



UNIVERSITY OF NEVADA, RENO
MACKAY SCHOOL OF MINES

NEVADA BUREAU OF
MINES & GEOLOGY
SPECIAL PUBLICATION
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THE NEVADA
MINERAL INDUSTRY
1988

Metals
Industrial Minerals
Oil and Gas
Geothermal

Exploration
Development
Mining
Processing
Directories of Operations

1989

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GOLD

OIL

SILVER

SAND & GRAVEL

BARITE

DIATOMITE

MERCURY

CRUSHED ROCK

CEMENT

LITHIUM

LIME

MAGNESITE

GEOTHERMAL

SILICA

CLAY

FLUORSPAR

TURQUOISE

ASPHALT

PERLITE

PUMICE

TUNGSTEN

OPAL

COPPER



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THE NEVADA MINERAL INDUSTRY — 1988

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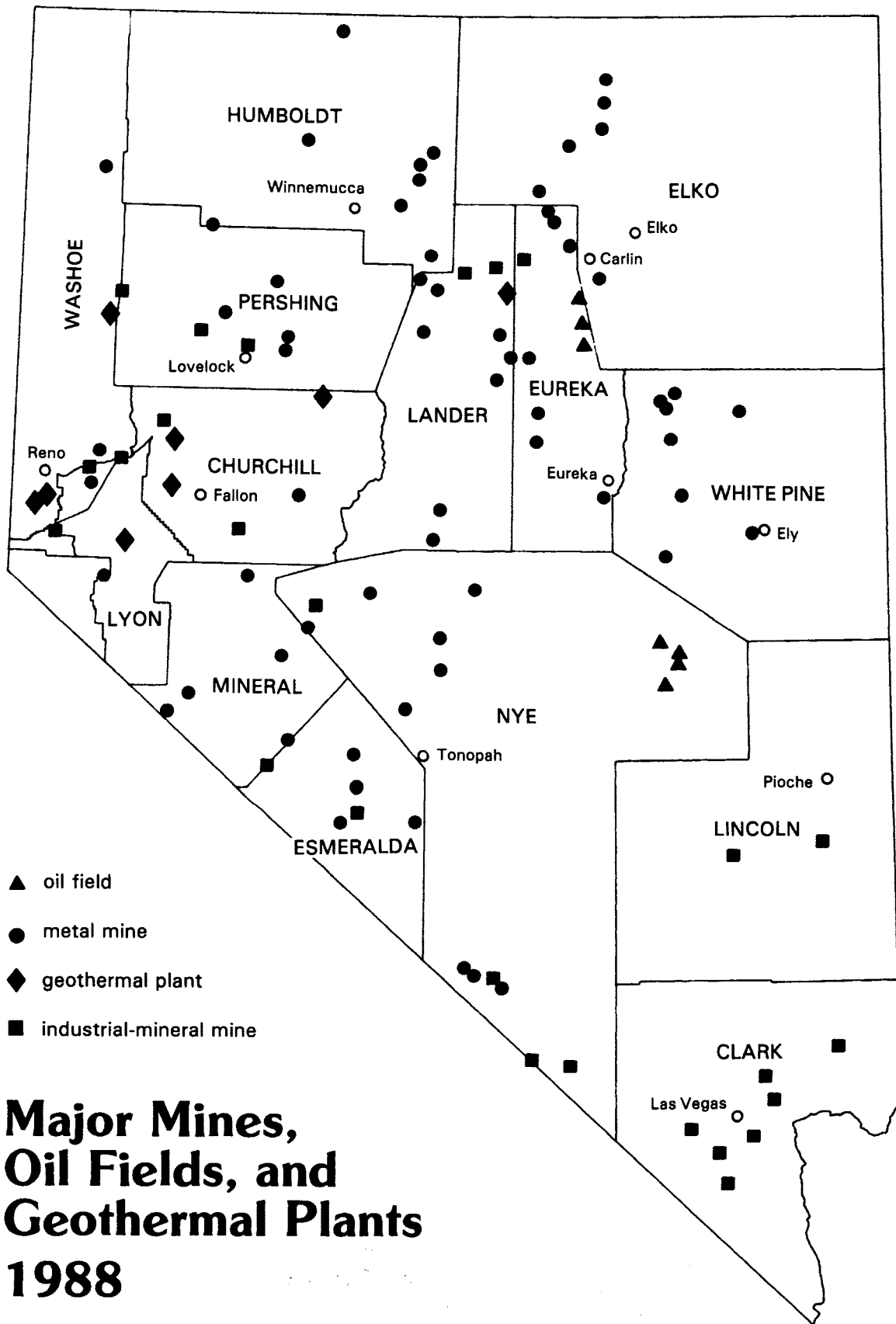
This report, tenth of an annual series, describes 1988 mineral and geothermal activities and accomplishments in Nevada: production statistics, exploration and development including drilling for petroleum and geothermal resources, discoveries of orebodies, new mines opened, and expansion and other activities of existing mines. Statistics of known bulk-mineable gold and silver deposits, and directories of mines and plants are included.

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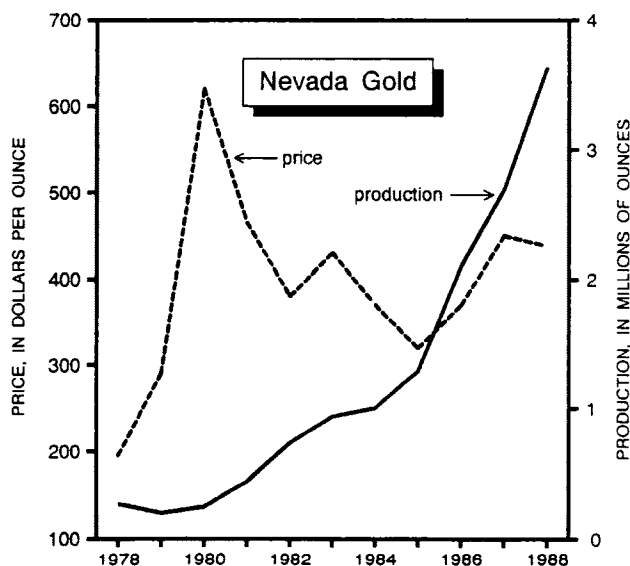


Summary

by Jonathan G. Price

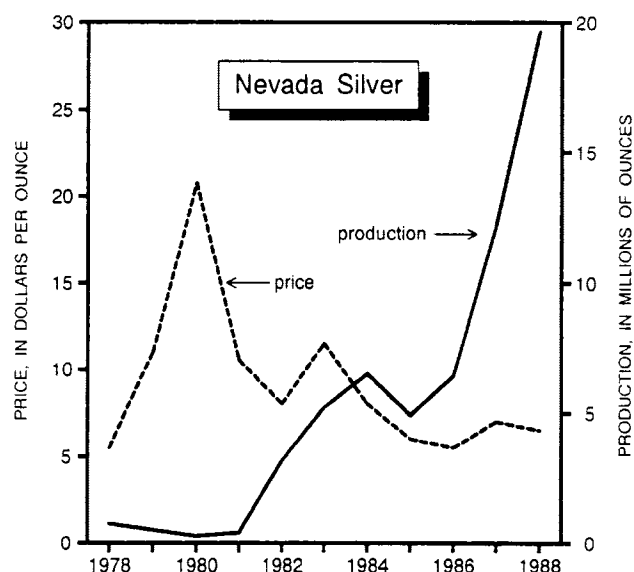
Nevada is in the midst of several economic booms, some caused by and some causing expanded activity in the mineral industry. This report highlights recent activities through 1988 in metals, industrial minerals, petroleum, and geothermal energy. Numerous tables and charts are included in this summary and throughout the individual chapters for quick inspection of the data and trends.

Gold continues to hold the spotlight of Nevada mineral production, and 1988 was another banner year—over 3.6 million troy ounces. Gold production in 1988 jumped 35 percent over 1987, in which production increased 28 percent over 1986. The value of gold production in 1988, nearly \$1.6 billion, accounted for 79 percent of total Nevada mineral and energy production. Despite significant drops in average gold sale prices from 1987, new mines and expansions at existing mines are likely to boost production in 1989. The chapter in this report on **Metals** summarizes the major exploration discoveries and new mine plans announced in 1988. The table on **Bulk-Mineable Precious Metal Deposits** lists reserves and resources, grades, and other pertinent information on most of the deposits for which information has been published.



Heap-leaching of ores by cyanide solutions is allowing the profitable production of gold from ores with average grades as low as 0.02 ounces per ton and cutoff grades as low as 0.008 ounces per ton. Declining international gold prices may limit the production of such low-grade deposits, but reserves of relatively high-grade ores should assure Nevada gold production at significant levels for at least two decades. The total identified Nevada gold resources, which range from measured, economic reserves to inferred, perhaps subeconomic resources, stand at approximately 94 million ounces.

In 1988 Nevada, the Silver State, ranked first in the U.S. not only in gold but also in silver production. Much of the silver production is, however, involuntary in the sense that it is a byproduct of gold production. It is therefore not surprising that Nevada silver production has closely followed gold in recent years. The gold boom is also a silver boom: silver production in 1988 jumped 60 percent over 1987—to 19.5 million ounces. Two mines in Pershing County, however, are exceptions to the generalization that silver is tied to gold. The Rochester mine, the largest single silver producer in the U.S. in 1988, produces gold and silver coproducts, with slightly more value in silver. The Trinity mine produced only silver.



Nevada ranked third in the U.S. in total value of nonfuel mineral production in 1988, according to figures provided by the U.S. Bureau of Mines. California ranked first because of its large population needing huge quantities of construction materials (cement, sand and gravel, and crushed stone). Arizona was second because of a resurgence in the price of copper, which constituted 81 percent of Arizona's value. Although Nevada was not in a position to take immediate advantage of the recent copper boom, higher copper prices have renewed interests in mining the Hall molybdenum-copper deposit in Nye County and in reprocessing dumps from the Yerington district in Lyon County.

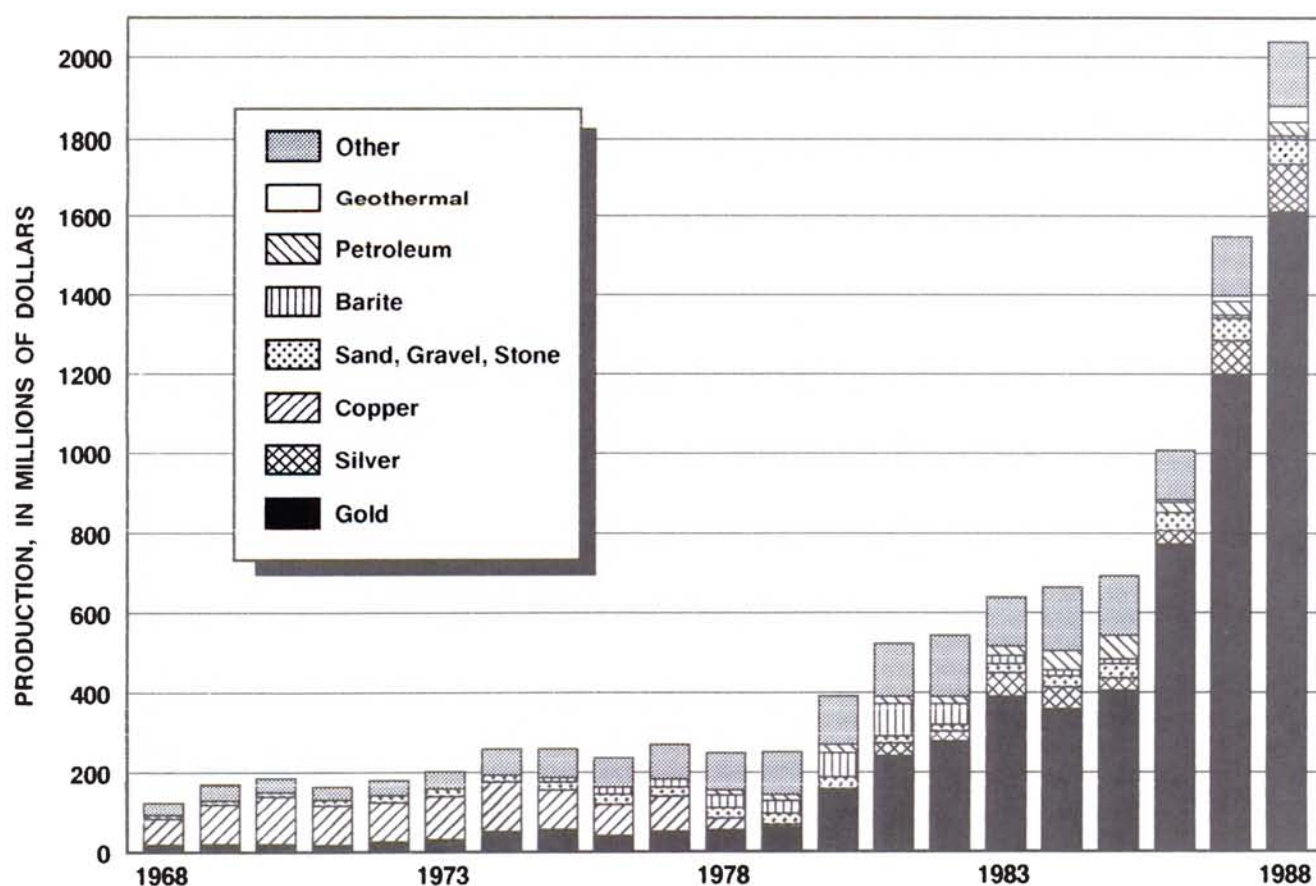
The population of Nevada is also booming, in part because of strengths in the gaming, tourism, and retirement industries. Clark County, in particular, is experiencing unprecedented growth. In response to this growth and to some extent in response to increased demand from California, production has increased significantly for sand and gravel, crushed stone, and gypsum. Lime production increased as a

MINERAL, PETROLEUM, AND GEOTHERMAL POWER PRODUCTION IN NEVADA¹

Minerals	1986		1987		1988 preliminary	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite (thousand short tons)	184	\$3,005	170	\$8,100	156	\$7,540
Clays (thousand short tons)	10	584	22	900	34	1,400
Gemstones	NA	213	NA	280	NA	280
Geothermal power (thousand megawatt-hours)	88	6,249	198	14,736	475	39,067
Gold (thousand troy ounces)	2,099	772,928	2,679	1,200,269	3,676	1,611,020
Petroleum (thousand 42-gallon barrels)	2,906	25,515	3,109	34,603	3,231	33,118
Sand, gravel, crushed stone (thousand short tons)	13,697	42,692	13,900	56,000	15,400	62,000
Silver (thousand troy ounces)	6,409	35,056	12,190	85,451	19,535	127,760
Other minerals ²	—	122,872	—	149,220	—	156,320
Total	—	1,009,114	—	1,549,559	—	2,038,505

¹Production as measured by mine shipments, sales, or marketable production (including consumption by producers); compiled by NBMG and U.S. Bureau of Mines.

²Production data for gypsum, industrial sand, mercury, and perlite are combined with copper, diatomite, fluorspar, iron ore, lime, lithium minerals, magnesite, molybdenum, portland cement, and salt to avoid disclosure of company proprietary data.



Nevada mineral, petroleum, and geothermal power production, 1968–1988 (compiled by NBMG and U.S. Bureau of Mines).

result of the booming gold industry, which needs high-calcium lime for pH control of cyanide solutions. The chapter on **Industrial Minerals** highlights these and the activities for other commodities, including diatomite, lithium carbonate, cement, barite, clay, magnesite, silica, salt, perlite, fluorite, and zeolites.

Employment in the Nevada mining industry increased 23 percent from 1987 to 1988. The increase came chiefly in large gold mines, ones with more than 100 employees. The **Directory of Mining**

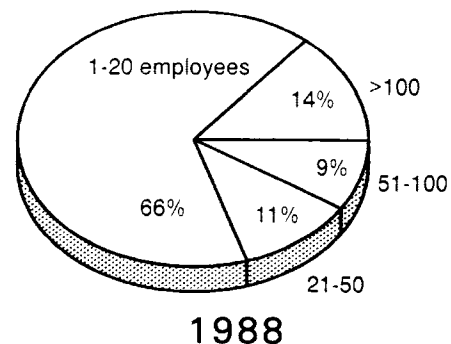
and **Milling Operations** lists the significant mines and plants throughout the state. The gold boom of the 1980's, which appears to be heading strongly into the 1990's, has added employment mainly in the rural communities. Although much of the activity has been in northern Nevada, mining is scattered throughout the state. Elko, Winnemucca, and Beatty are experiencing rapid growth. Reno and Sparks continue to be the locations of numerous exploration offices, analytical laboratories, and other service companies.

NUMBER OF MINES AND EMPLOYEES IN NEVADA'S MINERAL INDUSTRY

(Data for 1978-1987 are from the State Mine Inspector's Reports;
1988 data were compiled from the Directory of Mining and Milling Operations in this publication.)

