains Fm; tectonic breccias along some low- and high-angle faults in favorable hosts	SIMS and EMP: 200-500 ppm Au; 1-6% As; Au/As = 0.008 + 0.003; native Au (sedex?, post Carlin?) and py 10-100 ppm Au, high As = 1-16% Au/As <0.003; LAICPMS: As, Au, (Co, Ni, Pb) (Carlin-type in Good Hope dike); Co, Au, Bi, Tl, Ni, (W, Ag, As, Sb, Pb, Cu) (Cretaceous qtz sulfide vein from deep sulfide feeder in Drc); Ni, Co, Au, As, Tl, Zn, Cu, Mn, Sb, Hg, Pb, (Cs, Cr, V) (sedex(?) in Drc)
South Carlin Trend - Rain subdistrict (Rain, Emigrant)	Devonian karst breccias in up Devils Gate Ls; Mississippian (?) brecciation in Devils Gate Ls due to dolomitization; Late Jurassic synemplacement lamprophyre/tuffisite breccias; late Eocene hydrothermal dissolution collapse and crackle breccias (flat-lying) postore dissolution caverns and collapse breccias; tectonic breccias along NW and NE faults; hydrothermal breccias reported for Rain	Calculated from refractory ore analyses: Au >135-540 ppm, As >1.0-5.4%
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Jasperoid fault(?) breccias; minor compared to other districts	EMP: py = 1,500 ppm Au, 9.6% As; aspy = Au to 6,800 ppm
Tonkin Springs deposit-Battle Mountain-Eureka trend	No collapse breccias; tectonic breccias associated with low-angle faults	
Chert Cliff resource - Battle Mountain-Eureka trend	Collapse breccia with hydrothermal qtz and bar matrix and matrix-supported angular siltstone fragments	
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	1-2 m breccia at base of ~20 m main bedded jasperoid; jasperoid clasts in hydrothermal quartz matrix; postmineral 340 fault breccia; depositional sedimentary slump breccias; breccias along dike and sill contacts	Calc from rock analysis: Au >225 ppm, As >1.8%
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Common in jasperoids localized along high- and low-angle faults; common in East Archimedes jasperoid	
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Hydrothermal dissolution collapse breccias (ls and siltstone) during ore-stage alteration; fault breccias associated with NE and NS faults [Twin Creeks]	EPM: Au = <~4,000 ppm; As = ~6-15 wt %; EMP, SIMS, and LAICPMS: As, Cu, Hg, Sb, Au, Tl, ± Te, Pb; minimal/no Ag, Se, or Zn; trace elements generally highest in inner (earliest) rims
Jerritt Canyon	Preore karst breccias, ore-stage hydrothermal dissolution collapse breccias, and postore karst breccias; breccias common in jasperoids localized along high- and low-angle angle faults; late ore-stage crackle breccias	LAICPMS: Avg: Au, Tl, Hg, As, Pb, Cu, Sb; OShc: Tl, Au, As, Pb, Hg; SDrm: Au, Tl, Hg, Pb, Cu, Sb; Pbi: As, Tl, Hg, Au, Cu, Sb, Pb; Pbi (2): W, Hg, Tl, As, Au, Cu, Cr, Sb
Alligator Ridge	Sedimentary breccias in low Popovich-up Roberts Mountains Fm.; hydrothermal dissolution collapse breccias; tectonic breccias along some low- and high-angle faults	EMP: Au not detected, ≤2.3% As; LAICPMS: Au <200 ppm, As <5%, LAICPMS: As, Tl, Hg, Sb, Au, Cs, ± Cu

TABLE A2. *(Cont.)*

Districts/ subdivisions/deposits	Lithogeochemistry	Fluid inclusions (FI)	Pressures and depths based on fluid inclusions
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Sulfidic ore: Au/Ag = 20 to 3; enriched in S, As, Sb, Tl, Hg, Au, Ag, W, Te, W, ± (Fe, Si, Ba, Mo [Beast], Cs [Rodeo]); not enriched in base metals; depleted in CO_2, Ca, Mg, Sr, Mn, Na, ± (K, Rb, Cs [lampropyre dikes])	Quartz: Th = 240°-140°C, salinity <6%; stibnite: Th = 220°-200°C, salinity = 4%; orpiment: 220-100°C, salinity = 3-5%; calcite: 218°-120°C, salinity<5%; gases (mol %): CO_2 <4, CH_4 <0.X, N2 <0.X, H_2S = 0.1-0.0	
Central Carlin trend - Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Au, As, Sb, Tl, Hg, Co, Pb, Cu; Ag/Au = 0.5 - 3 [Gold Quarry]. Ag/Au = 1/1 [Main Mike]. Zn concentration 0.02 - 1.0 wt%. Sedex Zn, V, Ni, Org C, Mo, Ag, Hg, P, Pb.	Late barite: Th = 120°-180°C, salinity = 2-4% [paragenetic control on other minerals is inadequate]	Cretaceous(?) indicate 2- to 5-km lithostatic load
South Carlin Trend - Rain subdistrict (Rain, Emigrant)	Au, As, Hg, Sb, Tl, W (Ag/Au = 0.04 sulfide, 0.06 oxide. Au: 7.52 ppm sulfide; 4.83 ppm oxide. As: 1207 ppm sulfide, 834 ppm oxide) [Rain]. Conduits also have Ba and P (sedex?) [Rain]. Au, As, Hg, Sb, Tl, Ba [Railroad].	Qtz: Th = 195°-205°C (primary, in growth zone)	
Cortez subdistrict- Battle Mountain- Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Ag/Au in oxide: <0.02 [Pipeline].	Cretaceous(?) qtz veins: Th = 160°-265°C, salinity = 5.4-7.3 wt %; late ore-stage qtz-orp veins: Th = 192°-230°C, salinity = 5 wt %	
Tonkin Springs deposit- Battle Mountain- Eureka trend	Au, As, Sb, Hg, Tl, Ba		
Chert Cliff resource - Battle Mountain- Eureka trend			
Gold Bar district- Battle Mountain- Eureka trend (and satellite deposits- Gold Ridge, Gold Stone, Gold Canyon)	Unit 2 Upper Member Denay Fm: Au, As, Sb, SiO2, Tl, –CaO and –LOI; Immobile: Al2O3, TiO2, ± (K2O, Fe2O3). Introduced: Au, As, Sb, Tl, S, SiO2, ± (Zn, Hg). Depleted: CaO, LOI, MnO.		
Eureka district- Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Au correlates with As, Sb, Hg, Tl, Te		
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Au/Ag > 1, commonly > 10 in sed rocks; ~10 in dikes. Immobile: Ti, Al, Zr, and Th. Introduced: Au, Hg, Sb, Se, Te, Tl, Cs, (S, W). Depleted: Ca, Mn, Sr, Sc (Mg, Ba, K). Variably enriched or depleted: Fe, Cu, Mo.	Ore-stage jasperoid and drusy quartz: Th = 160°-220°C, salinity = 2-4%, ~2-4 mol % CO_2, <~2.3 mol % CH_4, <~ 0.2 mol % H_2S; orpiment: Th = 120°-180°C, fluorite: Th = 100°-160°C; calcite: Th = 100°-160°C; inclusions in orp, flu, and cc contain similar or more dilute dissolved salts and gases	>1.2-2.4 km lithostatic P; >3.3 km hydrostatic P
Jerritt Canyon	Hanson Creek and Roberts Mountains Fm ls - immobile: Al, Ti, K, Fe; introduced S, Au, As, Sb, Tl, Hg, Se, Ag, ± minor to major Si; depleted: CO_2, Ca, Sr, Mg, Mn. 324 and 40.8 Ma basalt dikes - immobile: Al, ±Ti; introduced: S, Au, As, Sb, Tl, Hg, W, Te, Se, Ag, ± minor Cu, Zn, Pb; depleted: Na, Mg, Ca, Mn, K, Ba, ± minor Fe, Si	Quartz and calcite: Th = 120°-235°C, Salinity = 0-7 wt %, 1.5-4 mol % CO_2, 0.1-0.01 mol % H_2S, <0.1-1 mol % combined N2, CH_4, and short chain hydrocarbons	1.5-3 km
Alligator Ridge	Au/Ag ~1 in carbonaceous ore but locally >20 in oxide ore; enriched in Si, S, As, Sb, Tl, Hg, Au, Ag, ± Ba, minor Fe; not enriched in base metal	Late ore-stage calcite: Th = 200°–230°C; Gases = low (very small to nil bubbles upon crushing in oil)	