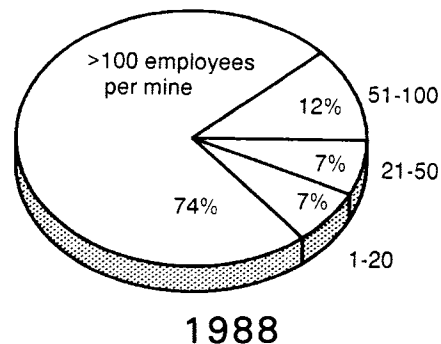
NUMBER OF MINES BY WORK-FORCE SIZE

Year	Work-force size (employees/mine)				Total
	1-20	21-50	51-100	> 100	
1978	306	18	9	9	342
1979	340	25	10	7	382
1980	392	30	11	17	450
1981	383	34	12	16	445
1982	312	22	8	14	356
1983	315	22	8	15	360
1984	325	24	12	18	379
1985	289	24	16	15	344
1986	250	26	14	21	311
1987	260	26	16	24	326
1988	155	25	22	33	235



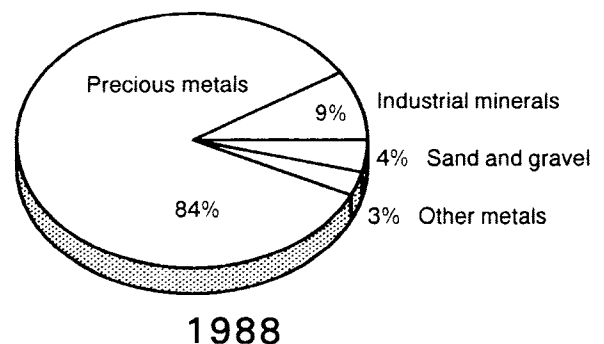
NUMBER OF EMPLOYEES BY WORK-FORCE SIZE

Year	Work-force size (employees/mine)				Total
	1-20	21-50	51-100	> 100	
1978	1,544	609	626	2,205	4,984
1979	1,738	791	588	1,311	4,428
1980	2,139	1,037	799	4,195	8,170
1981	2,124	1,128	884	4,400	8,536
1982	1,640	716	533	2,632	5,521
1983	1,635	742	561	2,812	5,750
1984	1,437	767	887	3,127	6,218
1985	1,279	722	1,129	3,310	6,440
1986	1,315	848	921	5,171	8,255
1987	1,376	799	1,166	6,973	10,314
1988	941	832	1,483	9,441	12,697



NUMBER OF EMPLOYEES BY COMMODITY

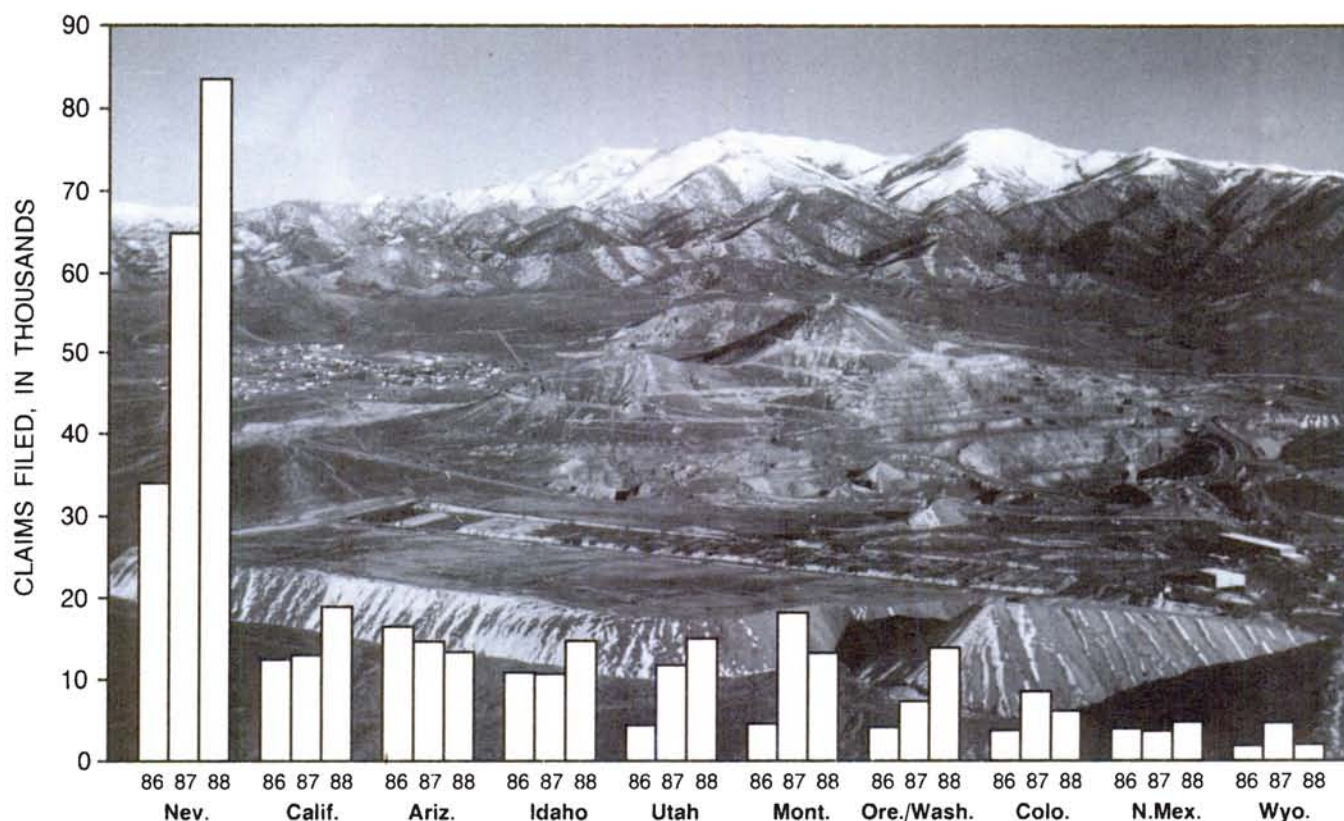
Year	Precious metals	Other metals	Industrial minerals	Sand & gravel	Total
1978	1,096	1,859	1,479	550	4,984
1979	1,503	833	1,604	488	4,428
1980	3,808	1,918	1,804	640	8,170
1981	4,263	2,018	1,760	495	8,536
1982	2,905	867	1,357	392	5,521
1983	3,616	598	1,104	432	5,750
1984	4,097	646	1,049	426	6,218
1985	4,595	256	1,046	543	6,440
1986	6,460	175	976	644	8,255
1987	8,636	160	901	617	10,314
1988	10,638	412	1,090	557	12,697



**CLAIMS FILED WITH THE
U.S. BUREAU OF LAND MANAGEMENT**

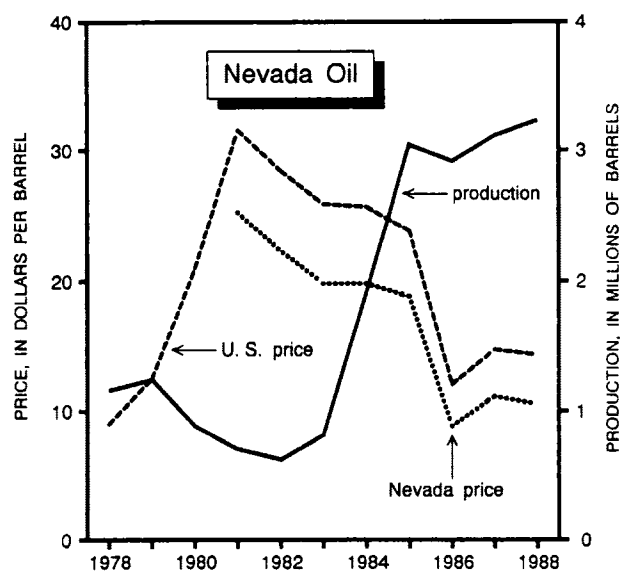
Nevada continues to lead the nation in the number of mining claims filed with the U.S. Bureau of Land Management. The gold boom and the fact that most of the land in Nevada is owned by the federal government combined to keep Nevada well ahead of other states in new claims in 1988 and in total active claims.

	1976-1987	1988	Total active claims
Nevada	455,971	83,389	369,048
California	199,206	18,992	150,480
Arizona	278,393	13,416	142,803
Utah	303,911	15,059	112,895
Montana	147,456	13,270	86,156
Idaho	128,290	14,832	85,926
Colorado	225,635	6,237	80,255
Wyoming	236,138	1,950	61,678
New Mexico	143,908	4,757	36,130
Oregon/Washington	97,304	13,683	52,675



New claims filed with the U.S. Bureau of Land Management, 1986-1988.

Whereas the U.S. is suffering significant declines in oil production and OPEC is keeping prices low and imports to the U.S. high, Nevada is experiencing a healthy increase in oil production—up nearly 4 percent from 1987 levels. This unusual trend is a clear indication that Nevada is one of few frontier areas for oil exploration in the lower 48 states. In 1988 the North Willow Creek field in Pine Valley in Eureka County became the eighth producing field in Nevada. Details of significant wells drilled in 1988 are given in the chapter on **Oil and Gas**.



Sources: Average U.S. domestic crude oil prices from Independent Petroleum Association of America; Nevada prices from Petro Source Refining Partners, Bakersfield, CA.

Low international oil prices have contributed to a decline in exploratory geothermal drilling, but past discoveries in Nevada have led to significant increases in geothermal power capacity—up 176 percent from 1987. Specifics on the new plants are given in the chapter on **Geothermal Energy**. Eight plants now have the combined capacity of producing 115.8 megawatts. In addition, numerous companies and individuals are using geothermal energy for direct use applications, such as space heating and greenhouses. The gold boom has even been felt by the geothermal industry; Round Mountain Gold Corp. is using warm waters to increase heap-leach recoveries and to extend processing year-round at its mine in Nye County.

The mining, petroleum, and geothermal industries pay certain taxes and fees directly or indirectly to the State of Nevada. As gold and other mineral production has increased in recent years so have the revenues from the tax on net proceeds of mines. Approximately 86 percent of the land in Nevada is managed by the federal government. The State receives a percentage of the revenues from oil and gas and geothermal leases, mining claim fees, and oil production taxes. Additional revenues are expected in 1989 because of new laws passed by the Nevada Legislature covering the net proceeds tax and mine reclamation.

ANNUAL TAX ON NET PROCEEDS OF MINERALS

Year	Annual net proceeds ¹ (thousands)	Annual tax (thousands)
1982	\$159,999	\$1,800
1983	\$245,688	4,152
1984	184,987	3,222
1985	198,263	3,527
1986	374,664	6,091
1987	627,330	12,083
1988	778,253	13,568

Source: Nevada Department of Taxation "1988-89 net proceeds of minerals."

¹Net proceeds are gross income minus direct costs incurred at the mine site.

MINERAL LEASING REVENUES PAID TO THE STATE OF NEVADA BY THE U.S. GOVERNMENT

(as provided by Section 35 of the Mineral Leasing Act of 1920)

Fiscal year ¹	Revenue (thousands)			
	Oil and gas	Geothermal	Other	Total
1982	\$11,618	\$934	\$44	\$12,596
1983	9,538	639	21	10,198
1984	8,013	432	39	8,484
1985	9,533	301	69	9,903
1988	6,966	367	81	7,414
1987	4,214	377	147	4,738
1988	4,866	858	542	6,266

Source: U.S. Bureau of Land Management annual progress reports for Nevada.

¹October 1 through September 30.

OTHER REVENUE TO THE STATE OF NEVADA FROM THE MINERAL INDUSTRY

Fiscal Year ¹	Mining claim fee ² (thousands)	Oil production tax ³ (thousands)
1983	\$158	NA
1984	158	\$ 52
1985	160	129
1986	160	155
1987	175	146
1988	337	158

Source: Nevada Department of Minerals.

¹July 1 through June 30.

²The State's share of the \$1.25 fee that each county collects for each new claim and each assessment report. The county retains \$.50 of this fee for mine reclamation and hazard reduction and forwards \$.75 to the Nevada Department of Minerals' operating fund.

³Does not include drilling permit fee.

The Nevada mineral industry is vital to the State and U.S. economy. Much of the Nation's hard-rock mining and exploration expertise resides in Nevada, and Nevada's mineral endowment is immense and diverse. Although precious metals clearly dominate the value of minerals produced in recent years, other commodities (some strategic and critical from a national perspective) are either currently being mined or have been mined in Nevada. Under the proper economic conditions, new metal and industrial-mineral mines and petroleum and geothermal fields are likely to be brought into production.



Wood Gulch plant site, Elko County. *Joseph Tingley photo.*

Metals

by Richard B. Jones



Sleeper Mine in Humboldt County. The Wood open pit is in the foreground and the Sleeper open pit is in the background. *Amax Gold Inc. photo.*

The information in this section was compiled primarily from news releases in Rocky Mountain Pay Dirt and in the Mining Record, Northern Miner, and Reno Gazette-Journal newspapers. Some information was extracted from company annual reports. Production costs given in this section are direct mine production costs and do not include exploration, development, start-up, or overhead costs.

Churchill County

Fireball Ridge property (S18,T23N,R26E7; Au,Ag). **Interaction Resources** continued exploration drilling on the property during 1988, consisting of 5,765 feet of reverse circulation drilling costing \$70,000. Assay results from some of the holes indicate the presence of a gold-silver zone in the Fireball fault that is continuous from surface to a depth of no more than 250 feet. One 25-foot intercept averaged 0.11 oz gold/ton, and included 5 feet of 0.446 oz gold/ton. Another intercept of 130 feet averaged 0.034 oz gold/ton, and another hole assayed an average of 0.02 oz gold/ton for 100 feet. **Interaction** acquired the property from **Cominco Resources International** in May 1987 and has the right to purchase a 100% interest, subject to a 6% net smelter royalty.

Clark County

Eldorado Canyon and Rand mines (S4,8,T26S, R64E; Au). In 1988, Calgary-based **Mohave Gold** acquired the Eldorado Canyon mine from **Canyon Development Mining Corp.** and the Rand mine from another party. Production is from heap-leaching old tailings. Reserves total 225,000 tons grading 0.03 oz gold/ton. Current production is 300 tons/day but Mohave would like to increase it to 1,000 tons/day.

Elko County

Antelope Creek property (southwest of Ivanhoe district; Au). **Alaska Apollo Gold Mines Ltd.** signed a purchase option to acquire this 2,375-acre property. Reconnaissance work indicates the presence of a shallow, low-grade gold-bearing formation that could be open-pit mined and heap-leached. A reverse circulation drilling program was planned for 1988.

Big Springs gold mine (S4,33,T42-43N,R54E; Au), owned by **Freeport McMoRan Gold Co.** (60%) and **Bull Run Gold Mines** (40%), was expected to produce about 99,930 oz of gold in 1988 but, due

to problems relating to grade and recovery, production ended up being approximately 54,167 oz of gold. Currently all production comes from heap-leaching. There are four heap-leach pads in production, having a total area of 909,500 square feet. A new conventional carbon-in-leach plant began operation and a 1,000-ton/day fluid-bed roasting system was still under construction at the end of 1988. The estimated cost for the construction of these facilities was \$16.2 million but latest cost figures indicate a cost overrun of about \$6.3 million, mainly associated with the construction of the fluid-bed roasting system.

The **Dee gold mine**, at the northwest end of the Carlin Trend, produced about 52,000 oz of gold during 1988. The mill averaged about 1,254 tons/day with a grade of 0.108 oz gold/ton. One of the more exciting things that was planned for the Dee property in 1988 was the drilling of a 1,400-foot hole in the bottom of the open pit. Two attempts were made but, due to a cavernous limestone horizon at about 1,000 feet, the intended target depth could not be reached.

Emigrant Springs property (~T32N,R53E; Au). **Multinational Resources** optioned a portion of this property from **Teck Resources** and has the right to earn a 50% working interest in exchange for advance royalty payments, expenditures of \$500,000 over a 3-year period, and giving Teck an option to purchase 500,000 Multinational shares. Mineralization occurs in silicified siltstone and previous drilling by **Homestake Mining** and Teck established geologically inferred reserves of 10 million tons grading 0.019 oz gold/ton. A drilling program was planned for 1988.

Ivanhoe joint venture (north-central T37N,R41E; Au). **Galactic Resources** and **Cornucopia Resources** (50-50) plan to bring the **Hollister** deposit into production in 1989 at an initial rate of 40,000 oz of gold the first year, increasing to 70,000 oz of gold per year thereafter. Announced geologic reserves total 83.5 million tons grading 0.034 oz gold/ton, comprising 52.8 million tons of oxide material and 30.7 million tons of sulfide material. The joint venture currently controls about 105,000 acres in the district. A new discovery, announced in 1988 and called the Butte No. 1 zone, lies approximately 1 mile northwest of the original reserves outlined in the Hollister deposit. Thirty of the 35 holes drilled in this zone encountered gold mineralization. Gold assays on some of the intercepts are as follows: 100 feet of 0.108 oz/ton, 60 feet of 0.07 oz/ton, 55 feet of 0.075 oz/ton, 95 feet of 0.052 oz/ton, 60 feet of 0.56 oz/ton, 45 feet of 0.076 oz/ton, and 45 feet of 0.073 oz/ton. The deposit is still open to the north, east, and south.

Jerritt Canyon gold mine, owned by **Freeport McMoRan Gold Co.** (70%) and by **FMC** (30%). A \$43 million expansion program was started during 1988. A large portion of this money will be spent on the installation of a fluid-bed roasting system capable of handling 3,500 tons/day. It was scheduled to be in operation by mid-1989 and is expected

to increase gold production by 20% over 1987. Mill recovery is expected to remain in the 90% range. Approximately half of the mine's reserves are of refractory nature and, as a result of this installation, mine reserves will increase to 23.48 million tons of ore containing 3.1 million oz of gold. Expansion will also increase the mill capacity to 7,000 tons/day (current mill capacity is 4,000 tons/day) and extend mine life 8 more years. A new discovery in the Saval/Steer Canyon area has added 237,000 oz of gold to the mine reserves and is still open in several directions. **Freeport-McMoRan Gold Co.** has a joint venture land position in the Jerritt Canyon mine area covering 325 square miles and it is anticipated that considerably more gold will be found over the next 4 years. Mine production in 1988 should be about the same as 1987 production—approximately 320,000 oz of gold.

Kinsley Mountain (T26N,R68E; Au). **Cominco Resources International** (60%) and **U.S. Minerals Exploration** (40%) continued work on this property during 1988. An additional \$600,000 was spent on further drilling which identified an oxidized gold resource of 2.6 million tons of ore with an average grade of 0.046 oz gold/ton in two separate orebodies: the "main zone" which contains 1.2 million tons of ore grading 0.054 oz gold/ton and the "upper zone" which contains 1.4 million tons of ore grading 0.04 oz gold/ton. The deposit is conformable within a limestone bed that outcrops and dips gently to the east. A feasibility study was undertaken at the end of the drilling program but, because of declining gold prices, production was postponed indefinitely.

Pan property (~T37N,R48-49E; Au). **Skylark Resources** (the operator and 60% owner) and **Pic Prospectors** (40%) identified eight geophysical anomalies on this property, based on IP and ground magnetic surveys. Four of the anomalies measured 800 by 1,200 feet, 500 by 4,000 feet, 600 by 1,400 feet, and 40 by 3,000 feet. Four others could not be accurately measured due to interference from power lines. During the summer two holes (2,000 feet and 1,770 feet) were drilled on two of the eight anomalies. Neither of the holes encountered mineralization nor any physical evidence for the IP anomalies. Drilling was suspended pending further evaluation of the data.

Rain gold mine (S33,T32N,R53E; Au). This mine, owned by **Newmont Gold Co.**, was completed under budget at a cost of \$45 million and became fully operational in August 1988. The mine is expected to produce approximately 110,000 oz of gold during the first year of operation. About one quarter of production will come from heap-leach operations. Approximately 1 million tons of low-grade ore will be loaded on the leach pads each year. This material has an average grade of 0.029 oz gold/ton. The mill will process another 740,000 tons/year. This ore has a head grade of 0.13 oz gold/ton. A minimum recovery of 60% is expected from the leach pads and an 88% recovery is expected from the milled ore.

Trout Creek property (~T30N,R53E; *Au,Ag*). **Lord River Gold Mines** entered into an agreement with **Teck Resources** giving Lord River the right to earn a 55% interest in this property. Gold mineralization occurs in two jasperoid breccias occupying northeast-trending fault structures. Previous drilling by **Amoco Minerals**, **Freeport Exploration**, and Teck partially defined a mineralized zone in each of these two breccias indicating a potential of about 1.5 million tons of near-surface reserves grading 0.04 to 0.05 oz gold/ton. In the southern fault zone, one hole drilled by Amoco intersected 40 feet of mineralization grading 0.083 oz gold/ton; and four holes drilled by Teck in 1987 ranged from 0.026 to 0.09 oz gold/ton over widths from 15 to 95 feet. Previous drilling in the central fault zone encountered mineralized intercepts in two holes, one of which assayed 0.037 oz gold/ton over 80 feet, the second intercept assayed 0.047 oz gold/ton over 40 feet. Results from a 4,000-foot drilling program in 1988 were encouraging. In the southern fault zone gold mineralization, grading 0.03 to 0.05 oz gold/ton, was outlined over a surface area 800 feet long by over 150 feet wide. In the central fault zone, lying about 1,000 feet north of the southern zone, an average mineralized thickness of 75 feet has been outlined grading 0.05 oz gold/ton over a length of 700 feet. Silver assaying up to 4.70 oz/ton is also present but values are erratically distributed throughout the zone.

The Tuscarora mine (old Dexter mine area), a joint venture between **Horizon Gold Shares** (71%) and **Fisher-Watt Gold Co.** (29%), was expected to produce about 14,000 oz of gold and 60,000 oz of silver during 1988. Besides owning 71% and being the operator, Horizon has also purchased a 10% overriding net smelter royalty on all joint venture revenues relating to the property from a Canadian consortium. Approximately 2,200 tons of ore grading 0.044 oz gold/ton is mined daily. Currently two leach pads are in operation; one is 700 feet by 250 feet, the second is 500 feet by 300 feet. Recovery is about 60% and direct production cost is \$225/oz of gold. Proven and probable reserves are estimated at 1.8 million tons grading 0.037 oz gold/ton and 0.74 oz silver/ton. The 2,200-acre property contains several promising drill targets which are expected to enlarge ore reserves. In December Horizon announced that it had signed a joint venture agreement with **Chevron Resources Co.** Chevron has the option to earn a 50% working interest by making up to a \$15 million investment in exploration and by either completing a major feasibility study or by making a substantial cash payment to Horizon.