Table A2. *(Cont.)*

Districts/ subdivisions/deposits	H isotopes in fluid inclusions (FI) and clay/alunite	Quartz: O isotopes
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Fluid inclusions-ore quartz: -107 to -175‰, postore quartz: -163 to -184‰ [Betze]; "Kaolinite": -160 to -145‰ [Meikle, Post, Betze], -152 to -94‰ [Deep Star]; <2 μm clay = -162 to -88‰ [Deep Star]; <2 μm clay = -162 to -140‰ [Deep Post, Betze: samples comprised mainly of kaolinite]; interpretation: meteoric water [Meikle, Post, Betze] ±component of magmatic/metamorphic water [Deep Star]; conflicting interpretation whether deep fluid source signal due to inherited Jurassic clays	Jasperoid: 4.0 to 7.9‰; Drusy quartz in jasperoid: 0.1 to 7.0‰; interpretation: meteoric water that evolved by exchange with carbonate rocks at elevated temp and moderate water/rock
Central Carlin trend - Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Mixtures of <2-_m kaolinite and white mica = -137 to -97‰; kaolinite-rich samples have lower values than white mica-rich samples; interpretation: if white mica produced by Cretaceous intrusion-related system and kaolinite by the late Eocene Carlin-type system, Carlin-type fluids consisted of meteoric water; if both minerals were produced by the Carlin-type system, then meteoric water and a deeper sourced magmatic or metamorphic water were involved; alunite: -144, -159‰ (20 Ma supergene waters)	
South Carlin Trend - Rain subdistrict (Rain, Emigrant)		
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Cortez: kaolinite = -138‰ (H_2O at 200°C = -119‰); fluid inclusions = calcite and quartz (uncertain paragenesis): -135 to -142‰	Cortez: quartz veinlets of uncertain pargenesis: 6.35-18.23‰; interpreted water at 200°C: -6 to 6‰; interpretation: meteoric water that evolved by exchange with carbonate rocks at elevated temp and moderate W/R
Tonkin Springs deposit-Battle Mountain-Eureka trend		
Chert Cliff resource - Battle Mountain-Eureka trend		Unaltered Webb Fm whole rock: 20 to 24.5‰; altered Webb Fm whole rock: 12 to 19‰
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Fluid inclusions, late ore-stage orpiment and realgar: -116‰ (meteoric water)	Ore stage(?) replacement quartz: 4.8 to 24.5‰; late ore-stage drusy quartz: -3.7 to 20.7‰; positive correlation between deposit size and $\delta^{18}O$ of jasperoid; interpretation: mix of highly evolved and unevolved meteoric water
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Fluid inclusions, hydrothermal dolomite: -139 to -141‰; interpretation: more consistent with a mid-Tertiary meteoric water overprint than with Cretaceous meteoric water	Windfall Fm jasperoid: 4.5 to 10.8‰; Ratto Canyon jasperoid: 11.9-13.6‰; interpretation: evolved meteoric water
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Getchell: Cretaceous preore quartz: -58 to -96‰; ore-stage quartz: -84, -97, -114‰; orpiment: -50 to -101.7‰; fluorite: δD= -77, -84‰, δ18O=4.8, 0.6‰; late ore calcite: -69 to -125‰; postore calcite -109‰; postore secondary fluids in rlg: δD = -133 to -151‰, δ^{18}O= -13.6 to -17‰; Turquoise Ridge: Cretaceous preore quartz: -54, -75‰; ore-stage quartz: -46, -33‰; late-stage calcite: -110‰; postore secondary fluids in rlg: δD = -140‰, δ^{18}O = -15.6‰; Chimney Creek: kaolinite = -138‰, fluid inclusion waters in calcite and quartz of uncertain paragenesis -135 to -142‰; interpretation: ore fluids have deep magmatic or metamorphic source and exhibit increased mixing with evolved meteoric fluids with time; fluids in realgar are secondary and unrelated to ore fluids	Getchell: Preore (Cretaceous) quartz: 15.1 to 24.6‰; ore-stage qtz: 18.7 to 21.9‰; Turquoise Ridge: Preore (Cretaceous) quartz: 22, 19.7‰, ore-stage quartz: 19.9, 21.6‰; Chimney Creek: quartz veinlets = - 6.35 to 18.23‰; interpreted water compositions: -12 to 0‰
Jerritt Canyon	Fluid inclusions, late ore-stage orpiment, realgar, quartz, stibnite and barite: -149 to -118‰. Ore stage kaolinite, argillized 40.8 Ma basalt dikes: -143 to -129‰. Interpretation: meteoric water.	Ore-stage replacement quartz: 1.1 to 15.2‰; late ore-stage drusy quartz: -1.6 to 9.2‰; positive correlation between Au content and δ18O value of jasperoid; interpretation: mix of highly evolved and unevolved meteoric water
Alligator Ridge	Late ore-stage kaolinite, –122 to –132‰; Whole-rock carbonaceous ore (illite), –116 to –119‰; interpretation: meteoric water	Jasperoid: 11 to 24‰, mode = 17‰; drusy quartz in jasperoid: 10.2 to 20.1‰; chalcedony veinlet in jasperoid: 16.4‰; opal veinlet in jasperoid: –1.1‰; interpretation: meteoric water that evolved by exchange with carbonate rocks at elevated temp and low water/rock