Wood Gulch mine (S25,26,35,36,T44N,R53E; *Au,Ag*). Owned and operated by **Homestake Mining Co.**, the Wood Gulch mine produced its first bullion November 15, 1988. Mine development took 4½ months and cost \$4.5 million. The operation will be closed down during the winter due to heavy snows and freezing weather. During the 2-year mine life, expected bullion production will be about 33,000 oz

of gold and 120,000 oz of silver. Announced ore reserves are 500,000 tons grading 0.098 oz gold/ton and 0.4 oz silver/ton. Bench height in the pit is 20 feet and the ultimate pit slope will be 50 degrees. Stripping ratio is about 3:1 waste to ore.

Esmeralda County

Hasbrouck Mountain property (S28,33,T2N, R42E; *Au*). **FMC Gold Co.** signed an option agreement with **Euro-Nevada Mining Corp.** to purchase a 100% interest in this property. The indicated geologic gold resource on the property is in excess of 250,000 oz. The property encompasses approximately 4 square miles and FMC has acquired an additional 8 square miles surrounding the property.

Eureka County

The **Buckhorn gold mine**, owned by **Cominco Resources** (76%) and **Equinox Resources** (24%), was expected to produce approximately 28,000 oz of gold and 90,000 oz of silver during 1988. Announced reserves at the end of June were 1.2 million tons grading 0.050 oz gold/ton. There is also a near-surface, inferred sulfide-type ore reserve of 1 million tons grading 0.075 oz gold/ton. A new gold sulfide discovery was made 1 mile north of the Buckhorn mine. By midsummer 57 holes had been drilled in a 600-foot by 1,000-foot area. Seven of these holes intercepted gold mineralization of 0.10 oz/ton over 25 feet or more. Other values ranged from 0.04 to 0.19 oz/ton gold over intervals of 35 feet to 135 feet. Drilling continued on this zone throughout the remainder of the year. Drilling on the previously announced West Sinter sulfide zone indicates high grades but erratic gold distribution. Exploration continues in this zone. Valuation of a newly acquired 35-square-mile area immediately east of the Buckhorn mine has identified several drill targets of possible gold mineralization. With the addition of this land the Buckhorn property now encompasses about 70 square miles.

The 50,000-acre **Gold Bar property**, owned by **Atlas Corp.**, produced 46,292 oz of gold during the fiscal year that ended June 30, 1988. Atlas received an average price of \$457/oz of gold sold and their direct production cost of gold was about \$150/oz. Atlas announced three new gold discoveries within the claim block, all within 6 miles of the mill: the Goldstone, Gold Ridge, and Gold Pick. Announced total in-place reserves as of November 1988 are 1.25 million oz of gold, divided among the various deposits as follows: Gold Bar mine—275,000 oz gold with an average grade of 0.10 oz/ton, Goldstone—135,000 oz gold with an average grade 0.08 oz/ton, Gold Ridge—240,000 oz gold with an average grade of 0.06 oz/ton, Gold Pick—600,000 oz gold with an average grade of 0.06 oz/ton. To develop the three new announced deposits, Atlas plans to spend about \$35 million over the next 2 years. Part of this expenditure will double the mill

capacity from the current 1,500 tons/day to 3,000 tons/day. Starting in 1989, gold production will increase to between 75,000 and 100,000 oz/year. Atlas expects to be able to maintain this production level for at least 5 years. Direct production costs are estimated at \$160/oz for the next 2 years and about \$200/oz thereafter.

Tonkin Springs gold mine. U.S. Gold Corp. (formerly Silver State Mining Corp.) purchased the remaining 45% of outstanding interests and now owns 100% of the property. A \$7 million expansion program started in 1988 consists of developing new ore, construction of a 1,500-ton/day, carbon-in-leach mill, and installation of a pre-oxidization bio-leaching system. This system will be the first of its kind in the U.S. to treat sulfide gold ore. Research indicates 94% recovery. When the two systems are in operation, which was supposed to be the end of 1988 or early 1989, production will increase to 50,000 oz of gold per year. Production for 1988 is thought to have been approximately 13,000 oz of gold. Direct operating costs are projected to be around \$230/oz of gold. Currently U.S. Gold controls 34 square miles along the Cortez/Battle Mountain trend. Exploration along a 4-mile segment within their property has disclosed a series of near-surface gold deposits.

Humboldt County

Ashdown property (~SW¼,T45N,R29E; Au, Mo). **Win-Eldrich Mines** has acquired a 100% interest in this property, subject to royalty payments to several different parties. The property underwent a feasibility study in 1988 plus renegotiation of royalty payments. It appears that the property may start production in 1989. It will be a heap-leach operation and capital costs to bring it into production are not expected to exceed \$2.5 million. Mineable reserves are given as 1 million tons grading 0.11 oz gold/ton at a stripping ratio of 5:1 (waste to ore); lab tests indicate a 80% recovery.

Chimney Creek gold mine. The owner, **Consolidated Gold Fields Mining Corp.**, announced in late 1988 a new gold reserve of 2.1 million oz in addition to the 2.5 million oz of reserves previously announced. This new reserve consists of sulfide mineralization lying beneath the South Pit area where work is currently in progress to bring an upper oxide orebody into production. The sulfide body has yet to be fully delineated and drilling is continuing. The mine was brought into production in December 1987 at a capital cost of \$90 million. Since start-up it has produced 126,000 oz of gold at an average mine production cost of \$86/oz during the second half of the fiscal year ending June 30, 1988. The mill is designed to process 700,000 tons/year and the heap-leach capacity is 1.2 million tons/year.

Dean mine project (S36,T30N,R45E; Au,Ag). **St. George Minerals** has undertaken an exploration program on this property. By midyear more than 900 feet of old workings had been sampled with assays

ranging from 0.03 to 0.4 oz gold/ton. A diamond drilling program was underway to define ore reserves near existing workings. Last year one drill hole intercept assayed 50.2 oz silver/ton over a 5-foot interval.

Getchell gold mine, owned by **FirstMiss Gold**, a subsidiary of **First Mississippi Corp.** Gold production was 19,500 oz for fiscal year ending June 30, 1988, 20% higher than the previous year. The average mine production cost was \$174/oz and the average sale price was \$457/oz. During the previous year, 16,200 oz of gold was produced at an average sale price of \$392/oz. For the first half of the new fiscal year, July 1 to December 31, 1988, gold production was 10,945 oz at an average production cost of \$156/oz and an average sale price of \$440/oz. Construction of the new mine/mill complex progressed nicely during 1988 and was scheduled for start-up in January 1989. Latest announced cost for this development and construction is \$82.6 million. Gold production is expected to be 170,000 oz for the first year of the mill's operation, leveling off to around 150,000 oz/year thereafter. Heap-leach production will continue to account for about 15,000 oz/year. Current mine life is projected to be 8.5 years with proven and probable reserves of 1.3 million oz of gold having an average grade of 0.155 oz/ton.

Lewis gold mine/Crofoot gold mine, owned and operated by **Hycroft Resources and Development**. Hycroft is 58% owned by **Granges Exploration** (may be 100% owned by 1989). The company projected 80,000 oz of gold and 150,000 oz of silver would be produced from both properties in 1988, with about 62,000 oz of the gold output coming from the Crofoot mine. Production costs are expected to be around \$226/oz with a 75% recovery rate. Ore grade averaged 0.03 oz gold/ton at the Lewis mine and 0.028 oz gold/ton at the Crofoot mine. These two mines will eventually merge into one open pit. Reserves from both properties are 31 million tons grading 0.028 oz gold/ton. The properties consist of 3,600 acres and contain other prime exploration targets within their boundaries. The Crofoot mine began production in April 1988 at a capital cost of \$29 million.

Marigold project (S18,T33N,R43E; Au), a joint venture between **Rayrock Yellowknife Resources, Inc.** (the operator), **Corona Corp.**, **Santa Fe Pacific Mining, Placer Dome**, and **Freeport-McMoRan Gold Co.** The property was expected to be in production early in 1989 with a production rate of 55,000 to 60,000 oz of gold per year and a capital expenditure of approximately \$30 million. Announced total reserves are approximately 12 million tons in four separate deposits. Proven and probable reserves of 7 million tons grading 0.035 oz gold/ton were announced in June 1988. The property comprises about 3,700 acres and it is highly probable that announced ore reserves will be increased. The mine will have both mill and heap-leach facilities. The mill is being designed to handle between 1,200 and

1,500 tons/day and the heap-leach operation will handle 1,500 tons/day. Currently, reserves are sufficient for a 10-year mine life.

The **McDermitt mercury mine**, a joint venture between **Placer Dome U.S. Inc.** (51%) and **Sterling Mineral Venture** (49%), reopened in March 1988 after closing down in January 1987. The mine is expected to produce between 10,000 and 14,000 flasks of mercury annually. Reasons given for the reopening were that the mine's mercury inventory was reduced and mercury prices had settled down to around \$350 per flask, a price at which the company can make a profit. The mine is an open-pit operation and plans are for an annual ore production of 200,000 tons. Mining is expected to be conducted 4 days a week with 10-hour shifts. The mill is expected to operate 16 to 20 hours daily.

North Peak property (S4,T32,R43E; Au). The property comprises 8,000 acres immediately north of the Lander County line and the claim group covers an area in which there was no previously known gold mineralization. The property is a joint venture between **Brican Resources** and **Bow Valley Mining**. Ore-grade mineralization was found in outcrop over a strike length of 4,000 feet and occurs in a zone of altered and faulted sedimentary rocks. Gold values ranged from 0.01 to 0.20 oz/ton. An 18-hole, \$35,000 reverse circulation program was begun late in the year to test mineralization in this zone. Numerous anomalous gold areas have been discovered within the claim block. Rock chip samples taken from newly constructed access roads have yielded assays of 0.073 oz gold/ton over 20 feet to 0.057 oz gold/ton over 20 feet.

Rabbit Creek property (S19,T39N,R43E; Au). Discovered on land owned by **Santa Fe Southern Pacific**, this property is being explored and developed by a subsidiary, **Santa Fe Pacific Mining, Inc.** Production will begin in late 1990 or early 1991, and is expected to yield 100,000 oz of gold per year over a projected 7-year mine life. Capital costs for development and construction are estimated at \$75 million. Announced geologic reserves are 3.6 million oz of gold, consisting of 1 million oz of demonstrated oxide reserves, 200,000 oz of inferred oxide reserves, 1.3 million oz of demonstrated sulfide reserves, and 1.1 million oz of inferred sulfide reserves. A 1,500-ton/day carbon-in-leach mill is being built to handle the oxide ore. Construction of facilities to process the sulfide reserves would require substantial additional investment, which will probably be made at a later date. Ore reserves have yet to be fully delineated and drilling is ongoing.

The **Sleeper gold mine**, owned by **Amax Gold, Inc.**, produced approximately 160,000 oz of gold in 1987, not quite up to the projected 200,000 oz. Amax received an average price of \$419/oz and had an average production cost of \$103/oz. Production was 230,410 oz of gold in 1988. Costs to produce an ounce of gold were about the same as 1987 costs. Head-grade in 1988 was 0.484 oz gold/ton. The mine underwent its third expansion since start-

up in 1986. This will increase annual production by 40,000 oz of gold and will be reflected in 1989 production. Cost of the expansion was \$17 million, part of which was spent on increasing mill production from 1,000 to 1,500 tons/day and increasing heap-leaching facilities from 4.5 million to 5 million tons/year.

Slumbering Hills project (~T39N,R35E; Au). **Freegold Recovery Inc.** controls a 22-square-mile claim block adjacent and directly south of Amax's **Sleeper mine**. Most significant results were obtained from a detailed biogeochemical sampling program which outlined five gold anomalies. Five reverse circulation holes totaling 3,520 feet were drilled in a small area within the southern portion of the claim group. Erratic alteration was encountered in all holes to a depth of 700 feet. Assays from drill cuttings indicated gold mineralization. Late in the year Freegold entered into a joint venture agreement with **U.S. Borax & Chemical Corp.** and **Bunker Hill Mining** to further explore this 1,000 acre section of Freegold's claim block. Under terms of the agreement U.S. Borax, as the operator, funded a 20-hole drill program with holes averaging 700 feet in depth. U.S. Borax and Bunker Hill can each earn up to a 30% interest with Freegold retaining 40%.

Lander County

Buffalo Valley gold mine. An open-pit, heap-leach operation owned by **Horizon Gold Shares**, the mine completed its second full year of operation, producing 9,238 oz of gold in 1988, 27% more than the 7,763 oz produced in 1987. The approximate direct cash cost to produce gold was \$210/oz. Production in 1988 came from three working areas and development started on two more areas. All five areas will eventually merge into one long linear pit measuring over 2,500 feet in length, 300 to 500 feet wide, and 200 feet deep. During 1988 Horizon purchased additional equipment, enlarged heap-leach pads, and increased capacity of the gold recovery mill. Announced reserves at the end of 1988 were 1.48 million tons, proven and probable, grading 0.05 oz gold/ton. The property encompasses 25,000 acres and it is quite likely that ore reserves will increase over the next few years. In September it was announced that **Chevron Resources Co.** had entered into an agreement with Horizon whereby Chevron can earn a 50% working interest in the Buffalo Valley and Tuscarora gold mines.

Canyon Placer, a **Battle Mountain Gold Co.** property, was expected to produce about 5,000 oz of gold in 1988 and 25,000 oz in 1989, its first full year of production. Direct production costs are expected to be \$194/oz. Proven and probable reserves are 260,000 oz of gold and recovery is expected to be almost 100%, using a gravity separation plant. Construction of this plant was to begin in early 1988 and the plant was in partial operation by early fall at a cost of \$4.5 million. Current life expectancy is 12 years.

Cortez gold mine, a joint venture of **Placer Dome U.S. Inc.** (the operator), **Vernon F. Taylor, Jr.**, and **B. P. Minerals America**. Installation was begun on a fluid-bed roasting facility to process carbonaceous ore from the Horse Canyon and Gold Acres properties. Estimated cost of the project is \$27 million including mine development. Approximately 4 million tons of carbonaceous ore with an average grade of 0.10 oz gold/ton will be processed and at least 6 years will be added to the life of the operation. Expected start-up is in mid-1989.

Fortitude mine complex, owned by **Battle Mountain Gold Co.** The **Surprise mine**, one of several satellite orebodies around the Fortitude mine, began production in late 1987 and hit full stride in 1988. The ore is being run through the Fortitude mill instead of being heap-leached, as originally planned, because of very favorable milling costs and a recovery rate of over 90% as opposed to only 60% from heap-leaching. Recovery rates at the Fortitude mill are 95% for gold and 71% for silver. Total production from Fortitude and Surprise in 1988 was 243,000 oz of gold and over 675,000 oz of silver. Battle Mountain had a net income of \$187/oz of gold equivalent from these two mines and an average realized gold price of \$447/oz. Direct operating costs were approximately \$169/oz of gold equivalent. Average 1988 grade was 0.23 oz gold/ton and 1 oz silver/ton. Midyear announced reserves at Fortitude, including all satellite orebodies except Surprise and Canyon Placer, were 1.325 million oz of gold. Announced reserves at the Surprise mine were 135,000 oz of gold and 1.3 million oz of silver at the end of 1987. Exploration in the Fortitude area during 1988 consisted of 150,000 feet of drilling, mostly in the 400- to 500-foot range but some holes were 1,000 feet or more deep. Life expectancy of both Fortitude and Surprise is 7 or 8 years.

Kingston mine (Victorine). The first full year of operation under the management of **Nevada Goldfields** ended June 30, 1988. Production amounted to 39,247 oz of gold and 88,207 oz of silver, with a recovery rate of 85.8% and a direct operating cost of \$246/oz of gold. Currently Nevada Goldfields receives all revenues but, after development costs have been recovered, 50% of net earnings will go to **New Beginnings Resources, Inc.** Expansion projects, which increased efficiency and recovery rates and decreased operating costs, consisted of the completion of a 600-foot raise from an adit at the bottom of Victorine Canyon up to the mine portal. This raise eliminates 1 1/4 miles of truck haulage, saving \$50,000 per month. Two additional leach tanks were installed in the mill which helped to increase recovery from 84% to 90%. Announced reserves at the end of fiscal 1988 were 902,000 tons grading 0.19 oz gold/ton. Exploration for fiscal year 1989 will consist of about 8,000 feet of surface core and reverse circulation drilling and about 15,000 feet of underground core drilling.

McCoy/Cove mines, owned and operated by **Echo Bay Mines Ltd.** Production increased from 90,788

gold equivalent oz in 1987 to 115,501 gold equivalent oz in 1988 (converting silver to gold at an average market price ratio of 66.5:1). All 1987 production came from the McCoy mine but over 75% of the 1988 production came from the Cove mine. Direct production costs for the two mines combined were \$202/oz of gold in 1988 and were projected at \$193/oz in 1989. Major construction was still under way in 1988. A 7,500-ton/day mill is being built to process both oxide and sulfide ore. Production from the mill is expected to begin in the third quarter of 1989. Production in 1990 is expected to be 330,000 oz of gold and 6.5 million oz of silver. Driving of decline ramps was also in progress during 1988 to test the upper and lower sulfide zones at depth in the Cove deposit and to verify drill-indicated ore-grade mineralization beneath the McCoy pit. Those two mines comprise only two small areas within the 125-square-mile claim block; exploration drilling, while continuing around the McCoy/Cove deposits, is expanding to test other prime targets within the claim block.

Robertson property (S8,T28N,R47E; Au,Ag). **Coral Gold Corp.** controls this 6,000-acre property. At the end of 1987 Coral announced reserves of 5 million tons grading 0.05 oz gold/ton. By the end of May 1988, reserves were up to 11 million tons grading 0.04 oz gold/ton. Production began in the second half of 1988 with an expected production of 20,000 oz of gold in 1988 and 50,000 oz of gold in 1989. The production will be solely from heap-leach at a mining rate of 3,000 tons/day with direct production costs of less than \$200/oz of gold and 70% recovery. Coral would like to expand production to 120,000 oz/year by 1990. The stripping ratio is 1:1. The deposit is currently open on all sides and indications are that it may be a mile in length.

Tolyabe property (Saddle deposit; S12,T25N, R46E; Au). The owner, **Inland Gold & Silver Corp.**, has an agreement with **N.A. Degerstrom, Inc.** whereby Degerstrom conducts all phases of mining on the property. Operations were started in mid-March and 10,000 oz of gold had been poured by May 24, 1988. The initial mine plan called for a 2-year lifespan based on 32,000 oz of recoverable, heap-leachable gold (60% recovery). The deposit has not been fully delineated and drilling is ongoing. By the end of March 1988 the initial geologic reserves had been more than doubled. The property encompasses approximately 11,000 acres and \$1 million was budgeted in 1988 for exploration throughout the property, most of which was to be spent on drilling. There is a significant tonnage of nonleachable carbonaceous material on the property but at this writing no decision had been made on processing it.

Lincoln County

Delamar property (S1,T6S,R64E; Au). **Fischer-Watt Gold Co.** completed a 5,000-foot exploration drilling program on this property by the end of

September. Fischer-Watt controls 144 claims in the area and has identified six exploration targets. This initial drilling tested, in part, three of the six targets. Results from the April Fool target indicated a geologic potential of over 200,000 tons grading 0.079 oz gold/ton.

Lyon County

Canyon Resources Corp. acquired 100% ownership of the **Haywood-Santiago mine** in November 1987. The operation consists of heap-leaching the old dumps. 1987 production was 3,400 oz of gold and 40,000 oz of silver. Ultimate production from these dumps is expected to be 6,000 oz of gold and 70,000 oz of silver. Other dumps are being examined in the Comstock area for possible heap-leach material. If none are obtained or found, this operation was to be closed by the end of 1988.