Table A2. *(Cont.)*

Districts/ subdivisions/deposits	Carbonate: C and O isotopes
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Fresh limestone: C = -2 to 2‰, O = 18 to 27‰; Fresh zebra dolomite: C = -3 to -1‰, O = 10 to 17‰; altered rocks: C = 0 to 3‰, O = 3 to 8‰; in calcite: C = 1.5 to 3.5‰, O = 2.5 to 6.5‰; interpretation: increased $\delta^{13}C$ values and decreased $\delta^{18}O$ values reflect reduction of CO_2 to CH_4 by organic matter in the rocks ± precipitation of calcite at low temperatures from exchanged meteoric water
Central Carlin trend - Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	
South Carlin Trend - Rain subdistrict (Rain, Emigrant)	Devils Gate Ls: C = 0.4 to 2.8‰, O = 16.3 to 21.4‰; dolostone: C = -0.3 to 0.9‰, O = 17.0 to 22.6‰; hydrothermal dolomite: C = 0.4 to 2.0‰, O = 10.3 to 13.2‰; carbonate clast in bx: C = -3.9‰, O = 11.8‰; calcite veinlets: C = 1.0 to 4.1‰, O = 7.6 to 10.6‰; interpretation: CO_2 derived from normal marine limestones; H_2O either consisted of, or contained a major component, of moderately exchanged meteoric water
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Cortez: calcite in unaltered host rocks: O = (mostly) 18-22‰, C = (mostly) 0-1‰; calcite veins in orebody: O = 9-14‰; C = 0 – -4‰; late-stage calcite: O = -15 to -12‰
Tonkin Springs deposit-Battle Mountain-Eureka trend	
Chert Cliff resource - Battle Mountain-Eureka trend	
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Preore sparry dolomite C = 0.6‰, O = 18.6‰; late ore-stage(?) calcite C = -4.8 to 1.5‰, O = 11.5 to 17.4‰; interpretation: CO_2 derived from normal marine limestones
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Getchell: Late ore-stage calcite: O = 10.1 to 25.2‰, C = -4.5 to -7.9‰; postore calcite: O = -12.2‰, C = -9.9‰; Turquoise Ridge: late calcite: O = 25.2‰; Chimney Creek: calcite veins, O = 9 to 14‰, C = 0- -4‰; Rabbit Creek: O shows crude zonation from 24‰ (unaltered carbonate) to 12‰ (ore), C = 0 to -10‰; interpretation: low $\delta^{13}C$ of late ore-stage calcite consistent with deep source of CO_2
Jerritt Canyon	Fresh and variably altered host rocks: calcite: C = -5.0 to 1.4‰, O = 7.0 to 23.3‰; dolomite: C= -0.8 to 2.6‰, O = 11.4 to 27.5‰; late ore-stage calcite veins: C = -3.2 to -0.8‰, O = 1.3 to 15.6‰; interpretation: CO_2 derived from normal marine limestones
Alligator Ridge	Data set 1: Distal unaltered Pilot carbonates: O = 24.4‰ (n = 4), C = -1.3‰ (n = 4); proximal Pilot carbonates: O = 12-26‰, C = -2.5 to 2‰; distal unaltered Devil's Gate carbonates: O = 23.7‰, C = 0.7‰, proximal Devil's Gate carbonates: O = 12-20‰, C = -0.5 to 2‰; calcite veins: O = 0-16‰, C = -1.5 to 3.5‰; organic matter: -26.5 to -30‰; jasperoid O = 12.9-20.1‰; data set 2: Fresh rocks: C = –2.1 to 2.1‰, O = 19.8-25.5‰; altered rocks: C = –2.3 to 1.4‰, O = 12.7-25.7‰; vein calcite: C = –1.3 to 3.1‰, O = 3.8-19.4‰; interpretation: increased $\delta^{13}C$ values and decreased $\delta^{18}O$ values reflect precipitation of calcite at low temperatures from exchanged meteoric water ± minor reduction of CO_2 to CH_4 by organic matter in the rocks