Talapoosa (~ S3,T18N,R24E; *Au,Ag*). **Athena Gold Corp.** has postponed production start-up on this property until 1989. Instead of beginning production in 1988, Athena employed several independent consulting firms in various capacities. One firm worked on pit design and one on reserve estimates. Reserves are around 2.5 million tons grading 0.041 oz gold/ton and 0.53 oz silver/ton. Another firm worked on metallurgical testing with results indicating a 72% gold recovery and a 30% silver recovery. A fourth firm worked on leach pad construction and soil permeability tests. Permitting was also underway and should have been completed by year end. The property also contains a near-surface sulfide deposit where prior work identified 14.9 million tons of material grading 0.03 oz gold/ton and 0.49 oz silver/ton. This sulfide body is still open to the south and southwest.

Mineral County

Aurora mine, owned and operated by **Nevada Goldfields**. About 250 tons/day is being processed by a 300-ton/day mill. Since start-up in December 1987, the mill processed 43,661 tons of ore grading 0.254 oz gold/ton, with an average recovery rate of 93%, and produced 10,302 oz of gold and 13,634 oz of silver by June 30, 1988. Direct cash cost to produce gold was reported as \$176/oz, 42% of which is mining costs, 35% is milling costs, and 23% is administration costs. Projected mill through-put for fiscal year 1989 is 92,814 tons of ore grading 0.21 oz of gold, at a recovery rate of 92%. Proven and probable reserves at the end of 1988 were 347,000 tons grading 0.253 oz gold/ton. Approximately 20% of these reserves will have to be mined by underground methods. A surface and underground exploration program is planned for fiscal year 1989. It will consist of 27,880 feet of surface drilling within the Aurora district, 4,264 feet of core drilling from underground workings, and 492 feet of exploration drilling. Nevada Goldfields controls about 3,500

acres in the district, mainly lands leased from **Siskon Corp.**

The **Borealis mine** is an open-pit/heap-leach operation that started in 1981 and was acquired by **Echo Bay Mines** in 1986. A number of small deposits have been mined since the start of operations and production began on another (Northeast Ridge) in 1988. Gold production in 1987 was 45,459 oz with direct production costs of about \$214/oz. Ore from the Freedom Flats deposit accounted for 78% of this production. Echo Bay completed reclamation work on the original Borealis pit in 1987. Expected gold production in 1988 was 50,000 oz at an estimated cost of \$220/oz. Production was from Freedom Flats and the Northern Ridge orebodies. Exploration is continuing on the property.

Cedar Mountain property (~ T8N,R37E; *Au*). The property covers 1,160 acres and is a joint venture between **Canyon Resources** and **American Consolidated Gold Corp.** (managed by **Bond International Gold**). ACGC can earn a 60% working interest by expending \$300,000 on drilling and other exploration activity over a 3-year period. Drilling has encountered gold mineralization in 21 of 59 holes. Mineralization occurs in jasperoid zones within a highly faulted complex of thinly bedded limestone and dolomite.

Mindora property (~ S16,T7N,R34E; *Au,Ag*), a joint venture between **Eureka Resources** and **Hawthorne Gold** with a projected start-up in 1989. Expected annual production will be 5,100 oz of gold and 215,000 oz of silver using conventional milling and heap-leaching. Capital costs are estimated at \$2 million, part of which includes a > 100-ton/day mill to process the high-grade silver ore. Estimated direct production costs are \$250/oz for gold and \$4.75/oz for silver.

Santa Fe mine (S31,T9N,R34,35E; *Au,Ag*). **Lacana Mining Corp.** decided in December 1987 to develop this property but before this was accomplished they were absorbed into **Corona Corp.**, along with four other Canadian mining companies; Corona Corp. finished the development and poured the first dore bar in August 1988. The official mine opening took place in October 1988. The 5,239-acre property is wholly owned by Corona, subject to production royalties and holding fees. Capital costs were \$10.5 million to bring the mine into production. Yearly production is expected to be 50,000 oz of gold and 150,000 oz of silver. Operating costs are expected to be \$256/oz; 71% of the costs will be charged to mining and crushing, 21% charged to milling, and 8% to administration. The stripping ratio is 2.3:1 waste to ore. The ore is agglomerated before being placed in the leach pad at a ratio of 14 pounds of cement to 1 ton of ore. Proven mineable reserves are 6.5 million tons of oxide ore and 2 million tons of sulfide ore. Overall grade is 0.037 oz gold/ton and 0.316 oz silver/ton. The sulfide reserve lies below the oxide ore and has not been fully delineated.

Nye County

Cuervo Gold Inc. (Sullivan) mine (S29,32,T11N, R36E; *Au,Ag*). **Glamis Gold, Inc.**, the owner, has increased heap-leach recovery to as much as 75%. They hoped to produce 12,000 oz of gold in 1988. Announced reserves are 10.8 million tons of proven ore and 2.7 million tons of probable ore, grading 0.025 oz gold/ton. Late in 1988 Glamis signed a letter of intent with **Keradomex, Inc.** and **Newcan Exploration, Inc.** They can earn up to 60% through a cash payment and by bringing the property into production. However, they had a 180-day option in which to conduct a 50,000-ton heap-leach test before making a final decision. If they decide to proceed with the operation they will get 100% of the proceeds until their capital is recovered. The property consists of 777 contiguous claims.

Hall molybdenum mine. Early in 1988 **Cyprus Minerals Co.** signed a letter of intent to acquire **ARCO Coal Co.**'s Hall molybdenum mine north of Tonopah. Cyprus officially acquired the mine in July. The transaction involved a combination of cash and production royalties. The mine contains substantial reserves of molybdenum, copper, and silver but, due to poor prices, the mine has been on a care and maintenance status the past few years. Cyprus plans to undertake a drilling program, concentrating on copper-gold reserves. The mine has the capacity to produce 15 million pounds of molybdenum and 5 million pounds of copper annually. It was expected that production would begin the latter part of 1988 but this did not happen. Ore is being stockpiled and the mill tuned up for production in 1989.

Manhattan mine has been in operation since 1984 and was acquired by **Echo Bay Mines Ltd.** in 1986. The mine has a conventional cyanide mill. In 1987 the mine produced 24,855 oz of gold at a production cost of \$320/oz. Echo Bay planned to modify the mill in 1988 to increase recovery rate and to lower costs. Part of the change in operations will be to begin heap-leaching reject material from the mill and other low-grade material from the mining operation. Echo Bay is considering at least two alternatives for the property: to continue normal operations supplemented by heap-leaching, producing about 40,000 oz of gold per year at an estimated production cost of \$270/oz; or to convert the mill to a custom operation to process high-grade ores from other operations owned by Echo Bay.

Mother Lode deposit (~S7,T12S,R48E; *Au*), initially a 50-50 joint venture between **GEXA Gold Corp.** and **U.S. Precious Metals**. The property is scheduled for production late in 1989. Upon making the decision to produce, the joint venture brought **N.A. Degerstrom** into the picture. Degerstrom can earn 20% of the joint venture by developing and bringing the property into production at 1,000 tons/day, and continuing as the operator. The deposit is relatively flat-lying and is open along strike and at

depth; the ore zone generally varies from 20 to 125 feet thick. Announced reserves are 4.9 million tons grading 0.054 oz gold/ton with some 5-foot intervals assaying as high as 0.131 oz gold/ton. These reserves consist of 1.6 million tons of oxide materials grading 0.049 oz gold/ton and 3.3 million tons of sulfide material grading 0.057 oz gold/ton. Initial production will be from the oxide zone, which can be mined by open-pit methods. Additional ore-grade material was intersected 1,500 feet southeast of this deposit during the drilling of water wells.

Paradise Peak gold-silver mine. Production for 1988 was 229,100 oz of gold and approximately 4.3 million oz of silver. Direct production costs were \$94/oz gold equivalent. Announced production grades for 1988 were 0.206 oz gold/ton and 4.146 oz silver/ton with recovery rates of 93% for gold and 75% for silver. Bullion bars are approximately 94% silver and 5% gold. Full-scale heap-leach production was attained in 1988 and added about 10% to gold production and 2% to silver production. Annual heap-leach production is expected to be approximately 15,000 oz of gold and 60,000 oz of silver. Known leachable reserves from the primary Paradise Peak orebody are 3.41 million tons and an additional 2.33 million tons from the Ketchup Flat area. Total contained precious metals in these two areas are 169,000 oz of gold and 3.24 million oz of silver. Mercury retorts were increased from four to eight in 1988, allowing a substantial increase in gold and silver production. The 1987 budget for exploration around the mine area was \$2 million and it was expected to be the same for 1988. Continued drilling in the Ketchup Flat area during 1988 found almost enough reserves to replace ore mined during the year.

Round Mountain mine, the world's largest heap-leach gold mine, produced 190,578 oz of gold in 1987 and 233,700 oz of gold in 1988 at a cash cost of around \$220/oz. An expansion program was under way during 1988 to increase annual production to 300,000 oz of gold in 1989. Estimated expenditures for the expansion are \$140 million. Components of the expansion project include: enlarging the pit; building a new ore-crushing, materials handling and stacking system; building new reusable leach pads; and building a new carbon recovery plant and a new town site.

The **Sterling gold mine** produced 8,000 oz of gold in 1987 and 8,500 oz of gold in 1988. **Cathedral Gold**, the owner, plans to increase gold production to 24,000 oz in 1989. To increase access to known ore reserves, a second 1,700-foot decline is being driven. A major exploration drilling program was carried out during the year to expand known reserves and perhaps find new ore. A new zone, the Burro North, was discovered late in 1987. Announced reserves for this deposit are 28,000 tons grading 0.250 oz gold/ton, all mineable by open-pit methods. Total geological reserves of the Sterling property are 469,000 tons grading 0.21 oz gold/ton.

Pershing County

Barrel Springs property (~S32,T34N,R29E; Au). **Pershing Gold, Inc.** (owner) signed a joint venture agreement with **Black Rock Gold**. The property consists of 22,000 acres and an extensive drilling program was planned for 1988 to test four bedrock targets defined by geology and geochemistry. **Black Rock** will have to spend \$500,000 to earn a 50% interest in the property.

The **Florida Canyon mine**, owned by **Pegasus Gold**, produced 48,000 oz of gold in 1987 from 3.79 million tons grading 0.022 oz/ton. The forecast for 1988 was 55,000 oz of gold at a project cash production cost of around \$300/oz. Announced reserves at the beginning of 1988 were 22 million tons grading 0.024 oz gold/ton. In September **Pegasus** announced an additional 19 million tons of reserves grading 0.022 oz gold/ton. These reserves are a southerly extension of the existing proven reserves and are still open to the south and west and at depth.

Relief Canyon mine, owned by **Pegasus Gold**. At the end of 1987, announced ore reserves were 3.3 million tons grading 0.03 oz gold/ton. Drilling has failed to establish new reserves and mining of known ore will be completed in the third quarter 1989. Leaching will continue into 1990. Gold production for 1987 was 42,000 oz at a cash production cost of \$283/oz. 1988 production was forecast at 45,000 oz but was about the same as 1987 production. Direct production costs for 1988 were around \$269/oz of gold. Mining is contracted to **Morrison-Knudsen** of Boise, Idaho.

The **Rochester silver mine** was the nation's number one primary producer of silver in 1988, producing over 5.01 million oz of silver. This 25% increase over 1987 production placed the mine in the number two spot of U.S. silver producers. Gold production in 1988 was 52,388 oz, almost double 1987 production. **Coeur d'Alene Mines Corp.**, owner of the property, took over the mining and crushing operations about midyear. **Morrison-Knudsen** had been doing these operations under contract since the mine opened in 1986. **Coeur d'Alene** discovered 14.8 million tons of new ore in 1987, grading 0.97 oz silver/ton and 0.016 oz gold/ton. This ore will extend mining life from 13 years to 17 years. The balance of **Rochester's** reserves include 63 million tons of proven ore grading 1.55 oz silver/ton and 0.011 oz gold/ton, and 39 million tons of probable reserves grading 1.26 oz silver/ton and 0.008 oz gold/ton.

Trinity silver mine. **United States Borax & Chemical Corp.**, a wholly owned subsidiary of **RTZ Corp.**, announced the pouring of the first silver bullion of the Trinity mine in January 1988 and had poured 4,186,000 oz of silver and 619 oz of gold by the end of the year. The mine is a 50% joint venture with **Santa Fe Pacific Mining, Inc.**, a subsidiary of **Santa Fe Southern Pacific Corp.** U.S. Borax is the operator. The open-pit mine is an oxidized silver

deposit containing about 1.05 million tons of ore grading 5.25 oz silver/ton. Mining is done under contract by **Lost Dutchman Construction, Inc.** of Sparks, and ore is agglomerated with cement before being placed on the leach pad. Construction began in July 1987; mining of the oxide ore was completed in August 1988; and heap-leaching is scheduled to continue until mid-1989.

Storey County

The **Gooseberry mine**, wholly owned by **Asamera Minerals**, was reopened and began production early in 1988 after being closed for 2 years due to low metal prices. The mine was expected to produce about 38,000 oz of gold and 224,769 oz of silver during 1988. Head grades have been averaging around 0.17 oz gold/ton and 9.0 oz silver/ton. It was decided during the year to heap-leach the old tailings dumps which consist of 250,000 to 300,000 tons of material. Production was initially scheduled for the fourth quarter of 1988 but was postponed to mid-1989. During the 18-month life of this project, production is expected to be 6,000 oz of gold and 189,000 oz of silver. In 1987 **Asamera** acquired the **Curtiss-Wright** property surrounding the **Gooseberry mine**. **Asamera** paid \$65 per acre for this 103,000-acre property and carries a 2% net smelter royalty to **Curtiss-Wright** on production. Drilling beneath the old workings on the **Ramsey-Comstock mine** (part on the **Curtiss-Wright** land package), last worked in the 1930's, revealed the existence of three gold zones. Some of the more interesting intercepts were: 10 feet of 0.16 oz gold/ton, 80 feet of 0.38 oz gold/ton and 20 feet of 0.53 oz gold/ton. This hole quit in 0.4 oz/ton material due to lack of compressor capacity. Later core drilling in this area, however, failed to substantiate these gold values.

Washoe County

Wind Mountain property (S34,T30N,R23E; Au,Ag). **Amax Gold, Inc.** announced that this property would be put into production. Construction of the plant and mine development began late in 1988 with full production expected by the spring of 1989. It will be a heap-leach operation and is expected to produce over 40,000 oz of gold and 300,000 oz of silver annually. Capital expenditures are estimated to be \$16 million. Announced reserves are 15 million tons grading 0.021 oz gold/ton. The property consists of 5,000 acres and there is an ongoing exploration program throughout the claim block.

White Pine County

Casino and Winrock properties (~S15,16,T24N,R58E; Au), a joint venture between **USMX** (51%) and **Pegasus Gold** (49%), with **USMX** the operator. The properties contain sediment-hosted, disseminated gold mineralization. Significant mineralization

has been found within 200 feet of the surface. Drilling is ongoing to further define tonnage and grade. On the Winrock property, 14,000 feet of drilling has been done with gold mineralization intercepted in 70% of the holes. Four target areas have been defined and all have several hundred feet of strike lengths and all are open in two directions. Some of the better intercepts vary between 50 feet averaging 0.043 oz gold/ton to 75 feet averaging 0.094 oz gold/ton. On the Casino portion of the joint venture 7,000 feet of drilling has been done with gold mineralization encountered in 50% of the drill holes. Mineralization has a strike length of at least 500 feet and is open in three directions. Some of the better drill intercepts are 35 feet grading 0.04 oz gold/ton to 145 feet grading 0.152 oz gold/ton. These deposits, if economic, will be amenable to open-pit mining and heap-leach recovery methods.

Golden Butte (S2,3,11,T23N,R61E; Au), owned by **Alta Bay Venture** (see Robinson property below), was being developed for production in the spring of 1989. This open-pit/heap-leach operation is expected to produce 15,000 oz of gold per year for 4 years. Total known reserves are 84,500 oz of gold.

Green Springs Gold mine (S25,T15N,R57E; Au). Owned by **USMX Corp.**, the mine officially commenced production at the end of July. Production for 1988 was expected to be around 12,000 oz of gold, increasing to 24,000 oz in 1989. Recovery is estimated at 70%. Capital costs to get the mine into production were about \$4 million. Initial ore reserves were 1.25 million tons grading 0.06 oz gold/ton. Additional mineralization has been discovered and work is underway to determine if it can be mined economically. Drilling in two of the zones indicates an additional 500,000 tons grading 0.036 oz gold/ton.

The **Little Bald Mountain mine**, operated by **Northern Dynasty** (43% owner), produced 3,500 oz of gold in 1987 and was projected to produce 7,000 oz in 1988. The mine began as an open-pit operation and is one of the few heap-leach mines in the U.S. to make the transition to underground production, which it did in late 1987. A deep drilling program was undertaken in 1988 to test a shaly limestone unit lying 800 to 1,200 feet below the surface. Results of this work are not known. Year-end ore reserves remained essentially the same as 1987 reserves—200,000 tons grading 0.13 oz gold/ton. During the year Northern Dynasty found several

other potential ore areas on the property. A drilling program to test them will begin in 1989.

Mount Hamilton property (S16,21,T16N,R57E; Au,Ag). Late in 1988 **Westmont Gold, Inc.** began applying for permits to operate an open-pit mine and cyanide heap-leach facility. They plan to mine ore from two pits and produce approximately 30,000 to 40,000 oz of gold and 200,000 to 400,000 oz of silver per year for 7 years. However, depending on exploration success, this time period could be substantially increased.

There were some name changes and participant changes associated with the **Robinson property** (the old Kennecott copper mine). Co-owners **Silver King Mines** and **Pacific Silver Corp.** formed the **Alta Gold Co.** and placed all their precious metals properties in this company. About midyear, an agreement was reached between **Alta Gold** and **Echo Bay Mines, Ltd.** and the **Alta Bay Venture** was formed; Alta Gold (60%) contributed their precious-metal properties and Echo Bay (40%) contributed their smaller precious-metal properties to the joint venture. Silver King is the operator. Nine gold deposits have been identified on the 14,000-acre property. Announced reserves from three of them are: 2.34 million tons of proven and probable ore grading 0.09 oz gold/ton; 11 million tons of proven and probable ore grading 0.08 oz gold/ton; and 1 million tons grading 0.025 oz gold/ton. The potential exists to more than double current known reserves. All ore was milled prior to mid-1988 but a heap-leaching program was started at midyear. The mine generally produced about 48,000 oz of gold per year, but with commencement of heap-leaching, gold production is forecast to increase about 50% to 75,000 oz/year at a cash production cost of \$135/oz.

White Pine mine (T24-25N,R57-58E; Au), wholly owned by **U.S. Gold Corp.**, subject to a 5% royalty on gross proceeds. Work in 1987 defined four mineable oxide gold deposits, all amenable to heap-leach/open-pit technology. The decision was made in mid-1988 to place the property into production and the first gold bar was poured in October. Annual production is forecast to be between 15,000 to 25,000 oz gold. There is enough proven ore to sustain 4 years of production. Construction costs were about \$2 million and operating costs are projected at \$240/oz. Drilling is ongoing on the 10,000-acre property to delineate current known ore zones and to explore new target areas.

Bulk-Mineable Precious-Metal Deposits

by Harold F. Bonham, Jr.



Round Mountain gold mine, Nye County.

RESERVES, PRODUCTION, HOST ROCKS, AND AGES

The information in this compilation was obtained from published reports, articles in mining newsletters, and company annual reports and press releases. Locations of most of these deposits are shown on NBMG Map 91.

Deposit name	Reserves	Production	Host rock	Mineralization age
CHURCHILL COUNTY				
Bell Mountain	1982: 1 million tons, 0.055 oz Au and 1.4 oz Ag/ton (possible additional 1 million tons, 0.022 oz Au and 1.0 oz Ag/ton; <i>Sphinx zone</i> : 50,000 tons, 0.14 oz Au and 3.3 oz Ag/ton)	no production	rhyolitic tuff	Miocene
Fondaway Canyon	1986: <i>geologic resource</i> —4.4 million tons, 0.134 oz Au/ton 1988: 400,000 tons, 0.06 oz Au/ton	1987: exploration 1988: pre-production	Triassic slate and phyllite	Cretaceous
ELKO COUNTY				
Big Springs (Sammy Creek)	1987: 3.76 million tons, 0.148 oz Au/ton 1988: 3.4 million tons, 0.148 oz Au/ton	1987: 350,000 tons/year 1988: ~ 54,000 oz Au	Mississippian to Permian overlap assemblage	Cretaceous or Tertiary
Bootstrap/Capstone	1987: 1 million tons, 0.12 oz Au/ton 1988: <i>geologic resource</i> —24.2 million tons, 0.04 oz Au/ton	1974–84: heap leaching, low-grade ore 1987: exploration 1988: Combined production of Bootstrap/Capstone, Blue Star, Genesis, and Gold Quarry was 895,500 oz Au	dacitic dikes, Paleozoic siltstone and laminated limestone/chert	~ 37 Ma

continued

BULK-MINEABLE, PRECIOUS-METAL DEPOSITS (continued)

Deposit name	Reserves	Production	Host rock	Mineralization age
ELKO COUNTY (continued)				
Burns Basin	1986: 3.2 million tons, 0.177 oz Au/ton; 804,000 tons, 0.038 oz Au/ton 1988 production and reserves included in Jerritt Canyon figures	pre-production	Roberts Mountains and Hanson Creek Formations	Cretaceous or Tertiary
Dee	1982: 2.5 million tons, 0.12 oz Au/ton; 1.1 million tons, 0.028 oz Au/ton heap-leach 1985: 2.14 million tons, 0.133 oz Au/ton mill-grade; 1.5 million tons, 0.027 oz Au/ton heap-leach 1987: 2.5 million tons, 0.1 oz Au/ton 1988: ~2.1 million tons, 0.1 oz Au/ton	1987: ~45,000 oz Au/year 1988: ~52,000 oz Au	Vinini Formation Devonian carbonates, dacitic dikes	Cretaceous or Tertiary
Dexter (Tuscarora)	1987: 2 million tons, 0.039 oz Au and 1.9 oz Ag/ton 1988: 1.8 million tons, 0.037 oz Au/ton, 0.74 oz Ag/ton	1896-1902: 29,940 oz Au, 28,543 oz Ag 1987: 5,000 oz Au, 70,000 oz Ag 1988: 14,000 oz Au, 60,000 oz Ag	Eocene rhyolitic ignimbrite and andesite	38 Ma
Emigrant Springs	1988: <i>geologic resource</i> —11.5 million tons, 0.024 oz Au/ton	exploration	lower Paleozoic sedimentary rocks	Cretaceous or early Tertiary
Ivanhoe	1986-87: 8 million tons, 0.045 oz Au/ton 1989: <i>oxide</i> —18.4 million tons, 0.035 oz Au/ton; estimated mineral inventory 83.5 million tons, 0.034 oz Au/ton, with 52.8 million tons of oxide and 30.7 million tons of sulfide	pre-production, exploration	rhyolitic tuff, flows, volcanoclastic rocks	Miocene
Jerritt Canyon	1981: 12.5 million tons, 0.231 oz Au/ton 1985: 4.5 million tons, 0.14 oz Au/ton (additional reserves) 1986: 16 million tons, 0.174 oz Au/ton 1987: 3.124 million oz Au/Ag at an average grade of ~0.18 oz Au/ton 1988: <i>joint venture</i> —3.27 million tons oz Au; millable: <i>proven</i> —19.6 million tons, 0.145 oz Au/ton; heap leach: <i>proven</i> —6.5 million tons, 0.044 oz Au/ton; millable: <i>probable</i> —1.076 million tons, 0.126 oz Au/ton; heap leach: <i>probable</i> —130,000 tons, 0.044 oz Au/ton	1981-84: 962,500 tons/year 1986: ~270,000 oz Au/year 1987: 316,000 oz Au 1988: 311,300 oz Au	Hanson Creek and Roberts Mountains Formations	Cretaceous or Tertiary
Kinsley Mountain	1987: 1 million tons, 0.06-0.08 oz Au/ton 1988: 2.6 million tons, 0.046 oz Au/ton	pre-production	upper Paleozoic carbonate rocks	Oligocene?
Rain	1984: 8.3 million tons, 0.083 oz Au/ton 1986: 10 million tons, 0.08 oz Au/ton 1987: 10.1 million tons, 0.08 oz Au/ton 1988: <i>geologic resource</i> —24.5 million tons, 0.052 oz Au/ton	1988: 29,000 oz Au	Webb Formation	36-37 Ma
Saval Canyon	1986: 2.5 million tons, 0.121 oz Au/ton 1988: 237,000 oz Au	evaluation	lower Paleozoic carbonate rocks	Cretaceous or Tertiary
Trout Creek	1988: 1.5 million tons, 0.04 Au/ton	1988: exploration	lower Paleozoic	Cretaceous or Tertiary
Winters Creek	1986: 1.4 million tons, 0.146 oz Au/ton	evaluation, exploration	lower Paleozoic carbonate rocks	Cretaceous or Tertiary
Wood Gulch	1987: 720,000 tons, Au mineralization 1988: 500,000 tons, 0.098 oz Au and 0.4 oz Ag/ton	commenced November 1988	lower Paleozoic sedimentary rocks, andesite-dacite dikes and sills	Cretaceous or Tertiary
Wright Window	1986: 1.3 million tons, 0.095 oz Au/ton	evaluation, exploration	lower Paleozoic carbonate rocks	Cretaceous or Tertiary
ESMERALDA COUNTY				
Boss Mine	1987: 500,000 tons, 0.07 oz Au/ton	heap-leach	Ordovician sedimentary rocks	Miocene?
Divide	1988: 307,000 tons, 0.057 oz Au and 0.45 oz Ag/ton	evaluation	Miocene silicic tuff	16 Ma
Goldfield	1983: 1.75 million tons, 0.087 oz Au/ton	1903-45: 4.19 million oz Au, 1.45 million oz Ag	andesite, rhyodacite, rhyolite	21 Ma

BULK-MINEABLE, PRECIOUS-METAL DEPOSITS (continued)

Deposit name	Reserves	Production	Host rock	Mineralization age
ESMERALDA COUNTY (continued)				
Hasbrouck	1982: 5 million tons, 0.06 oz Au and 1.5 oz Ag/ton 1986: 12.9 million tons, 0.0291 oz Au and 0.59 oz Ag/ton	exploration	Siebert Formation tuff and volcanoclastic rocks	16 Ma
Weepah	1986: 200,000 tons, 0.1 oz Au and 0.4 oz Ag/ton	1986-87: 2,500 oz Au/month 1988: idle	Wyman Formation	Cretaceous
Top	1986: <i>proven</i> —2.5 million tons, 0.10 oz Au/ton; <i>possible</i> —2.65 million tons, 0.087 oz Au/ton	1986: 50,000 oz Au	granite porphyry Cambrian shale and limestone	35-38 Ma
EUREKA COUNTY				
Blue Star	1987: 1.95 million tons, 0.066 oz Au/ton 1988: <i>geologic resource</i> —22.8 million tons, 0.029 oz Au/ton	1974-84: intermittent 1988: combined production of Bootstrap/Capstone, Blue Star, Genesis, and Gold Quarry was 895,500 oz Au	lower Paleozoic sandy siltstone and carbonate rocks, granodiorite	37.5 Ma
Bobcat	1988: <i>geologic resource</i> —17.6 million tons, 0.029 oz Au/ton			
Buckhorn	1984: <i>Cominco</i> : 5 million tons, 0.044 oz Au, 0.585 oz Ag/ton <i>Northern Dynasty</i> : 2 million tons, 0.056 oz Au, 0.224 oz Ag/ton 1986: 3.215 million tons, 0.048 oz Au, 0.58 oz Ag/ton 1987: <i>oxide</i> —1.6 million tons, 0.047 oz Au/ton; <i>sulfide</i> —1.0 million tons, 0.075 oz Au/ton 1988: 1.484 million tons, 0.05 oz Au/ton	30,000 oz Au and 270,000 oz Ag/year (projected by Cominco) 1988: 28,730 oz Au, 151,832 oz Ag	basaltic andesite, sinter, and silicified sediments	14.6 Ma
Bullion Monarch	1987: 1 million tons, 0.10 oz Au/ton	exploration, evaluation	lower Paleozoic sedimentary rocks	Tertiary or Mesozoic
Carlin	1984: 4.5 million tons, 0.16 oz Au/ton 1987: 1.5 million tons, 0.127 oz Au/ton 1988: <i>geologic resource</i> —518,600 oz Au in tailings and stockpiles on property	1965-84: 14 million tons, 4,300,000 oz Au 1988: no production, exploration	Roberts Mountains Formation	~ 37 Ma
Genesis	1987: 14 million tons, 0.097 oz Au/ton 1988: <i>geologic resource</i> —25.6 million tons, 0.051 oz Au/ton	1986: production commenced 1988: combined production of Bootstrap/Capstone, Blue Star, Genesis, and Gold Quarry was 895,500 oz Au	Ordovician-Devonian limestone, argillite chert	36-37 Ma
Gnome	1988: <i>geologic resource</i> —2.7 million tons, 0.048 oz Au/ton	exploration	Paleozoic sedimentary rocks	Cretaceous or early Tertiary
Gold Bar	1984: 2.8 million tons, 0.09 oz Au/ton 1987: ~600,000 oz Au, ~0.1 oz Au/ton 1988: 275,000 oz Au at 0.10 oz Au/ton	1987: 45,000 oz Au/year 1988: 46,000 oz Au	Devonian Nevada Formation	Eocene
Gold Pick	1988: 600,000 oz Au at 0.06 oz Au/ton	exploration	Paleozoic sedimentary rocks	Eocene
Gold Quarry	1984: 183 million tons, 0.043 oz Au/ton (45 million tons, 0.078 oz Au/ton) 1987: 197.8 million tons, 0.042 oz Au/ton 1988: <i>geologic resource</i> —503 million tons, 0.04 oz Au/ton	1985: 170,000 oz Au/year 1988: combined production of Bootstrap/Capstone, Blue Star, Genesis, and Gold Quarry was 895,500 oz Au	Ordovician to Devonian chert, shale, siltstone, and impure carbonates, in part, Vinini Formation	30-38 Ma
Gold Ridge	1988: 240,000 oz Au at 0.06 oz Au/ton	exploration, evaluation	Paleozoic sedimentary rocks	
Goldstone	1988: 135,000 oz Au at 0.08 oz Au/ton	exploration, evaluation	Paleozoic sedimentary rocks	
Gold Strike (Betze, Post)	1983: 250,000 tons, 0.1 oz Au/ton; 3 million tons, 0.04 oz Au/ton 1987: <i>Post oxide</i> —1.4 million oz Au; <i>Deep Post and Betze</i> —7.3 million oz Au 1988: 128.4 million tons, 0.095 oz Au/ton	1980-86: 221,000 oz Au 1986: 48,000 oz Au 1987: 52,000 oz Au 1988: 119,000 oz Au	Ordovician to Devonian chert, shale, siltstone, and impure carbonates, in part, Vinini Formation	36-37 Ma

continued

BULK-MINEABLE, PRECIOUS-METAL DEPOSITS (continued)

Deposit name	Reserves	Production	Host rock	Mineralization age
EUREKA COUNTY (continued)				
Horse Canyon	1984: 3.94 million tons, 0.055 oz Au/ton 1988: reserves and production included in Gold Acres figures	1984: 40,000 oz Au/year	Vinini Formation, Wenban Limestone	34 Ma?
Lantern	1988: <i>geologic resource</i> —15.45 million tons, 0.028 oz Au/ton	exploration	lower Paleozoic sedimentary rocks	Cretaceous or early Tertiary
Maggie Creek	1984: 3.6 million tons, 0.079 oz Au/ton 1986: 6.7 million tons, 0.045 oz Au/ton 1988: <i>geologic resource</i> —303,000 tons, 0.092 oz Au/ton	1984: 1,250,000 tons 1986: intermittent production 1988: no production reported	Ordovician to Devonian siltstone, chert, sandstone, impure limestone	Cretaceous or early Tertiary
North Star	1988: <i>geologic resource</i> —6.7 million tons, 0.053 oz Au/ton	exploration	lower Paleozoic sedimentary rocks	Eocene or Oligocene
Pete	1987: 572,000 tons, 0.198 oz Au/ton 1988: <i>geologic resource</i> —15.7 million tons, 0.030 oz Au/ton	exploration	Roberts Mountains Formation	36–37 Ma
Post/Deep Post	Newmont Gold Co. holdings only— 1987: 22 million tons, 0.052 oz Au/ton 1988: <i>geologic resource</i> —94.6 million tons, 0.071 oz Au/ton	1987: pre-production	Vinini Formation	36–37 Ma
Ratto Canyon	1984: ~ 200,000 oz Au	exploration phase	Dunderberg Shale, Hamburg Dolomite	Oligocene
Tonkin Springs	1983: 1.84 million tons, 0.089 oz Au, 0.204 oz Ag/ton 1987: <i>oxide</i> —1.5 million tons, 0.05 oz Au/ton; <i>sulfide</i> —2.5 million tons, 0.09 oz Au/ton	1987: ~ 9,700 oz Au 1988: less than 1,000 oz Au; plant construction on bacterial leaching facility for sulfide mineralization; production expected in 1989	Vinini Formation, dacitic dikes	Oligocene?
Tusc	1988: <i>geologic resource</i> —20.8 million tons, 0.035 oz Au/ton	exploration	lower Paleozoic sedimentary rocks	Eocene or Oligocene
Windfall	3 million tons, 0.03 oz Au/ton	1908–16: 65,000 tons, 0.365 oz Au/ton 1975–84: 3 million tons, 0.03 oz Au/ton	Hamburg Dolomite	Eocene or Oligocene
HUMBOLDT COUNTY				
Ashdown	1987: 1.16 million tons, 0.125 oz Au/ton 1988: 1 million tons, 0.11 oz Au/ton	exploration	Mesozoic granitic rocks	Mesozoic
Chimney Creek	1987: 20.5 million tons, 0.065 oz Au/ton 1988: <i>proven, probable</i> —26.9 million tons, 0.068 oz Au/ton; <i>inferred in south pit</i> —2.1 million oz Au	1987: ~ 150,000 oz Au/year; 1988: 150,000 oz Au	Etchart Limestone	Cretaceous or Tertiary
Crofoot	1987: 23.45 million tons, 0.027 oz Au/ton 1988: 25 million tons, 0.025 oz Au/ton	1988: 60,000 oz Au	Camel conglomerate, rhyolite dikes	1–2 Ma
Getchell	1983: 3.25 million tons, 0.18 oz Au/ton (possible 10 million tons, 0.16 oz Au/ton) 1987: 1.3 million oz Au, 0.17 oz Au/ton 1988: 1.3 million oz Au, 0.155 Au/ton	1938–50, 1962–67: 788,875 oz Au, 2,113,030 tons, 0.37 oz Au/ton 1987: ~ 15,000 oz Au 1988: ~ 20,000 oz Au	Comus Formation, Preble Formation, granodiorite dikes, granodiorite	90 Ma
Lewis	1984: 10 million tons, 0.04 oz Au/ton 1987: 9 million tons, 0.032 oz Au/ton	1984: 3,500 tons/day 1987: ~ 8,800 oz Au	Camel conglomerate rhyolite dikes	1–2 Ma
Marigold	1988: 7 million tons, 0.035 oz Au/ton	pre-production	Paleozoic chert and argillite	Tertiary?
Pinson	1980: 3.245 million tons, 0.119 oz Au/ton 1984: <i>CX zone</i> : 490,000 tons, 0.106 oz Au/ton; 500,000 tons heap-leach 1985: 1.049 million tons, 0.09 oz Au/ton 1986: 4.835 million tons, 0.086 oz Au/ton mill-grade; 1.064 million tons, 0.027 oz Au/ton heap-leach 1987: 4.0 million tons, 0.09 oz Au/ton mill-grade; 1.8 million tons, 0.028 oz Au/ton heap-leach 1988: 4.4 million tons, 0.09 oz Au/ton mill-grade; 2.2 million tons, 0.029 oz Au/ton heap-leach	1980: 1,500 tons/day, 56,000 oz Au 1986: 67,000 oz Au 1987: 60,000 oz Au/year 1988: 62,864 oz Au	Comus Formation	90 Ma

BULK-MINEABLE, PRECIOUS-METAL DEPOSITS (continued)

Deposit name	Reserves	Production	Host rock	Mineralization age
HUMBOLDT COUNTY (continued)				
Preble	1985: 1.8 million tons, 0.062 oz Au/ton 1986: 3.16 million tons, 0.093 oz Au/ton heap-leach; 80,000 tons, 0.242 oz Au/ton mill-grade 1987: 46,000 tons, 0.16 oz Au/ton mill-grade; 81,000 tons, 0.056 oz Au/ton heap-leach 1988: 630,000 tons, 0.051 oz Au/ton	1985: 360,000 tons, 17,000 oz Au 1987: 28,000 oz Au 1988: 18,828 oz Au	Preble Formation	90 Ma?
Rabbit Creek	1988: 3.6 million oz Au: 1.2 million oz oxide reserves, 1.3 million oz sulfide reserves, and 1.1 million oz inferred sulfide reserves	pre-production	Valmy Formation	Cretaceous?
Sleeper	1985: 4.2 million tons, 0.13 oz Au and 0.73 oz Ag/ton (of which 1.4 million tons contains 0.35 oz Au and 1.0 oz Ag/ton) 1987: 2,225,000 oz Au 1988: 3.4 million tons, 0.317 oz Au/ton mill-grade; 44.9 million tons, 0.021 oz Au/ton heap-leach	1986: 128,000 oz Au, 94,000 oz Ag 1987: 158,696 oz Au 1988: 230,410 oz Au	Miocene "latite" flows and dikes, silicic ash-flow tuff Triassic slate and phyllite	5.9 Ma
LANDER COUNTY				
Austin Gold Venture	1986: 1.75 million tons, 0.16 oz Au/ton 1987: 1.2 million tons, 0.186 oz Au/ton 1988: 253,000 tons, 0.182 oz Au/ton	1986: 55,000 oz Au 1987: 52,000 oz Au 1988: 33,695 oz Au	Antelope Valley Limestone	Cretaceous or Tertiary
Buffalo Valley	1988: 1.48 million tons, 0.05 oz Au/ton	1988: 9,238 oz Au		Eocene?
Cortez	mined out	1968-82: 3.6 million tons, 0.279 oz Au/ton	Roberts Mountains Formation	34 Ma
Fire Creek	1982: 350,000 tons, 0.06 oz Au/ton	1983-84: 767 oz Au	basaltic andesite	Miocene
Fortitude (Copper Canyon) (Battle Mtn.)	1984: 16 million tons, 0.15 oz Au, 0.57 oz Ag/ton 1986: 7 million tons, 0.23 oz Au, 0.57 oz Ag/ton 1987: 10.7 million tons, 0.24 oz Au and 0.69 oz Ag/ton 1988: <i>proven, probable</i> —6.1 million tons, 0.20 oz Au and 0.76 oz Ag/ton (includes Surprise)	1978-84: <i>Tomboy-Minnie deposits</i> : 3.9 million tons, 0.09 oz Au, 0.28 oz Ag/ton 1986: 259,000 oz Au, 902,000 oz Ag 1987: 255,000 oz Au 1988: 243,000 oz Au, 675,000 oz Ag (includes production from Surprise)	Battle Formation, Antler Peak Limestone, Pumpernickel Formation	37 Ma
Gold Acres and Little Gold Acres	1987: 4.8 million tons, 0.105 oz Au/ton 1988: 5.4 million tons, 0.093 oz Au/ton	1942-84: 2.4 million tons, 0.13 oz Au/ton; 2 million tons, 0.041 oz Au/ton leached. <i>Little Gold Acres</i> : 800,000 tons, 0.124 oz Au/ton 1988: 42,322 oz Au (includes Horse Canyon)	Roberts Mountains Formation, Wenban Limestone, Valmy Formation, quartz porphyry dikes	92.8-94 Ma and 36 Ma
Hilltop	1984: 10.3 million tons, 0.073 oz Au/ton (of which 800,000 tons, 0.055 oz Au/ton is oxide and 5.7 million tons, 0.079 oz Au/ton is mineable by open-pit methods)	no production	Valmy Formation	Oligocene?
McCoy/Cove	1981: 2.5 million tons, 0.08 oz Au, 1 oz Ag/ton 1986: 6 million tons, 0.055 oz Au/ton 1987: 14 million tons, 0.05 oz Au/ton 1988: 56.4 million tons, 0.059 oz Au and 2.5 oz Ag/ton	1986: 50,000 oz Au 1987: 200,000 oz Au, 5 million oz Ag 1988: 100,000 oz Au, 700,000 oz Ag	Panther Canyon Formation (conglomerate, sandstone), Augusta Mountain Formation (limestone, granodiorite), both of Triassic age	39.5 Ma
Robertson	5 million tons, 0.05 oz Au/ton 1988: 11 million tons, 0.04 oz Au/ton	1988: commenced in November at rate of 200-300 oz Au per week		
Surprise	1987: 225,000 oz Au 1988: production and reserves included in Fortitude figures	1987: 2,000 oz Au	skarn	37 Ma
Toiyabe	1988: 813,400 tons, 0.066 oz Au/ton	1988: ~ 16,000 oz Au	lower Paleozoic calcareous siltstone	Eocene?