Table A2. *(Cont.)*

Districts/ subdivisions/deposits	Sulfide: S isotopes (conventional unless indicated as ion probe)
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Dev Popovich Formation: syngenetic and diagenetic py = -16.4 to 16.0‰, sph =10-18‰; Jurassic py = 9‰, 14.8 to 20.0‰, sph =1 0.6‰, gal = 8.6‰, po 4.6‰; ore-stage py (mostly) 14-20 (multiple data sets), mc = 10 ± 3‰ [Post, Betze, Meikle, Deep Star]; ion probe analyses: ore py 1 to 7‰ [Screamer], -0.8 to 4.2‰ [Betze-Post]; late orp = 3.8 to 5.4‰, rlg = 3.6 to 15.2‰, stib = 3.8 to 8.7‰, with mode of 5‰ for these minerals; late botryoidal pyrite/marcasite = -29 to 20‰ [Carlin-highest stib and rlg S values]; interpretation: reduced S derived from diagenetic pyrite, organic S compounds, ±TSR [Carlin], ±magmatic [Screamer, Betze-Post]
Central Carlin trend - Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Stratiform py + sph = 8.4‰ [Mike]; diagenetic pyrite = 11.7 to 14.0‰ [Gold Quarry]; Cretaceous brassy pyrite in milky quartz veins = 9.3‰ [Gold Quarry], gal vein = 0.6‰ [Gold Quarry], dark sph = 1.6‰ [Mike], ion probe: dark sph = -9 to 8‰ [Mike]; mixtures of preore and ore stage pyrite = 3.9 to 13.0‰ [Gold Quarry and Mike]; ore-stage pyrite = 8.5 to 9.6‰ [Gold Quarry]; Late ore-stage stibnite = 3.8‰; orp = 11.0‰ [Gold Quarry]; late ore to postore py-marc = 0.2-3.2‰ [Gold Quarry]; supergene framboidal sph = -70 to -25‰ [Mike]; interpretation: these data suggest H_2S in ore fluids was derived primarily from diagenetic pyrite and organic S compounds in sedimentary rocks
South Carlin Trend - Rain subdistrict (Rain, Emigrant)	Diagenetic pyrite: 2.4 to 13.4‰; hydrothermal pyrite or mixture of diagentic and hydrothermal pyrite: -28.4 (late perithermal?) to 21.5‰ [Rain]; interpretation: alunite as proxy for average sulfide suggests H_2S was derived from diagentic py, org S compounds, ± minor TSR
Cortez subdistrict- Battle Mountain- Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Diagenetic py: 5.1‰; mixture of diagenetic and ore stage pyrite: 5.4‰[Cortez]
Tonkin Springs deposit- Battle Mountain- Eureka trend	Orpiment 8.7-9.3‰; realgar 8.7-10.8‰; interpretation: H_2S derived from sedimentary py, organic sulfur compounds, TSR
Chert Cliff resource - Battle Mountain- Eureka trend	Diagenetic pyrite -20 to 14‰; mixture of diagenetic and ore-stage pyrite -12.1 to 14.1‰; As-pyrite rims 10.0-13.0‰; realgar 14.2 to 14.6‰; orpiment -3.8 to 3.7‰
Gold Bar district- Battle Mountain- Eureka trend (and satellite deposits- Gold Ridge, Gold Stone, Gold Canyon)	Late ore stage: orpiment and realgar = 12.6 to 15.5‰, realgar = 7.1‰, stibnite = 5.7 to 8.2‰; interpretation: H_2S derived from sedimentary pyrite, organic sulfur, TSR
Eureka district- Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Cretaceous skarn vein and replacement: 7.2-20.1‰, mean = 14‰; mixture ore and diagenetic(?) py = 13.2, 17.2‰; realgar 8.7-10.0‰ and 17.9-20.7‰; interpretation: H_2S derived from sedimentary py, organic S, and TSR, perhaps from Neoproterozoic-Lower Cambrian siliciclastic rocks
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Getchell: ore-stage py/mc: -3.1-3.1‰ (ion probe analyses), calculated H_2S in fluid: -4.85-1.35‰; orp: -0.9-6.2‰, calculated H_2S in fluid: 2.95-10.05‰; rlg: 1.5-5.3‰, calculated H_2S in fluid: 5.7-9.5‰; Chimney Creek pyrite = 5.42‰; interpretation: S in Getchell district is consistent with a magmatic source but also with derivation from sedimentary rocks; S evolved to higher compositions in late ore-stage minerals, possibly indicating increasing S contribution with time from thermochemical sulfate reduction
Jerritt Canyon	Diagenetic pyrite: -13.7 to 29.4‰; MVT-like sph 15.5‰; ore-stage pyrite, marc, aspy = 7.4 to 12.4‰; Late ore stage: orpiment = 6.4 to 7.4‰, realgar = 6.8 to 9.1‰, stibnite = 10.0 to 11.5‰; interpretation: H_2S derived from sedimentary pyrite and organic sulfur
Alligator Ridge	Barren Pilot sh py: -5 - 5‰. Jurassic Bald Mtn reduced intrusion-related Au system: 10.0-26.4‰, mode = 17‰; mineralized Pilot sh py: -5 to 12‰; orp, real, stib = –7.7 to 14.4‰; interpretation: reduced S leached from sedimentary rocks by exchanged meteoric water

TABLE A2. *(Cont.)*

Districts/ subdivisions/deposits	Sulfate: S and O isotopes	He isotopes (R/Ra)
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Preore sedex and diagenetic barite: S = 26 to 51‰; O = 13 to 23‰; postore barite crystals: S = 13.2 to 16.0‰; O = 3‰; Carlin S = 26.6 to 34.4‰; supergene alunite: 8.6 to 11.2‰, mean = 9.6‰; interpretation: postore sulfate from oxidation of H_2S-rich fluid that leached sulfur from organic S compounds ± sulfides in sedimentary rocks; sulfate in postore barites with high 34S values derived primarily from early barites	
Central Carlin trend - Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)	Preore milky vein barite: S = 33.1‰; late ore barite S = 27.4-40.7‰, O = 0.0 to 2.4‰; postore barite S = 15.0-17.1‰; supergene alunite S = -1.9 to 8.7‰, median = 6.0‰; sulfate O = -2.8 to 2.5‰; interpretation: sulfate mainly derived from syngenetic and diagenetic barite by meteoric water with localized oxidation of H_2S derived from organic S and/or diagenetic sulfide minerals	
South Carlin Trend - Rain subdistrict (Rain, Emigrant)	Rain: Late barite S = 23.7 to 37.6‰, O = 0.5 to 12.9‰; Railroad: Late barite S = 18.0 to 35.9‰, O = 0.0 to 11.7‰; alunite: -8.7 to 14.2‰, median = 12.9‰; jarosite: 7.7‰	
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)	Horseshoe: Postore barite: S = 14.6‰	
Tonkin Springs deposit-Battle Mountain-Eureka trend		
Chert Cliff resource - Battle Mountain-Eureka trend	Preore barite: S = 33.1 to 36.7‰	
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)	Late ore-stage barite from jasperoid: 30.6 to 40.9‰, 2.6 to 17.6‰; supergene alunite: 12.0‰; interpretation: sulfate derived from diagenetic(?) barite by meteoric water with little or no oxidation of sulfide minerals or H_2S	
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Ratto Canyon late barite: S = 28.0‰ and O = 4.0‰; interpretation: sulfate leached from marine sedimentary source rocks by moderately exchanged meteoric water	
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Getchell: sedimentary barite: S = 30.5 to 36.5‰, postore barite: S = -6.9 to 4.1‰; Chimney Creek: alunite = 1.0 to 1.7‰	Fluid inclusions in: preore (Cretaceous) qtz = 6.6 ± 1.1; orp = 1.47 ± 0.57, 1.1 ± 0.59; fluor = 0.55 ± 0.04, 0.21 ± 0.007; galkhaite = 0.14 ± 0.01; interpretation: ore fluids contain small but unequivocal mantle/magmatic He signature that was increasingly diluted by radiogenic He with time
Jerritt Canyon	Preore barite: bedded - S = 19.3 to 29.0‰, O = 12.0 to 18.1‰; discordant vein and pod: S = 23.7 to 34.0‰, O = 8.7 to 18.8‰; late ore-stage barite: S = 17.6 to 27.6‰, O = -6.8 to 9.3‰; interpretation: sulfate dominantly from preore barite with minor oxidized H_2S	
Alligator Ridge	Preore barite: S = 25.9 to 47.1‰, O = 11.0 to 17.0‰; late barite: S = 21.0 to 39.4‰; O = -6.2 to 9.4‰; alunite: 3.8 to 13.5‰; interpretation: late sulfate derived from dissolution of sedimentary sulfate (barite) and oxidation of preexisting sulfide minerals	

Table A2. *(Cont.)*

Districts/ subdivisions/deposits	U, Th, Pb isotopes	References
North Carlin trend (Rossi, Capstone, Tara, Ren, Meikle, Goldstrike, Beast, West Leeville, Carlin)	Pb isotopes in galena and pyrite from quartz-base metal veins in Goldstrike stock ($^{206}Pb/^{204}Pb$ = 19.63) are distinct from pyrite associated with the Carlin systems ($^{206}Pb/^{204}Pb$ = 22.15-29.00) that reflect mixing between Neoproterozoic-Cambrian Pb and Pb from Paleozoic calcareous and siliciclastic rocks	Radke et al., 1980; Rye, 1985; Bakken et al., 1989; Arehart et al., 1992, 1993a, b; Kuehn and Rose, 1992, 1995; Sha, 1993; Lamb, 1995; Lamb and Cline, 1997; Teal and Jackson, 1997; Armstrong et al., 1998; Hofstra and Rye, 1998; Tosdal and Nutt, 1999; Hofstra and Cline, 2000; Furley, 2001; Bettles, 2002; Thompson et al., 2002; Ye et al., 2002; Arehart et al., 2003; Chakurian et al., 2003; Emsbo and Hofstra, 2003; Emsbo et al., 2003; Haynes et al., 2003; Heitt et al., 2003; Hickey et al., 2003a, b; Kesler et al., 2003a, b; Theodore et al., 2003; Tosdal et al., 2003; Henkelman, 2004; Lubben, 2004; Hofstra (unpub. data [Deep Star, Deep Post, Betze-Post, Screamer])
Central Carlin trend - Maggie Creek area (Gold Quarry, Mike, West Mike, Tusc)		Rota and Hausen, 1991; Arehart et al., 1992, 1993a, b; Heitt, 1992; Arehart and O'Neill, 1993; Sha, 1993; Jensen et al., 1995; Rota, 1996; Harlan et al., 2002; Norby and Orobona, 2002; Chakurian et al., 2003; Nemitz and Johnston, 2003; Bawden et al., 2003; Hofstra, unpub. data
South Carlin Trend - Rain subdistrict (Rain, Emigrant)		Thoreson, 1991; Arehart et al., 1992, 1993a, b; Williams, 1992; Clode et al., 1997; Shallow, 1999; Rayias, 1999; Clarke and Thompson, 2000; Clark et al., 2000; Williams et al., 1998, 2000; Longo et al., 2002
Cortez subdistrict-Battle Mountain-Eureka trend (Pipeline, Gold Acres, Cortez, Horse Canyon, Cortez Hills, Pediment)		Wells et al., 1969; Wells and Mullens, 1973; Rye et al., 1974, 1985; Radtke et al., 1987; Hays and Foo, 1991; Young, 1993; Blamey and Norman, 2000
Tonkin Springs deposit-Battle Mountain-Eureka trend		Gesick, 1988; Espell and Rich, 1991; Maher et al., 1993; Jennings, 2001; David Reid, unpub. U.S. Gold Corp. reports; Hofstra, unpub. data
Chert Cliff resource - Battle Mountain-Eureka trend		Maher et al., 1993; Vikre and Maher, 1996
Gold Bar district-Battle Mountain-Eureka trend (and satellite deposits-Gold Ridge, Gold Stone, Gold Canyon)		Broili et al., 1988; Masinter, 1990; French et al., 1996; Yigit, 2001; Yigit and Hofstra, 2003; Yigit et al., 2003, and refs therein
Eureka district-Battle Mountain-Eureka trend (Archimedes, Ratto Canyon, Windfall)	Ratto Canyon realgar (19.388, 15.761, 39.271) and Windfall pyrite (19.057, 15.712, 39.251) have lower $^{206}Pb/^{204}Pb$ values and similar $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ values to pyrite, galena, plagioclase in the Cretaceous Ruby Hill intrusion-related system; these values are distinct from plagioclase in a 36.8 ± 1.1 Ma qtz-feldspar porphyry dike (19.625,15.789, 39.465); Pb from sedimentary rocks ± Cretaceous mineralization	Blake et al., 1975; Barton, 1982; Wilson and Wilson, 1986; Holland et al., 1988; Dilles et al., 1996; Margolis, 1997; Vikre, 1998; Ghidotti and Barton, 1999; Mortensen et al., 2000; Hofstra, unpub. data
Getchell trend (Getchell, Twin Creeks, Rabbit Creek, Chimney Creek, Pinson)	Pb in ore-stage pyrite has the average value ($^{208}Pb/^{206}Pb$ = 1.99-2.02) for Neoproterozoic and Cambrian clastic rocks outcropping elsewhere in Nevada and also in the Osgood Mountains, with a component of Pb derived from "local" Paleozoic calcareous and siliciclastic rocks ($^{208}Pb/^{206}Pb$ <1.99); post ore-stage sulfide (orpiment and realgar) have Pb derived from the "local" Paleozoic calcareous and siliciclastic rocks ($^{208}Pb/^{206}Pb$ <1.99)	Taylor, 1976; Rye, 1985; Osterberg, 1990; Arehart and O'Neill, 1993; Groff, 1996; Barker and Harter, 1997; Cline et al., 1997, 2001, 2002, 2003; Groff et al., 1997; Hall et al., 1997, 2000; Cail, 1999; Horton, 1999; Cline and Hofstra, 2000; McLachlan et al., 2000; Tretbar et al., 2000; Cail and Cline, 2001, unpub. data; Tretbar, 2004
Jerritt Canyon	Post ore-stage (orpiment and stibnite) have elevated $^{206}Pb/^{204}Pb$ (19.65-21.44) indicating derivation of late Pb from Paleozoic calcareous and siliciclastic sedimentary rocks	Hofstra, 1994, unpub. data; Dewitt, 1999; Hofstra and Cline, 2000; Peters et al., 2003a, b; Tosdal et al., 2003
Alligator Ridge		Hausen and Park, 1985; Tapper, 1986; Ilchik et al., 1986; Ilchik, 1990a, b; Hulen and Collister, 1999; Nutt et al., 2000; Nutt and Hofstra, 2003