continued

BULK-MINEABLE, PRECIOUS-METAL DEPOSITS (continued)

Deposit name	Reserves	Production	Host rock	Mineralization age
LINCOLN COUNTY				
Atlanta	1980: 1.1 million tons, 0.08 oz Au and 1.6 oz Ag/ton	1980: 88,000 oz Au, 1,710,000 oz Ag 1987: idle 1988: idle	Pogonip Group, Ely Springs and Laketown Dolomites, Oligocene silicic tuff, dacite dikes	early Miocene?
Delamar	1988: 200,000 tons, 0.079 Au/ton	1988: exploration	Cambrian quartzite	Miocene
LYON COUNTY				
Talapoosa	1988: 2.5 million tons, 0.041 oz Au and 0.53 oz Ag/ton <i>oxide</i> 14.9 million tons, 0.03 oz Au and 0.49 oz Ag/ton <i>sulfide</i>	pre-production	dacite	Miocene
MINERAL COUNTY				
Aurora	1983: 1.5 million tons, 0.129 oz Au and 0.3 oz Ag/ton 1988: 347,000 tons, 0.253 oz Au/ton	1930's: 500,000 tons, 0.2 oz Au/ton 1983: 85,000 tons, 10,000 oz Au 1988: 10,302 oz Au	andesite, rhyolite	10 Ma
Borealis	1981: 2.1 million tons, 0.08 oz Au and 0.5 oz Ag/ton 1984: 2.5 million tons, 0.07 oz Au/ton 1987: 1.132 million tons, 0.113 oz Au/ton 1988: 1.792 million tons, 0.046 oz Au/ton	1981-84: 2.1 million tons, 170,000 oz Au 1986-87: 40,000 oz Au/year 1988: 86,256 oz Au	rhyolite flow dome, andesite flows, breccias, volcanoclastic rocks	5 Ma
Candelaria	1982: 18.5 million tons, 1.09 oz Ag and 0.009 oz Au/ton 1986: 15.8 million oz Ag and 95,000 oz Au added to reserve 1988: 24 million tons, 1.267 oz Ag/ton	1982: 1.7 million oz Ag, 9,000 oz Au 1987: 3 million oz Ag/year; total production was 10 million oz Ag as of June 1987 1988: 3.8 million oz Ag, 11,000 oz Au	Candelaria Formation serpentinite, granitic dikes	Cretaceous
Mindora	1988: 1.04 million tons, 0.036 oz Au and 1.78 oz Ag/ton	1988: exploration		
Rawhide	1986: 24.1 million tons, 0.045 oz Au and 0.47 oz Ag/ton (additional 15 million tons, 0.014 oz Au/ton possible)	pre-production production scheduled 1989	rhyolite plugs, flows, tuffs, breccias	16 Ma
Santa Fe	1984: 8 million tons, 0.032 oz Au and 0.26 oz Ag/ton 1987: 8.5 million tons, 0.037 oz Au/ton and 0.316 oz Ag/ton	evaluation phase 1988: production commenced October, 50,000 oz Au, 150,000 oz Ag estimated yearly	Luning Formation	Miocene
NYE COUNTY				
Cuervo (Sullivan)	1987: 10.2 million tons, 0.039 oz Au and 0.086 oz Ag/ton and 0.37% Cu 1988: <i>proven</i> —10.8 million tons, <i>probable</i> —2.7 million tons, 0.025 oz Au/ton	exploration	Mesozoic granodiorite	Mesozoic
Gold Bar	1987: 1.23 million tons Au ore	exploration, evaluation	silicic volcanic rocks	Miocene
Ketchup Flat	1987: 160,000 oz Au, 1,688,000 oz Ag 1988: 207,800 oz Au at 0.051 oz Au/ton and 2.39 million oz Ag at 0.58 oz Ag/ton		Miocene volcanic rocks	Miocene
Manhattan	1983: 5 million tons, 0.036 oz Au/ton 1986: <i>east pit</i> —1 million tons, 0.036 oz Au/ton; <i>west pit</i> —2.5 million tons, 0.08 oz Au/ton 1987: 162,000 oz Au, 0.026 oz Au/ton 1988: 47,000 oz Au, 0.021 oz Au/ton	1905-59: 500,000 oz Au 1983: 26,000-27,000 oz Au 1986: 3,000 tons/day 1987: 24,855 oz Au 1988: 4,752 oz Au	Gold Hill Formation	16 Ma
Montgomery Shoshone	1988: 3.1 million tons, 0.072 oz Au and 0.240 oz Ag/ton			
Mother Lode	1988: 4.9 million tons, 0.054 oz Au/ton	pre-production	lower Paleozoic	14 Ma

BULK-MINEABLE, PRECIOUS-METAL DEPOSITS (continued)

Deposit name	Reserves	Production	Host rock	Mineralization age
NYE COUNTY (continued)				
Northumberland	1981: 17 million tons, 0.045 oz Au/ton 1986: 773,000 tons, 0.07 oz Au/ton	1939-42: 220,284 tons, 327,000 oz Au 1981-84: 950,000 tons/year 1986: leaching existing heaps only	Roberts Mountains and Hanson Creek Formations, granodiorite, tonalite, quartz porphyry dikes	85 Ma
Paradise Peak (Goose)	1984: 10 million tons, 0.1 oz Au and 3 oz Ag/ton 1986: 12 million tons, 0.097 oz Au and 3.52 oz Ag/ton 1987: 1.1 million oz Au, 37.8 million oz Ag 1988: 7.6 million tons, 0.108 oz Au and 4.18 oz Ag/ton; and 4.8 million tons, 0.032 oz Au and 0.47 oz Ag/ton	1986: 143,000 oz Au, 1,088,000 oz Ag 1987: 188,000 oz Au, 3,084,800 oz Ag 1988: 229,000 oz Au, 4,312,200 oz Ag	rhyolite and andesite flows, ash-flow and air-fall tuffs	Miocene
Round Mountain	1977: 12 million tons, 0.061 oz Au and 0.07 oz Ag/ton 1984: 195 million tons, 0.043 oz Au and 0.08 oz Ag/ton 1987: 194 million tons, 0.035 oz Au/ton 1988: 250 million tons, 0.0324 oz Au/ton	1977-84: 313,480 oz Au, 160,419 oz Ag 1984: 70,000 oz Au 1987: 190,600 oz Au 1988: 233,700 oz Au	rhyolite ignimbrite	25 Ma
St. Joe-Bullfrog	1987: 60 million tons ore, 3.215 million oz Au, 3.375 million oz Ag 1988: 14.3 million tons, 0.110 oz Au and 0.192 oz Ag/ton	pre-production stripping and mill construction	silicic ash-flow tuff	Miocene
Sterling	1983: 200,000 tons, 0.20 oz Au/ton (possible 300,000 tons additional reserves of similar grade) 1988: 469,000 tons, 0.21 oz Au/ton	1984: 58,000 tons, 9,000 oz Au 1987: 7,000 oz Au 1983-88: 330,000 tons at 0.23 oz Au/ton 1988: 8,500 oz Au	Wood Canyon and Bonanza King Formations	14 Ma
PERSHING COUNTY				
Florida Canyon	1987: 22 million tons, 0.023 oz Au/ton 1988: 37 million tons, 0.023 oz Au/ton	1987: 48,000 oz Au 1988: 61,300 oz Au	Grass Valley Formation	Cretaceous or Tertiary
Relief Canyon	1983: 9 million tons, 0.032 oz Au/ton 1986: 3.3 million tons, 0.03 oz Au/ton 1988: ~ 1.3 million tons, 0.03 oz Au/ton	1984: 24,500 oz Au, 1 million tons 1987: 41,600 oz Au 1988: 40,400 oz Au	Natchez Pass Limestone, Grass Valley Formation	Cretaceous
Rochester	1981: 75 million tons, 1.5 oz Ag/ton 1987: 117 million tons, 0.011 oz Au and 1.55 oz Ag/ton	1986: 4 million oz Ag, 43,000 oz Au 1987: > 4 million oz Ag, 27,000 oz Au 1988: 5.0 million oz Ag, 52,388 oz Au	Koipato Group, Weaver Rhyolite	Late Cretaceous
Standard	mined out	1932-51: 884,000 tons, 46,602 oz Au, 102,721 oz Ag	Natchez Pass Limestone, Grass Valley Formation	73 Ma
Trinity	1987: 1 million tons, 5.25 oz Ag/ton	1987-89: 4.6 million oz Ag projected 1988: mining ended August 1988, heap-leaching continuing	rhyolite plugs	Miocene
STOREY COUNTY				
Flowery	1986: 500,000 tons, 36,000 oz Au, 428,000 oz Ag		Alta Formation	12 Ma
WASHOE COUNTY				
Hog Ranch	1984: 2.5 million tons, 0.085 oz Au/ton 1986: 5 million tons, 0.08 oz Au/ton 1987: 6.8 million tons, 0.054 oz Au/ton	1986: 50,000 oz Au 1988: 30,000 oz Au	rhyolite, explosion breccia, sinter	15-16 Ma
Wind Mountain	1988: 15 million tons, 0.021 oz Au and 0.42 oz Ag/ton	1988: pre-production	Tertiary sedimentary rocks	late Tertiary or Quaternary

continued

BULK-MINEABLE, PRECIOUS-METAL DEPOSITS (continued)

Deposit name	Reserves	Production	Host rock	Mineralization age
WHITE PINE COUNTY				
Alligator Ridge	1983: 5 million tons, 0.09 oz Au/ton 1986: 1.79 million tons, 0.064 oz Au/ton	1981-82: 2 million tons, 0.11 oz Au/ton 1983-87: 60,000 oz Au and 14,000 oz Ag/year 1988: 40,000 oz Au	Pilot Shale	early Oligocene?
Bald Mountain (Top)	1986: <i>proven</i> —2.5 million tons, 0.10 oz Au/ton; <i>possible</i> —2.65 million tons, 0.087 oz Au/ton 1988: 3.2 million tons, 0.056 oz Au/ton	1986: 50,000 oz Au 1988: 48,619 oz Au	granite porphyry Cambrian shale and limestone	35-38 Ma
Casino/ Winrock	1988: 1 million tons, 0.05 oz Au/ton		Paleozoic sedimentary rocks	Eocene?
Easy Junior (Nighthawk Ridge)	1988: 81,000 oz Au at 0.031 oz Au/ton		Devonian and Mississippian rocks	Eocene?
Golden Butte	1988: 2.7 million tons, 0.031 oz Au/ton		Chainman Shale	Cretaceous or Eocene
Green Springs	1987: 1.943 million tons, 0.053 oz Au/ton 1988: 1.25 million tons, 0.06 oz Au/ton <i>possible resource</i> —500,000 tons, 0.036 oz Au/ton	1988: ~ 12,000 oz Au	Paleozoic sedimentary rocks	Eocene?
Illipah	1987: 57,000 oz Au 1988: mined out	1987: ~ 25,000 oz Au/year 1988: 25,324 oz Au, mining ended in 1988	Paleozoic sedimentary rocks	Eocene?
Little Bald Mtn.	1986: 1 million tons, 0.10 oz Au/ton 1987: 220,000 tons, 0.14 oz Au/ton 1988: 200,000 tons, 0.13 oz Au/ton	1985-86: 140,000 tons, 0.08 oz Au/ton 1987: 3,500 oz Au 1988: 7,000 oz Au	Antelope Valley Formation	Eocene
Mt. Hamilton	1988: 7.7 million tons, 0.05 oz Au and 0.5 oz Ag/ton	pre-production	Dunderberg Shale	Cretaceous
Robinson	1986: 1.5 million tons, 0.14 oz Au, 0.3 oz Ag/ton (approximately 1.3 million tons averaging 0.08 oz Au/ton present in district) 1988: 231,000 oz Au at 0.026 oz Au/ton	1986: 48,000 oz Au, 96,000 oz Ag 1987: 50,207 oz Au 1988: 38,750 oz Au	Rib Hill Sandstone Riepe Spring Limestone	Cretaceous
Sunnyside	1988: 32,000 oz Au at 0.187 oz/ton gold equivalent			
Taylor	1980: 10 million tons, 3 oz Ag/ton	1980: 1,200 tons/day	Guilmette and Joana Limestones, rhyolite dikes	Eocene or Oligocene
White Pine	1988: 63,000 oz Au, 0.04 oz Au/ton	1988: 16,000 oz Au/year projected	Paleozoic sedimentary rocks	Oligocene?

Industrial Minerals

by Stephen B. Castor



Blue Diamond plant (James Hardie Gypsum, Inc.), Clark County. Union Pacific Railroad photo.

The total value of industrial minerals produced in Nevada in 1988 is estimated at 230 million dollars, an increase of about 5 percent over 1987. Increases in production and dollar values for clay, diatomite, gypsum, lithium carbonate, sand and gravel, and silica sand have offset decreases in barite and magnesia production. The most important Nevada industrial minerals produced in 1988, in order of estimated dollar value, were sand and gravel, diatomite, lithium carbonate, cement, barite, gypsum, silica sand, clay, and magnesia.

BARITE. According to the U.S. Bureau of Mines, Nevada barite production continued to decline in 1988 to approximately 92 percent of the 1987 production, and 8 percent of the peak production in 1980. These decreases are mainly due to drops in oil well drilling, but also reflect increased imports of foreign barite.

Five Nevada barite producers were active in 1988. **N L Industries, Inc.**, **M.I. Drilling Fluids, Milpark, Inc.**, and **Circle-A Construction Co.** produced barite for use in drilling mud. Shipments from these companies consisted mainly of milled product, but considerable amounts of bulk ore were sent to the Gulf Coast to compete with foreign sources. The **Standard Magnesia Co.** mines barite in Nye County and processes it in Fallon for sales to paint manufacturers. This production is relatively small, accounting for less than 2 percent of the Nevada total in 1988; however, paint-grade barite brings a premium price.

BORATES. The **American Borate Co.**, an **Owens-Corning** subsidiary, processed some stockpiled colemanite ore at its Amargosa Valley plant in 1988. In the past, this plant processed large amounts of rich ore from now inactive mines in nearby Death Valley, California. A scheme to reprocess tailings

was evaluated in 1988, but no production is anticipated in 1989.

CEMENT. The **Nevada Cement Co.** plant at Fernley, about 30 miles east of Reno, was the only producer of cement in Nevada in 1988. Annual production at this plant is relatively stable at about 400,000 tons, which is about equally divided between northern Nevada and northern California market areas.

The **Las Vegas Cement Co., Inc.** plant at Logandale in Clark County was slated for start-up in 1988; However, construction work on the site is not complete, and initial production has been postponed until late 1989, at the earliest. Construction has not begun on a cement plant proposed by the **Great Star Cement Co.** in the Las Vegas area.

CLAY. **Industrial Mineral Ventures, Inc.**, a subsidiary of **Gulf Resources and Chemical Corp.**, is the largest producer of clay mineral products in Nevada. Production at this operation increased more than 60 percent in 1988 over 1987. At present, sepiolite accounts for 80 percent of the clay sold by the company, although saponite, hectorite, and bentonite are also treated in its Amargosa Valley plant. Organo-clad sepiolite, sold under the trade name "Thermogel," is a popular product, particularly in Japan, and production of organically treated hectorite, mined nearby in California, increased dramatically in 1988.

Vanderbilt Minerals Co. produced small amounts of white montmorillonite from a deposit near Beatty. This clay is used as a filler and thickening agent in pharmaceutical and cosmetic products. The **J.M. Huber Co.** mined minor amounts of hectorite from a volcanoclastic deposit in the McDermitt caldera in 1988 for testing.

Halloysite is mined in Washoe County by the **Art Wilson Co.** for use in cement by the **Nevada Cement Co.**

DIATOMITE. In 1988 diatomite was the second most important industrial mineral produced in Nevada in terms of dollar value. Four companies shipped diatomite from Nevada, three from a relatively small area in northern Nevada. **Eagle-Picher Minerals, Inc.** is by far the largest Nevada producer, mining various grades of diatomite from three separate areas in northern Nevada for beneficiation at the Colado plant at Lovelock and the Clark plant near Reno, and for shipment as crude diatomite. Filter-grade diatomite from the Colado plant is marketed worldwide as "Celatom Filter Aid." In 1988, the company was awarded the Nevada Exporter of the Year title by the Nevada Trade Council for its success in foreign markets.

Grefco, Inc. produces diatomite, mainly for use in fillers, from the Basalt mine on the Esmeralda/Mineral county line. **CR Minerals Corp.** operates an absorbent-grade diatomite mill near Fernley which utilizes material hauled from a pit near Hazen. In 1988, **Moltan Co.** of Tennessee began production of diatomite cat litter sold under the "Sani-Cat" label, and "Ultra-sorb" oil and grease absorbent from its operation north of Fernley.

FLUORSPAR. **Crowell Daisy Co.** continues to be the only fluorspar producer in Nevada. About 3,000 tons of fluorite is mined underground annually from a deposit near Beatty and shipped to California for use in cement.

GYP SUM. Gypsum production in Nevada increased from about 1.3 million tons in 1987 to more than 1.5 million tons in 1988, mainly due to continued construction industry strength in California and Nevada. All four Nevada wallboard plants ran at capacity during 1988. Production increases are anticipated in 1989, as non-wallboard markets are exploited by some companies.