Table A3. Ages determined for Nevada Carlin-type gold deposits

Deposit	Age of mineralization	Fission-track data	Maximum age constraints	Minimum age constraints	Minimum age constrained by age of supergene alunite
Dee			37.64 ± 0.21 Ma 37.43–37.85 Ma • Ar-Ar plateau whole rock age on basaltic andesite • small plug that is clay-altered along margins and is correlated with mineralized basaltic andesite dikes in the pit and underground • Ressell et al. (2000a), (EG paper) • High confidence		
Rodeo	39.8 ± 0.6 Ma 39.2–40.4 Ma • Rb-Sr date on late ore-stage galkhaite • Arehart et al. (2003) • High confidence				
Griffin	40.03 ± 0.05 Ma 39.98–40.08 Ma • Ar-Ar total gas age on illite-bearing alteration associated with mineralized dike that assayed between 2 and 6 ppm (same dike with the U-Pb zircon date) • Age is older than age of dike emplacement, attributed to ^{39}Ar recoil loss • Ressel et al. (2000b) • Moderate confidence		38.1 ± 0.8 Ma 37.3–38.9 Ma • U-Pb date on zircons from 10 ft core interval of mineralized dike that assayed between 2 and 6 ppm Au • Mortensen et al. (2000) • High confidence 39.21 ± 0.12 Ma 39.09–39.33 Ma • Ar-Ar plateau age on biotite, unaltered part of dike that is correlated with mineralized dikes • Ressel et al. (2000a, b), • High confidence		
Post-Betze		35.5 ± 3.7 Ma 31.8–39.2 Ma • magmatic apatite in Goldstrike stock, uncertain association with Au mineralization • Chakurian et al. (2003) • moderate confidence	39.3 ± 0.8 Ma 38.5–40.1 Ma • Ar-Ar plateau age on biotite, unaltered part of dacite dike that is correlated with mineralized dikes • Arehart et al. 1993a, b), Emsbo et al. (1996), Ressel et al. (2000a) • High confidence 39.07 ± 0.21 Ma 38.86–39.28 Ma • Ar-Ar plateau age on biotite from rhyodacite dike that appears unaltered but has hydrated glass with light δD values, interpreted to be pre-ore • Ressel et al. (2000a) • moderate confidence, could be postmineral		9.5 ± 0.4 Ma 8.4–9.7 Ma • 2 K-Ar dates • Arehart et al. (1992), Arehart and O'Neil (1993) • High confidence

Table A3. *(Cont.)*

Deposit	Age of mineralization	Fission-track data	Maximum age constraints	Minimum age constraints	Minimum age constrained by age of supergene alunite
Deep Star				38.05 ± 0.09 Ma, 38.98 ± 0.26 Ma 37.96–39.24 Ma • Ar-Ar plateau? whole rock age on postore aphyric rhyolite • Postore rhyolite intrudes weakly mineralized pre-ore rhyolite with no reactivation along the contact, suggesting short time span between the pre- and post-re rhyolites; therefore, post-mineral rhyolite age is interpreted to be very close to the age of ore formation • Heitt et al. (2003) • High confidence	
Genesis			40.1 ± 0.3 Ma 39.8–40.4 Ma • Ar-Ar plateau age on biotite, unaltered part of dacite dike that is mineralized at depth • Farmer (1996, published in Ressel et al., 2000a), • High confidence		11.0 ± ? Ma • 1 K-Ar dates • Heitt (1992) • High confidence
Beast			37.31 ± 0.14 Ma (biotite), 37.37 ± 0.11 Ma (sanidine), 37.17–37.48 Ma • Ar-Ar plateau ages on unaltered part of rhyolite dike that hosts ~50% of the orebody • Ressel et al. (2000a), • High confidence	17.4–19.8 Ma	18.6 ± 1.2 Ma • 1 Ar-Ar date • Ressel et al. (2000a) • High confidence
Carlin East		27.7 ± 6.8 to 40.9 ± 4.0 Ma 20.9–44.9 Ma • 5 dates on magmatic, detrital, and hydrothermal apatite, uncertain association with Au mineralization • Chakurian et al. (2003) • moderate confidence			
Mike					19.7 ± 1.0 Ma 8.4–9.7 Ma • K-Ar date • Teal and Branham (1997) • High confidence
Gold Quarry					30.0 ± 1.2 Ma 25.3–31.2 Ma • 8 K-Ar dates • Heitt (1992), Arehart et al. (1992), Arehart and O'Neil (1993) • High confidence

TABLE A3. *(Cont.)*

Deposit	Age of mineralization	Fission-track data	Maximum age constraints	Minimum age constraints	Minimum age constrained by age of supergene alunite
Rain		31.7 ± 10.3 Ma 20.4–42.0 Ma • fission tracks on hydrothermal apatite in ore-bearing silicifed breccias • Longo et al. (2002) (NBMG paper) • moderate confidence	38.89 ± 0.20 Ma 38.69–39.09 Ma • Ar-Ar plateau? age on biotite from "lamprophyre" dike in Saddle deposit, similar dikes intensely clay-altered at Rain, could be postmineral at Saddle—not enough field description • Longo et al. (2002) (NBMG paper) • low confidence		22.3 ± 1.8 Ma 12.1–24.1 Ma • 7 K-Ar dates • Williams (1992), Arehart et al. (1992), Arehart and O'Neil (1993) • High confidence
Emigrant			37.5 ± 0.8 Ma 36.8–38.3 Ma • U-Pb SHRIMP date on zircons from an altered monzonite dike, unknown relationship with gold • Garwin (2001 published in Longo et al., 2002) • moderate confidence		
Getchell	39.0 ± 2.1 Ma 36.9–41.1Ma • Rb-Sr date on late ore-stage galkhaite • Tretbar et al. (2000) • High confidence				
Twin Creeks (Megapit)	41.37 ± 0.23 to 42.40 ± 0.25 Ma 41.14–42.65 Ma • 7 Ar-Ar plateau ages on unencapsulated adularia (grain size?) that is intergrown with ore-stage arsenian pyrite or late ore-stage stibnite • Groff et al. (1997), Hall et al. (2000) • High confidence				15.1 ± 1.2 Ma 14.4–16.3 Ma • 2 K-Ar dates • Bloomstein et al. (1991), Arehart and O'Neil (1993) • High confidence
Pinson		42.7 ± 5.3 Ma 37.4–48.0 Ma • hydrothermal apatite, uncertain association with Au mineralization • cf. Hofstra et al. (1999) • moderate confidence			
Preble					23.0 Ma 14.4–23.0 Ma • 2 K-Ar dates, no uncertainties published • Arehart and O'Neil (1993) • High confidence

TABLE A3. *(Cont.)*

Deposit	Age of mineralization	Fission-track data	Maximum age constraints	Minimum age constraints	Minimum age constrained by age of supergene alunite
Jerritt Canyon		MDRU data	40.8 ± 0.2 Ma 40.6–41.0 Ma • Ar-Ar plateau age on plagioclase on weakly altered but unmineralized basalt dike in West Generator Hill pit, similar dikes in pit are strongly altered and mineralized • Farmer (1996 published in Ressel et al., 2000) (EG paper) • High confidence		
Pipeline		38.7 ± 2.0 Ma 36.7–40.7 Ma • weighted mean of 7 samples within 2 km of Pipeline that had ages near 40 Ma, within 2 km of Pipeline there are 9 samples with ages between 13 and 29 Ma, and 2 samples with ages of 45 and 49 Ma, uncertain association with Au mineralization • G. Arehart, pers. commun. (2004) • moderate confidence			
Cortez		30.7 ± 5.0, 44.4 ± 4.3 Ma 25.7–48.7 Ma • 2 dates on apatite in Ada 52 pit, uncertain association with Au mineralization • G. Arehart, pers. commun. (2004) • moderate confidence		35.2 ± 0.2 Ma 35.0–35.4 Ma • U-Pb date on zircons from quartz-feldspar porphyry dike with clay-altered margins interpreted to be postmineral by Cortez mine staff • Mortensen et al. (2000) • low confidence	but is “barren” of gold,
Tonkin Springs				37.5 ± 0.8 Ma 38.5–39.3 Ma • K-Ar age on biotite in tuff that overlies Paleozoic-hosted Au mineralization • tuff is locally argillized and contains minor Hg and other trace elements • unpublished Homestake and Nevada Contact report tuff is separated from underlying mineralized Paleozoic rocks by regolith with altered clasts • Maher et al. (1993), unpublished Homestake report (1992); Jennings (2001) • low confidence, debate whether this is pre- or postmineral	

TABLE A3. *(Cont.)*

Deposit	Age of mineralization	Fission-track data	Maximum age constraints	Minimum age constraints	Minimum age constrained by age of supergene alunite
				33.4 ± 5.2 Ma 28.2–38.6 Ma • K-Ar age on biotite in unaltered andesite that overlies tuff • Maher et al. (1993) • high confidence	
Chert Cliff				33.9 ± 2.0 Ma 31.9–35.0 Ma • K-Ar age on biotite in unaltered dome that intrudes and overlies mineralization • Maher et al. (1993) • high confidence	
Gold Bar				23.8 Ma (no uncertainty published) • K-Ar whole rock? on postmineral tuff • Broili et al. (1988), Masinter (1990), Yigit and Nelson (2000) • high confidence	
Windfall-Rustler			36.4 ± 2.6 to 38.0 ± 1.6 Ma 33.8–39.6 Ma • 3 K-Ar age on biotite in rhyodacite within a few kms of the pits that are interpreted to be cogenetic with altered dikes in the pits, dikes contain minor Au and trace elements • McKee et al. (1971), Nolan et al. (1974), Wilson and Wilson (1986) • low confidence		
Ratto Canyon				37.8 ± 2.6 Ma 40.4–35.2 Ma • K-Ar age on hornblende from nearby rhyodacite • in pit, weakly argillized block and ash deposit of same rhyodacite unconformably overlies mineralized Paleozoic sediments, being separated by a regolith • block and ash deposit contains up to 16 ppb Au, 96 ppm As, 4 ppm Hg • McKee et al. (1971), Nolan et al. (1974), unpublished data, J. Muntean (1999, unpub. data) • low confidence	

Table A3. *(Cont.)*

Deposit	Age of mineralization	Fission-track data	Maximum age constraints	Minimum age constraints	Minimum age constrained by age of supergene alunite
Alligator Ridge			~ 45 Ma Eocene gastropods • Eocene sedimentary rocks, interpreted to be premineral, are silicificed, have the same $\delta^{18}O$ values as mineralized Paleozoic-hosted jasperoids but contain only up to 32 ppbAu, 447 ppm As, 26 ppm Sb, 24.5 ppm Hg and 5.6 ppm Tl • Nutt and Good (1998), Nutt and Hofstra (2003) • high confidence	34.99 ± 0.16 (sanidine), 34.83–35.15 Ma • Ar-Ar age on sanidine from reworked, unaltered tuff that overlies mineralization at Vantage pit • Nutt (1997), Nutt and Good (1998), Nutt and Hofstra (2003) • high confidence	12.4 ± 1.0 Ma 3.4–13.4 Ma • 8 K-Ar dates • Ilchik (1990a, b), Arehart and O'Neil (1993) • high confidence