Pacific Coast Building Products, which mines relatively low-grade ore from a shallow pit in flat-lying Pliocene sediments near Lake Mead, was the largest Nevada gypsum producer in 1988. The company increased production by about 10 percent over 1987, and anticipates a similar increase in 1989. The **United States Gypsum Co.** plant in Washoe County, utilizing ore from a mine in adjacent Pershing County, was the second largest Nevada gypsum producer in 1988. **James Hardie Gypsum, Inc.**, operating the Blue Diamond mine and plant southwest of Las Vegas, produced at about the same rate in 1988 as in 1987, but hopes to increase production in 1989 by increasing sales to cement manufacturers. The **Georgia Pacific Corp.**, which ranked fourth in production in Nevada in 1988 from its new operation northeast of Las Vegas, anticipates an increase of about 10 percent in 1989. The **Art Wilson Co.** produces gypsum and anhydrite from the Adams mine near Carson City. Gypsum is shipped to cement manufacturers in Nevada, California, and Idaho, while a mixture of gypsum and anhydrite is sold to agricultural users. In 1988, **Nevada Gypsum and Mining** started mining gypsum from the Miocene Horse Spring Formation in the Rainbow Garden area east of Las Vegas. This operation, which is the smallest Nevada producer at about 30,000 tons per year, ships coarse-crushed gypsum to cement manufacturers and agricultural users in California.

LIME AND LIMESTONE. Nevada lime production was up in 1988 due to increased use of high-calcium lime for pH control of leach fluids in the booming western precious-metal mining industry. **Chemstar, Inc.** is the only Nevada lime producer, making high-calcium lime at a rate of 360 tons per day at its Apex plant 15 miles northeast of Las Vegas. Chemstar also operates a plant in Henderson that makes lime from dolomite mined at Sloan south of Las Vegas, mainly for use in construction industry products.

In 1988, **Continental Lime, Inc.** of Salt Lake City continued development work on a high-calcium lime operation near Pilot Siding in eastern Elko County. The plant is scheduled to start up in the fall of 1989 on material stockpiled by the original owner, **Marblehead Lime**, and to begin quarrying operations in 1990. The northern Nevada gold mining industry is targeted as the main market. In 1988, at least two other companies were engaged in evaluation of high-calcium lime production in northern Nevada. **Min-Ad**,

Inc. of Winnemucca grinds and bags about 12,000 tons per year of dolomitic limestone for sale to agricultural users.

LIGHTWEIGHT AGGREGATE. Operations utilizing various types of crushed stone for concrete or asphalt aggregate and railroad ballast are included under SAND AND GRAVEL (see below). In addition, the Nevada aggregate industry also produces about 400,000 tons per year of lightweight aggregate. Because this industry is specialized and includes some products that are exported to California, it is treated separately here. In Nevada, lightweight aggregate is mainly pumiceous rhyolite, whereas in other areas, treated (and therefore more expensive) products such as thermally expanded shale or perlite are used. Nevada lightweight aggregate is mainly used in concrete and concrete blocks, but also finds use in base aggregate. Producers are currently studying the possibilities of marketing pulverized rhyolite for use as a natural pozzolan.

Rilite Aggregate Co. in southeast Reno is the largest Nevada producer of lightweight aggregate, mostly for use in concrete made by its parent company, **C.B. Concrete. Naturalite Aggregate Corp.** ships significant amounts of its material to northern California from its mine near Dayton, and manufactures locally available "Basalite" bagged dry ready-mix cement. **Southern Nevada Lightweight**, which operates a quarry about 20 miles south of Las Vegas, has found a strong market for lightweight fines in construction sand. The **All-lite Aggregate Co.** began a new lightweight aggregate operation in 1988 on Washington Hill, 5 miles east of Reno. The rhyolite from Washington Hill is somewhat more dense than that from other sources in the Reno area, but consistently yields high quality aggregate and constitutes a considerable resource, occurring as a dome about one mile in diameter. **Cind-R-Lite Co.** of Las Vegas is the only lightweight aggregate producer in Nevada which does not use rhyolitic material, instead using volcanic scoria from a cinder cone near Amargosa Valley in cement blocks for the Las Vegas market.

LITHIUM CARBONATE. **Foote Minerals Co.**, which produces lithium carbonate from brine at Silver Peak in Esmeralda County, was acquired by **Cyprus Minerals Co.** in April 1988, and production increased by about 15 percent over 1987. The impact of Cyprus's new lithium brine operation in Chile on Silver Peak production will probably be negligible because the Nevada operation is the world's lowest cost producer.

MAGNESIA. Production at the **Basic, Inc.** magnesite mine and magnesia plant at Gabbs was up slightly in 1988 compared with 1987, but 1989 sales are projected to be lower. Sales of dead-burned magnesia used in refractories slipped to about 15 percent of the 1981 peak, and the parent company, **C-E Refractories, Inc.**, is considering shutting this part of the operation down permanently. Light-burned magnesia sales were up slightly in 1988 due to increases in chemical sales. The company is

attempting to build markets for light-burned magnesia in municipal water treatment and in leach plant pH control at Nevada gold mines.

PERLITE. The **Wilkin Mining and Trucking Co.** mines perlite in Lincoln County. In 1987, the company began producing expanded perlite in its new milling and popping plant at Caliente, about 30 miles east of the mine. Market response in 1988 was very good, and a second furnace is scheduled to be added in 1989. The plant is unique because it utilizes a pre-heating technique to reduce thermal shock and enable production of larger amounts of coarse perlite. Most sales are to horticultural users in California, Hawaii, and Florida.

SALT. The **Huck Salt Co.** produces about 10,000 tons of salt per year from a dry lake near Fallon. The salt is mostly sold locally for road de-icing. This family operation has been in business more-or-less continuously for 50 years.

SAND AND GRAVEL. In 1988 Nevada's sand and gravel producers benefitted from the continuing boom in local construction, producing an estimated 15 million tons. Las Vegas is the largest sand and gravel market in Nevada, and producers in the Las Vegas area account for about half of the state's total production.

Bonanza Materials, Inc., which was the largest sand and gravel producer in Nevada in 1988 at about 2.1 million tons, was acquired by **Gifford-Hill & Co.** of Texas. This company operates a large gravel pit in Henderson and a smaller pit east of Henderson, which is mainly a source of sand. **WMK Transit Mix, Inc.**, a subsidiary of **ARC America**, was the second largest producer in Nevada at about 1.2 million tons. In 1989, WMK plans to shut down its Henderson operation and rely completely on its Buffalo Road pit in southeast Las Vegas. Other large producers in the Las Vegas area in 1988 were **Stocks Mill & Supply Co.**, **Las Vegas Paving Corp.**, **Las Vegas Building Materials, Inc.**, and **Wells Cargo, Inc.**, all of which were estimated to have produced more than 400,000 tons in 1988. In addition, large amounts of screened base material were produced during surface preparation for large residential developments in west Las Vegas; however, production from this source will decline in 1989.

The largest sand and gravel producer in the Reno-Carson City area in 1988 was **Granite Construction Co.**, which produced from its Patrick Pit east of Reno and from a pit near Gardnerville. Other large producers in the Reno-Carson City area were **Robert L. Helms Construction Co.**, **Palute Pit Aggregates, Inc.**, **Sha-Neva, Inc.**, **Eagle Valley Construction Co.**, and **Jack N. Tedford, Inc.**, each producing at least 250,000 tons.

SILICA. **Simplot Silica Products** at Overton produced about 600,000 tons of silica sand in 1988, an increase of more than 5 percent over 1987. Simplot's material is high in silica, at 99.2 percent, and low in alumina and iron when compared with other West Coast operations. In addition, the sand, which is mined from a relatively friable Cretaceous

sandstone unit over 100 feet thick, is very consistent in quality. In 1988 modifications to in-pit washing equipment led to increased efficiency. Future sales projections are difficult, because of inconsistent production by California glass sand mines and because the effect of the new California bottle bill, enacted in late 1988, is not clear.

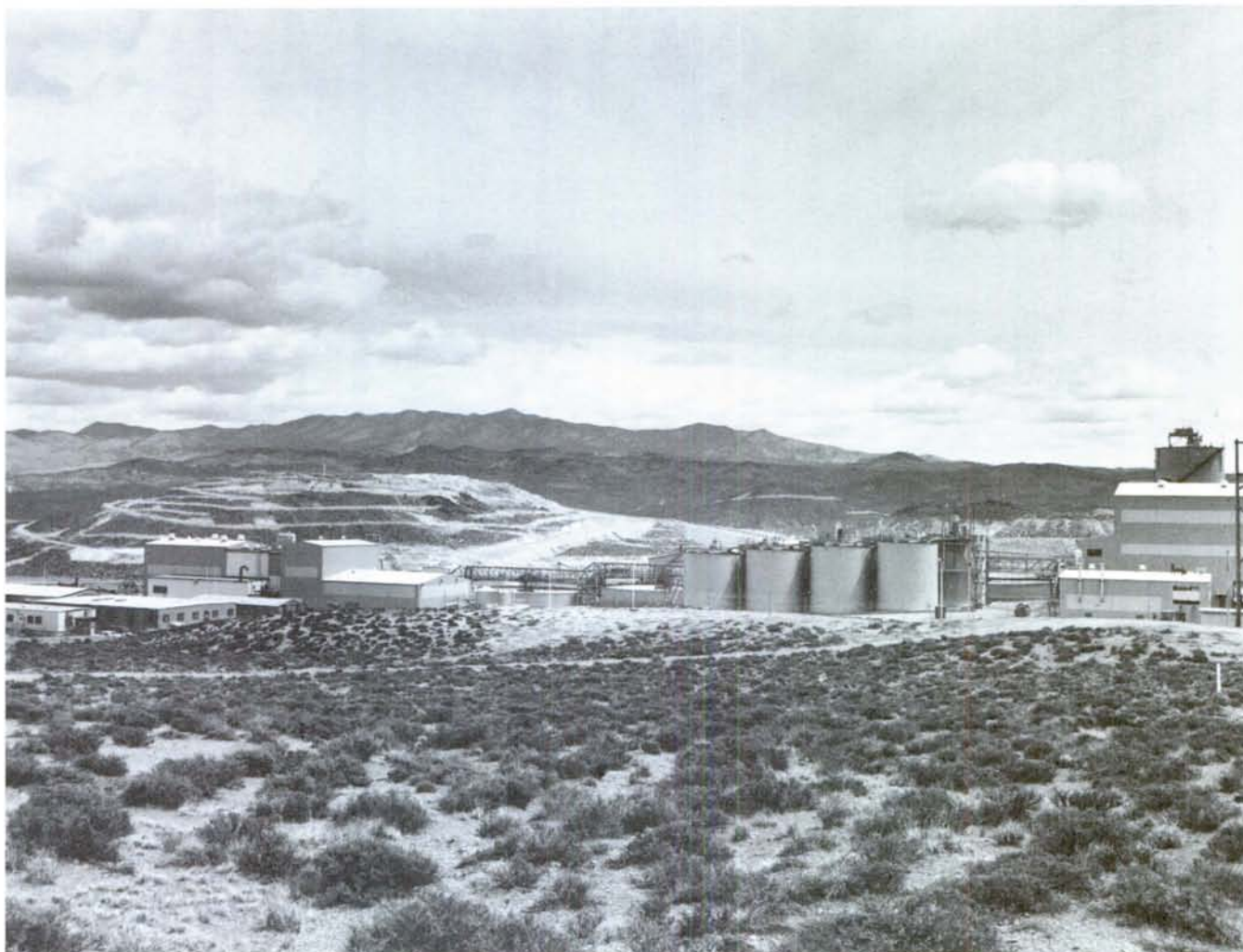
ZEOLITES. At its Ash Meadows plant near Amargosa Valley, **East West Minerals, Inc.** processes a small amount of clinoptilolite trucked from a nearby deposit in California. Plant capacity is 8,000 tons per year, but 1988 production was only about 10 percent of capacity. Most sales are to the aquaculture industry, but sewage and waste water treatment markets are promising.

At Eastgate in Churchill County, East West initiated production of mordenite in 1987. This plant has an annual capacity of 30,000 tons/year; however, production was discontinued in 1988 pending installation of drying equipment. The operation is being evaluated for acquisition or investment by another company, and it is possible that the plant will be restarted in 1989. Target markets are cat litter and oil and grease absorbent.

Estimates in this report are based on U.S. Bureau of Mines data supplemented by visits to several operations, from conversations with producers, and from published information.

Directory of Mining and Milling Operations

by Keryl L. Fleming and Richard B. Jones



Paradise Peak mine and mill, Nye County. FMC photo.

Compiled from information supplied by the Nevada Division of Mine Inspection, Nevada Department of Minerals, U.S. Mine Safety and Health Administration, and U.S. Bureau of Land Management. Does not include sand, gravel, or lightweight aggregate operations.

EX = exploration, HL = heap leach, ML = mill, OP = open-pit mine, OS = other surface, PL = placer, UG = underground mine.

Mine/plant name	Operator	Location	Commodity	Type	Process/ activity	Employees	Address
CHURCHILL COUNTY							
CR Minerals pit and mill	CR Minerals Corp.	S8,17,T19N,R26E; S11,T20N,R24E	diatomite	OP,ML	grinding	5	Henry Turnbaugh P.O. Box 455 Fernley, NV 89408
Huck Salt Co.	Elmer Huckaby	S12,T16N,R31E	salt	OP	solar evaporation	3	Elmer Huckaby 895 Harrigan Road Fallon, NV 89406
Landsources	L & C Venture	S26,T24N,R29E	gold silver	OP	single bench	14	Bob Lain, Operations Manager 316 California Street, Suite 461 Reno, NV 89509
Moltan mine	Moltan Co.	S28,29,32,33, T23N,R27E	diatomite	OP,ML	drying calcining grinding	37	Dallas Herreld P.O. Box 860 Fernley, NV 89408-0860

continued

DIRECTORY OF MINING OPERATIONS (continued)

Mine/plant name	Operator	Location	Commodity	Type	Process/ activity	Employees	Address
CHURCHILL COUNTY (continued)							
Shoshone mine	Lombardo Turquoise Milling & Mining Co.	S21,T21N,R40E	turquoise	UG	drifting stoping	2	Danielle M. Kohler, Manager 1300 East Main Street Austin, NV 89310
Wonder mine	Belmont Resources Inc.	S4,T18N,R35E	silver gold	OP,HL	cyanide single bench	12	James M. Dickinson 1105 Crest Drive Santa Rosa, CA 95404
	International Recovery Services, Inc., <i>lessee</i>	S5,T18N,R35E		OP,HL	single bench	5	Paul Davis P.O. Box 2270 Sparks, NV 89432-2270
CLARK COUNTY							
Apex quarry and plant	Chemstar, Inc.	S26,T18S,R63E	lime	OP,ML	crushing sizing calcining	30	Art Reber, Plant Manager P.O. Box 3598 North Las Vegas, NV 89030
Blue Diamond mine	James Hardie Gypsum Inc.	S20,29-32, T21S,R59E; S5,T22S,R59E; S24-26,T21S,R58E	gypsum	OP	grinding screening caloining	123	James E. Price HCR 89033, Box 2900 Las Vegas, NV 89124
Capitol Camps mine & mill	Mining & Milling Corp. of America	S13,T26S,R64E	gold silver	OP,ML	single bench construction gravity	5	Paul R. Thompson, President P.O. Box 13507 Las Vegas, NV 89112-1507
Dolomite plant	Chemstar, Inc.	S18,T22S,R63E	lime	ML	calcining	31	Dave Johnson, Vice President 2551 North Green Valley Parkway, St. 201-B Henderson, NV 89015
Golden Dawn's mine	Snowbird Resources	S2,T29S,R63E	gold	OP,ML	single bench gravity	6	M. R. Vandergrift, President 3355 Spring Mountain Road Las Vegas, NV 89102
Gypsum mine	Georgia Pacific, Inc.	S10,T16S,R66E	gypsum	OP	single bench	7	Bob Shajary, Superintendent P.O. Box 30006 North Las Vegas, NV 89030
Money pit	Southern Nevada Liteweight	S9,16,T25S,R61E	rhyolite	OP	multiple bench crushing screening	19	Spencer Apple 4675 Wynn Rd. Las Vegas, NV 89103
Pabco mine	Pacific Coast Building Products	S7,8,17,18, T20S,R64E	gypsum	OP	single bench crushing screening calcining	17	Stanley L. Asbell, Plant Manager P.O. Box 43327 Las Vegas, NV 89116
North Rainbow Gardens Pit	Nevada Gypsum and Mining	S34,T20S,R63E	gypsum	OP	crushing	5	Georgia Powers 850 S. Boulder Hwy., Box 162 Henderson, NV 89015
Simplot Silica Products	Simplot Industries	S30,T16S,R68E	silica sand	OP,ML	multiple bench flotation screening drying	42	Jack A. Olson P.O. Box 308 Overton, NV 89040
Sloan quarry	Chemstar, Inc.	S13,T23S,R60E	dolomite	OP	multiple bench crushing sizing	12	Earl Gillian Star Route 70, Box 2300 Las Vegas, NV 89124
Techatticup mine	Canyon Development & Mining, Inc.	S2,T26S,R64E	gold silver	OP,HL	single bench cyanide	4	Larry Clouse, President 624 Arroyo Boulder City, NV 89005
Treasure Hawk mine & mill	Eddie Bounsall	S34,T19S,R70E	gold silver	OP,ML	single bench gravity cyanidation	2	Eddie & Billy Bounsall, Owners P.O. Box 357 Logandale, NV 89021
Wallboard plant	Georgia Pacific, Inc.	S24,T18S,R63E	gypsum	ML	calcining	4	Jean Wassenberg, Manager P.O. Box 30006 North Las Vegas, NV 89030

DIRECTORY OF MINING OPERATIONS (continued)

Mine/plant name	Operator	Location	Commodity	Type	Process/ activity	Employees	Address
DOUGLAS COUNTY							
Bouvie Lou placer claims	David L. Allen	S8,17,20, T13N,R24E	gold silver	PL	gravity	1	David L. Allen 17 Smith Ln. Yerington, NV 89447
Buckskin leach plant	Sonora Mining Corp.	S13,T13N,R23E	gold silver	HL	cyanide	28	George Newell P.O. Box 546 Yerington, NV 89447
ELKO COUNTY							
Big Four mine & mill	Phil Heater	S25,T44N,R52E	gold silver	OP,ML	single bench cyanidation	2	Phil Heater, Owner P.O. Box 187 Mountain City, NV 89831
Big Springs mine	Freeport-McMoRan Gold Co.	S1-3,11,12, T42N,R53E	gold	OP,HL	multiple bench cyanide fluid bed roasting	32	D. Scott Barr, Mine Manager Mountain City Star Route Elko, NV 89801
	Gibbons & Reed Co., <i>contractor</i>	S11,12,T42N,R53E		OP	multiple bench	70	C. David Baer, Project Manager 1111 Brickyard Road Salt Lake City, UT 84130
	Lang Drilling, <i>contractor</i>	S10,T42N,R53E		EX	rotary drilling	6	Jim Collard, Project Manager 439 West Commercial Elko, NV 89801
	The Industrial Co. of Steamboat Springs, <i>contractor</i>	S11,12,T42N,R53E		OP	construction	40	Stan Palmer, Superintendent Rural Route 42144 Elko, NV 89801
Dry Creek Mill	Circle A Construction Co.	S15,T40N,R47E	barite	ML	gravity concentration	2	Steve Aslett, Owner P.O. Box 3 Twin Falls, ID 83301
Cornucopia mine	Priet Joint Venture	S18,19,T42N,R50E	gold silver	OP,ML, HL	single bench screening cyanide	2	Bill Schultz, Manager P.O. Box 254 Elko, NV 89801
	Bud Barrows Mining, <i>contractor</i>	S18,19,T42N,R50E		OP,ML, HL	single bench screening	5	Bud Barrows, Owner P.O. Box 334 Carlin, NV 89822
Dee gold mine	Rayrock Mines, Inc.	S34,T37N,R49E	gold silver	OP,HL, ML	single bench cyanide	98	David S. Cook P.O. Box 1193 Elko, NV 89801
Jerritt Canyon joint venture	Freeport-McMoRan Gold Co.	S33,T41N,R53E	gold	OP,ML, HL	multiple bench cyanide grinding fluid bed roasting	366	Cecil L. Kinard II Mountain City Star Route Elko, NV 89801
	Blatzer Construction Co., <i>contractor</i>	S33,T41N,R53E		ML,HL		8	John Blatzer, President P.O. Box 4460 Medford, OR 97501
	George Delong Construction, <i>contractor</i>	S16,T40N,R53E		EX	rotary drilling	6	Royce Hackworth, President 833 East 4th Street Winnemucca, NV 89445
	Hackworth Drilling, <i>contractor</i>	S16,T40N,R53E		EX	rotary drilling	3	Royce Hackworth, President 850 West Main Street Elko, NV 89801
	Idaho Resources, Inc., <i>contractor</i>	S34,35,T41N,R53E		ML,HL		24	Mark Cook, Superintendent P.O. Box 84340 Vancouver, WA 98684-0340
	The Industrial Co. of Steamboat Springs, <i>contractor</i>	S33,T41N,R53E		OP	multiple bench	200	Doug Green, Construction Manager Rural Route 4213 & Freeport Road Elko, NV 89801
	Transystems, Inc., <i>contractor</i>	S33,T41N,R53E		OP	multiple bench	17	J. Michael Rice, President P.O. Box 399 Black Eagle, MT 59414