Notes: Uncertainites are 2σ, only the oldest supergene alunite date is listed

TABLE A4. Models for Sources of Hydrothermal Fluids and Gold

Model	Description	References	Evidence for	Evidence against
Leaching by meteoric water—lateral fluid flow	In lateral flow domains of convection cells, gold from sedex deposits is leached and locally redeposited in the same host rocks to form Carlin-type deposits	Emsbo et al. (2003)	• In the northern Carlin trend, gold-bearing sedex deposits occur in rocks that host Carlin-type gold deposits • Consistent with inclusion homogenization temperatures and paucity of main ore-stage silicification • Consistent with most O and H isotope data • Consistent with most S isotope data (reduction of sedex barite by carbonaceous material in carbonate host rock, leach S from organic C compounds) • Absence of significant alteration or mineralization below deposits along ore controlling structures	• Significant gold-bearing sedex deposits only documented in northern Carlin trend • Pb isotopes indicate ore-stage Pb is from underlying Neoproterozoic rocks in Getchell trend • Evidence for leaching of sedex Au not documented • Magmatic or metamorphic fluids indicated at Getchell and Deep Star • S isotope data for Getchell and some north Carlin trend deposits consistent with magmatic S source • Gold present in sedex mineralization not shown to be sufficient to account for that in Carlin-type deposits
Leaching by meteoric water—upper crust (<10–15 km)	Leaching of gold by meteoric water convecting to the base of the upper crust; convection driven by magmatism and/or increase in geothermal gradient owing to extension; upwelling fluids focused into old, through-going basement fault zones	e.g., Ilchik and Barton (1997)	• O and H data show large component of exchanged meteoric water • S isotope data generally consistent with a sedimentary source • Pb, Sr, and Nd isotopes are consistent with two sources of upper crustal Pb-Neoproterozoic and Cambrian clastic rocks at the base of the upper crust and siliciclastic rocks of the Roberts Mountain allochthon • Synextensional penetration of meteoric waters to the brittle-ductile transition at 10 to 15 km has been documented by isotopic data in the metamorphic core complexes of eastern Nevada • Required leaching volumes are reasonable • Potential Proterozoic host rocks at the base of the crust are thickest in north-central Nevada • Consistent with deposits that lack coeval intrusions	• Evidence for magmatic/metamorphic waters at Getchell, Deep Star is not consistent with solely a leaching model • Reconstructions and apatite fission track data indicate northern Carlin trend and Jerritt Canyon formed below topographic and structural highs along dilatant fault systems that also localized dikes
Low-sulfidation epithermal	Carlin-type deposits are the sediment-hosted equivalents of volcanic hosted low-sulfidation epithermal deposits	Joralemon (1951), Roberts et al. (1971), Radtke et al. (1980)	• Generally similar hydrothermal alteration (silicification, decarbonatization, argillization) • Similar trace element signature • Similar estimated oxidation state • Some Carlin-type deposits formed near the surface • O and H isotope data in most districts indicate meteoric H_2O sources	• No evidence for open space filling and veining during main ore stage • Low abundance quartz • No textural, mineralogical, or fluid inclusion evidence for boiling or overlying steam-heated alteration (oxidation in Carlin-type deposits is supergene) • Much greater vertical extent to mineralization • No alteration or mineralogical zoning with respect to surface • Hydrothermal breccias rare to absent • Most deposits are illite-dickite stable rather than adularia-sericite stable

TABLE A4. *(Cont.)*

Model	Description	References	Evidence for	Evidence against
				• Limited association with volcanic centers • Gold is submicron and restricted to arsenian pyrite • Low Ag/Au ratios and low Ag concentrations • Though some deposits have similar depths of formation (<1 km), some deposits have formed at depths of 2–4 km, significantly deeper than low-sulfidation epithermal deposits
Distal deposits of epizonal intrusions (<~5 km)	Carlin-type deposits are distal products of deposits, such as porphyry copper-gold deposits, that form from magmatic-hydrothermal fluids expelled from stocks emplaced within 5–10 km of the surface	Sillitoe and Bonham (1990), Johnston and Ressel (2004)	• Late carbonate-hosted distal disseminated deposits have very similar alteration, mineralogy, and trace element signatures to Carlin-type deposits • Compatible with O and H isotope data from Getchell, Deep Star • Compatible with S isotopes from Getchell and Screamer • Porphyry copper-gold, skarn, and distal disseminated deposits formed in north-central Nevada during the same time as porphyry copper deposits • Deposits in the northern Carlin trend, such as Deep Star, have evidence for cogenetic dikes emplaced before and after mineralization • Dikes in the northern Carlin trend are ilmenite-rich and magnetite-poor, suggesting mineralization may be related to reduced I-type intrusions, which elsewhere in the world lead to Au-rich base metal-rich mineralization associated with low-salinity, CO_2-rich magmatic fluids.	• Lack of any significant zonation in alteration, or metals over scales of 10s of kms laterally or up to 1 km vertically that is characteristic of typical intrusion-related hydrothermal systems, either oxidized intrusions associated with porphyry coppers deposits or reduced I-type intrusions. For example no coeval skarn or base metal rich zones are associated with the large Carlin-type deposits. • Indicates no cooling of nearby high-temperature magmatic fluids. • No evidence of temperatures >250°C associated with Carlin-type deposits • The large Carlin-type deposits (>10 Moz) are an order of magnitude larger than any known distal disseminated deposit associated with an epizonal intrusion • The large Carlin-type deposits (>10 Moz) have no spatial association with coeval hypabyssal stocks
Metamorphism	Hydrothermal fluids and gold are derived from dehydration and decarbonation reactions in the lower and middle crust during metamorphism	Seedorff (1991), Hofstra and Cline (2000)	• Compatible with O and H isotope data from Getchell, Deep Star • He isotopes in fluid inclusions associated with ore have a mantle signature indicating deep fluid source • Close association with basement fault systems • Characteristics, including low salinity, elevated CO_2, high Au/Ag, high Au/base metals, associated and elevated Au-As-Sb, lack of consistent alteration and metal zoning, association of Au with carbon, and Au deposition coincident with regional thermal events, is similar to orogenic gold deposits, which have been proposed to form from metamorphic fluids	• Known peak metamorphism occurred in the late Cretaceous, which may require “storage” of metamorphic fluids until extension in the Eocene enabled their release • Unknown whether metamorphism occurred during the Eocene or whether lower crust was still sufficiently hydrated after Cretaceous metamorphism to generate metamorphic fluids • No evidence for temperatures >250°C • No coeval quartz veins below the deposits; such veins are characteristic of orogenic deposits proposed to form from the cooling of metamorphic fluids

Table A4. *(Cont.)*

Model	Description	References	Evidence for	Evidence against
			• The size of the Carlin gold belt in Nevada, the volume of gold in the deposits, the uniform fluid characteristics, the lack of zoning, and the large-scale geologic features that control deposit locations, suggest deep crustal-scale processes, such as metamorphism, were involved in forming the deposits	
Deep magmatism (>5–10 km)	Gold is transported by immiscible magmatic vapors from deeply emplaced intrusions (>10 km?)	Heinrich (2005)	• Au-Cu-As-Sb-Hg-Te signature of ore-stage pyrite is consistent with vapor transport • Compatible with O and H isotope data from Getchell, Deep Star • He isotopes in fluid inclusions associated with ore at Getchell have a mantle signature indicating deep fluid source • Compatible with S isotopes from Getchell and Screamer • Deposits in the northern Carlin trend, such as Deep Star, have evidence for cogenetic dikes emplaced before and after mineralization • Condensation of magmatic volatiles into ground water can explain carbonate dissolution and argillization	• Not all deposits have dikes • Most O and H isotope data indicate meteoric water • Most S isotope data suggest sedimentary source • No quartz veins in ore fluid conduits below deposits indicating cooling of magmatic fluids • No high T mineral assemblages or fluid inclusions like those typically found below high sulfidation deposits • No hypogene alunite

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