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DIRECTORY OF MINING OPERATIONS (continued)

Mine/plant name	Operator	Location	Commodity	Type	Process/ activity	Employees	Address
ELKO COUNTY (continued)							
Rossi mine	N. L. Industries, Baroid Division	S15,21,22, T37N,R49E	barite gold	OP,ML	multiple bench crushing gravity	2	August V. Castelli, Manager P.O. Box 231 Battle Mountain, NV 89820
	John Davis Trucking Co., <i>contractor</i>	S15,21,22, T37N,R49E		OP	multiple bench	6	John N. Davis, Owner 165 West Front Street Battle Mountain, NV 89820
	Target Construction, Inc., <i>contractor</i>	S15,22,26, T37N,R49E		OP	multiple bench	6	Kevin Fegert, Owner 333 Holcomb Avenue, Suite 100 Reno, NV 89502
Tuscarora gold mine	Horizon Gold Shares, Inc.	S3,T39N,R51E	gold silver	OP,HL	multiple bench cyanide	48	Randall J. Bargelt P.O. Box 37 Tuscarora, NV 89834
Wood Gulch	Homestake Mining Co.	S23-26,T44N,R53E	gold silver	OP,HL	multiple bench cyanide	19	Scott A. Caldwell P.O. Box 277 Mountain City, NV 89831
	Seubert Excavating, <i>contractor</i>	S23-26,T44N,R53E		OP	crushing	10	J.P. Seubert & George Seubert, Owners c/o Chambers Motel P.O. Box 177 Mountain City, NV 83522
	Welsh Construction Co., <i>contractor</i>	S23-26,T44N,R53E		OP,HL	multiple bench	30	Joe Shea, Construction Superintendent P.O. Box 1236 Winnemucca, NV 89445
ESMERALDA COUNTY							
Basalt mine & mill	Grefco, Inc.	S29,T2N,R34E	diatomite	OP,ML	single bench grinding	13	Robert A. Poelvoorde P.O. Box 288 Mina, NV 89422
Blanco #3	Vanderbilt Minerals Corp.	S22,T1N,R37E	clay	OP	grinding	10	J. W. Lease P.O. Box 399 Beatty, NV 89003
Boss mine	Falcon Exploration	S30,31,T3N,R39E	gold silver	OP,ML	multiple bench construction	24	Rick Moritz, General Manager P.O. Box 3719 Tonopah, NV 89049
Gold Bug mine	Vulcan Mining & Development Co.	S26,T7S,R41.5E	gold silver	OP,ML	single bench flotation gravity	4	Pete Franks Star Route 30 C Goldfield, NV 89013
Goldfield operations	Dexter Gold Mines, Inc.	S36,T2S,R42E	gold silver	OP,HL	cyanide	22	George H. Bennett P.O. Box 475 Goldfield, NV 89012
	Red Rock Mining, Inc., <i>contractor</i>	S36,T2S,R42E		OP,HL		11	Steven H. Grundstedt, Managing Director P.O. Box 160 Goldfield, NV 89013
Silver Peak operations	Cyprus Foote Mineral Co.	S22,T2S,R39E	lithium carbonate	OS	evaporation precipitation	62	P. J. Seaman State Road 265 Silver Peak, NV 89047
Silver Peak mill	Sunshine Mining Co.	S1,2,T3S,R38E	gold silver	ML	cyanide leach (tanks) merrill crowe precipitation	47	John C. Barber P.O. Box 97 Silver Peak, NV 89047
Weepah project	Sunshine Mining Co.	S23,T1N,R39E	gold silver	OP,HL	cyanide	19	John C. Barber P.O. Box 97 Silver Peak, NV 89047

DIRECTORY OF MINING OPERATIONS (continued)

Mine/plant name	Operator	Location	Commodity	Type	Process/ activity	Employees	Address
EUREKA COUNTY							
Buckhorn mine	Cominco American Resources Inc.	S30,31,T27N,R49E	gold silver	OP,HL	multiple bench cyanide	79	Art Schweizer P.O. Box 847 Carlin, NV 89822
Dunphy mill	N. L. Industries, Baroid Division	S26,T33N,R48E	barite	ML	gravity	22	B. C. Baldwin, Manager P.O. Box 430 Battle Mountain, NV 89820
Gold Bar mine	Atlas Gold Mining Inc.	S26,27,T22N,R49E	gold	OP,ML, HL	multiple bench crushing grinding cyanidation	92	David M. Rubio P.O. Box 282 Eureka, NV 89316
	CEC Construction Co., <i>contractor</i>	S26,27,T22N,R49E		OP	multiple bench	50	Phil Rothstein, President P.O. Box 784 Eureka, NV 89316
	Selland Construction Co., <i>contractor</i>	S26,27,T22N,R49E		OP	multiple bench	20	Brad Selland, President 1285 S. Wenatchee Wenatchee, WA 99223
Gold Strike mine	Barrick Goldstrike Mines, Inc.	S30,T36N,R50E; S23-26,T36N,R49E	gold	OP,ML, HL	multiple bench cyanide milling	686	John T. McDonough, Mine Manager P.O. Box 29 Elko, NV 89801
	Liggett Industries, Inc., <i>contractor</i>	S30,T36N,R50E		OP		12	Wayne M. Liggett, President 7003 W. Banff Peoria, AZ 85345
	J. S. Redpath Corp., <i>contractor</i>	S23,T36N,R49E		UG	exploration development	30	Scott McIntosh, General Manager P.O. Box 3094 Elko, NV 89801
Horse Canyon mine	Cortez Gold Mines	S6-8,17,T26N,R48E; S26,T27N,R47E	gold silver	OP	multiple bench	106	A. L. Walsh, Mine Manager Cortez, NV 89821
Nevada Barth iron mine & mill	Nevada Barth Corp.	S7,8,T31N,R51E	magnetite iron ore	OP,ML	crushing screening	2	Celso Yraguen, Mine Manager P.O. Box 425 Carlin, NV 89822
Newmont Operations	Newmont Gold Co.	T31N-36N, R49E-53E	gold	OP,ML, HL	carbon-in-leach carbon-in-pulp cyanide	1184	T. Peter Philip, President P.O. Box 669 Carlin, NV 89822-0669
	Bechtel Construction, Inc., <i>contractor</i>	S31,T31N,R53E		OP,ML	construction	710	R. C. Isaacson, Construction Manager P.O. Box 340 Carlin, NV 89822
	Coats Drilling Co., <i>contractor</i>	S30,T36N,R50E		OP	exploration	10	Otto Schmitke, Job Foreman 3051 North Deer Run Road Carson City, NV 89701
	Johnson Controls, Inc., <i>contractor</i>	S1-3,T33N,R51E; S35,36,T34N,R51E		OP	multiple bench	175	James H. Keyes, President P.O. Box 520 Carlin, NV 89822
	Liggett Industries, Inc., <i>contractor</i>	T33N-36N, R50E-51E		OP		12	Wayne M. Liggett, President 7003 W. Banff Peoria, AZ 85345
	O'Keefe Drilling, <i>contractor</i>	S6,T37N,R50E		EX	rotary drilling	3	Robert E. Chamberlin, General Foreman P.O. Box 3810 Butte, MT 59710
Norse Windfall mine	Norse Windfall Mines Inc.	S2,22,T18N,R53E	gold silver	OP,HL	multiple bench cyanide	56	Jeffrey D. King P.O. Box 326 Eureka, NV 89316
Tonkin Springs	Silver State Mining Corp.	S2-6,T23½N,R49E	gold silver	OP,ML, HL	single bench bio-oxidation cyanide	29	Joseph L. Young P.O. Box 671 Elko, NV 89801
	Welsh Construction Co., <i>contractor</i>	S2,3,T23N,R48.5E		OP	construction	25	P.O. Box 1236 Winnemucca, NV 89445

continued

DIRECTORY OF MINING OPERATIONS (continued)

Mine/plant name	Operator	Location	Commodity	Type	Process/ activity	Employees	Address
HUMBOLDT COUNTY							
Adelaide Crown	Icarus Exploration Co.	S13,24,T34N,R39E; S18-21,T34N,R40E	gold silver	OP	multiple bench cyanidation	2	Gary R. Williams, President P.O. Box 1434 Winnemucca, NV 89445
	Target Construction, Inc., <i>contractor</i>	S13,18,19,24, T34N,R39E		OP	multiple bench	21	Earl Fegert, Vice President 333 Holcomb Avenue, #100 Reno, NV 89502
Bonanza opal mine	G. Keith Hodson	S13,T45N,R25E	opals	OP	single bench	1	G. Keith Hodson, Owner P.O. Box 97 Denio, NV 89404
Cecilie Anne mine	C. George Hewitt	S8,9,T45N,R26E	opals	OP	single bench	1	C. George Hewitt, Owner P.O. Box 33 Denio, NV 89404
Chimney Creek	Gold Fields Mining Corp.	S5-8,T39N,R43E	gold silver	OP,ML, HL	multiple bench grinding cyanide	138	Jim H. Gourdie P.O. Box 69 Golconda, NV 89414
Crofoot mine	Hycroft Resources & Development, Inc.	S24?,T35N,R29E; S19,20?,T35N,R30E	gold	OP,HL	cyanide	120	Roger Leonard P.O. Drawer M Winnemucca, NV 89445
Daisy "M"'s	C. George Hewitt	S24,25,T45N,R26E	opals	OP	single bench	1	C. George Hewitt, Owner P.O. Box 33 Denio, NV 89404
Getchell mine	FirstMiss Gold Inc.	S3,4,T38N,R42E; S33,T39N,R42E	gold silver	OP,ML, HL	multiple bench fluid bed roasting cyanide	47	Q. Allen Neal P.O. Box 220 Golconda, NV 89414
	Brown & Root USA, Inc., <i>contractor</i>	S3,4,T38N,R42E; S32-34,T39N,R42E		OP	multiple bench	15	Larry Kuhlman, Project Manager P.O. Box 1560 Winnemucca, NV 89445
	Crestliners, <i>contractor</i>	S3,4,T38N,R42E; S32-34,T39N,R42E		OP	multiple bench	22	Dick West, Operations Manager P.O. Box 9382 Salt Lake City, UT 84109
	Engineered Structures, Inc., <i>contractor</i>	S3,4,T38N,R42E; S32-34,T39N,R42E		OP	multiple bench	10	Richard W. Slama, Project Superintendent P.O. Box 1608 Winnemucca, NV 89445
	Stebbins Engineering & Manufacturing Co., <i>contractor</i>	S3,4,T38N,R42E; S32-34,T39N,R42E		OP	construction	50	A. I. Calligaris, President, CEO P.O. Box 129 Golconda, NV 89414
	The Industrial Co., <i>contractor</i>	S3,4,T38N,R42E; S32-34,T39N,R42E		OP	multiple bench	50	Ken Dean, Project Superintendent P.O. Box 1880 Winnemucca, NV 89445
	Welsh Construction Co., <i>contractor</i>	S3,4,T38N,R42E; S32-34,T39N,R42E		OP	multiple bench	25	P.O. Box 1236 Winnemucca, NV 89445
	Western Central Concrete, <i>contractor</i>	S3,4,T38N,R42E; S32-34,T39N,R42E		OP	construction	2	Ken Dean, Project Superintendent P.O. Box 2528 Hawthorne, NV 89415
	Marlon H. Thompson	S28,T34N,R40E	gold	OP	single bench gravity	5	Marlon H. Thompson, Owner/Operator 1930 Mizpah Winnemucca, NV 89445
Golden Sands project	Bronco Minerals, Inc.	S25,26,30,31,36, T37N,R31E	gold	OP,ML	single bench gravity	4	Donald Holder, President P.O. Box 1885 Winnemucca, NV 89445
	Hydromet, Inc., <i>lessee</i>	S25,26,30,31,36, T37N,R31E		OP	single bench	4	Donald Holder, President P.O. Box 1885 Winnemucca, NV 89445
	Micon, Inc., <i>contractor</i>	S25,26,30,31,36, T37N,R31E		OP,ML	single bench gravity	10	John Rice & Gene Pridemore, Managers P.O. Box 1940 Winnemucca, NV 89445

DIRECTORY OF MINING OPERATIONS (continued)

Mine/plant name	Operator	Location	Commodity	Type	Process/ activity	Employees	Address
HUMBOLDT COUNTY (continued)							
Jumbo mine	Jumbo Mining Co.	S33,36,T40N,R35E	gold silver	OP,UG, HL	single bench cyanide	5	E. B. King P.O. Box 1171 Winnemucca, NV 89445
	Elquist Mining Company, Inc., <i>contractor</i>	S33,36,T40N,R35E		OP,ML	single bench screening	5	Jim Elquist & Larry Elquist, Owners P.O. Box 488 Battle Mountain, NV 89820
Kelley mine	C. George Hewitt	S30,T45N,R26E	opals	OP	single bench	1	C. George Hewitt, Owner P.O. Box 33 Denio, NV 89404
Lewis mine	Hycroft Lewis Mine, Inc.	S8,17-20, T35N,R30E	gold silver	OP,HL	multiple bench cyanide	60	Roger Leonard P.O. Drawer M Winnemucca, NV 89445
Marigold mine	Marigold Mining Co.	S8,T33N,R43E	gold	OP,ML, HL	development multiple bench cyanide	36	Art Schwandt, General Manager P.O. Box 1608 Winnemucca, NV 89445
	Engineered Structures, Inc., <i>contractor</i>	S8,T33N,R43E		OP,ML, HL	multiple bench	45	Art Schwandt, General Manager P.O. Box 1608 Winnemucca, NV 89445
McDermitt mine	McDermitt Mine Joint Venture	S27,28,33,34, T47N,R37E	mercury	OP,ML	multiple bench flotation retorting	23	Randy Powell P.O. Box 497 McDermitt, NV 89421
Pinson mine	Pinson Mining Co.	S28,29,32,33, T38N,R42E	gold	OP,ML, HL	multiple bench cyanide grinding	130	H. D. Harper P.O. Box 192 Winnemucca, NV 89445
Preble mine	Pinson Mining Co.	S17,18,T36N,R41E	gold	OP,HL	cyanide	15	H. D. Harper P.O. Box 192 Winnemucca, NV 89445
Rainbow Ridge & Bonanza mines	Rainbow Ridge Opal Mines, Inc.	S6,7,22,23, T45N,R26E	opals	OP,UG	multiple bench	2	G. Keith Hodson P.O. Box 97 Denio, NV 89404
Royal Peacock opal mine	Royal Peacock Opal Mines, Inc.	S18,19,20, T45N,R26E	opals	OS	hand digging	2	Walter Wilson 10 Virgin Valley Rd. P.O. Box 55 Denio, NV 89404
Royal Peacock #2 opal mine	Royal Peacock Opal Mine, Inc.	S19,T45N,R26E	opals	OP	single bench	2	Harry Wilson, President P.O. Box 36 Denio, NV 89404
Sleeper mine	Nevada Gold Mining Inc.	S16,17,20,21, T40N,R35E	gold silver	OP,ML, HL	multiple bench cyanide gravity grinding	155	Lawrence Hansen P.O. Box 1820 Winnemucca, NV 89445
	Gilbert Western Corp., <i>contractor</i>	S16,17,20,21, T40N,R35E		OP	multiple bench	57	Rance Hinnewinkel, Project Manager Star Route Lovelock, NV 89419
	The Industrial Co. of Steamboat Spgs., <i>contractor</i>	S16,17,20,21, T40N,R35E		ML	construction	30	Ray Dix, Project Manager P.O. Box 366 Winnemucca, NV 89445
LANDER COUNTY							
Argenta mine and mill	Milpark Drilling Fluids	S6,19,T32N,R47E	barite	OP	gravity grinding	27	Keith S. Olson, Manager of Nevada Operations P.O. Box 277 Battle Mountain, NV 89820
Austin gold venture	Western Gold Exp. and Mining Co.	S27,36,T18N,R43E	gold	OP,ML	multiple bench flotation cyanide	50	R. A. Prescott P.O. Box 502 Austin, NV 89310
	Morrison-Knudsen Co., Inc., <i>contractor</i>	S36,T18N,R43E		OP	multiple bench construction	29	Duane E. Eubanks, Mine Manager P.O. Box 503 Austin, NV 89310

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DIRECTORY OF MINING OPERATIONS (continued)

Mine/plant name	Operator	Location	Commodity	Type	Process/ activity	Employees	Address
LANDER COUNTY (continued)							
Battle Mountain grinding plant	M-I Drilling Fluids Co.	S18,T32N,R45E	barite	ML	gravity grinding	16	Garry Thielen, Nevada Operations Manager P.O. Box 370 Battle Mountain, NV 89820
Buffalo Valley mine	Horizon Gold Shares, Inc. (Buffalo Valley venture)	S33,34,T32N,R42E	gold	OP,HL	single bench cyanidation	62	John E. Watson, President P.O. Box 358 Valmy, NV 89438
Canyon Placer	Battle Mountain Gold Co.	S4,T30N,R43E	gold	PL		15	R. H. DePoali, Operations Manager P.O. Box 1627 Battle Mountain, NV 89820
Cortez gold mines	Placer Dome U.S. Inc.	S24,T27N,R47E	gold silver	OP,ML, HL	multiple bench cyanide grinding	135	A. L. Crandell
Fortitude mill	Battle Mountain Gold Co.	S23,24,T31N,R43E	gold silver copper	ML	cyanidation flotation grinding gravity	185	R. H. DePoali, Operations Manager P.O. Box 1627 Battle Mountain, NV 89820
Fortitude/Surprise	Battle Mountain Gold Co.	S21,22,T31N,R43E; S28,T32N,R44E	gold silver copper	OP,HL	cyanide flotation gravity grinding	371	R. H. DePoali, Operations Manager P.O. Box 1627 Battle Mountain, NV 89820
Kingston mine and mill	Nevada Goldfields Inc.	S27,T16N,R43E; S5,6,T15N,R44E	gold silver	UG,ML	carbon-in-leach drifting	110	Jeffrey Earnshaw Kingston Box 119 Austin, NV 89310
McCoy/Cove mine	Echo Bay Minerals Co.	S1,2,11,T28N,R42E; S36,T28N,R43E	gold silver	OP,ML, HL	cyanide	305	David C. Naccarati P.O. Box 1658 Battle Mountain, NV 89820
	Davy McKee Corp., <i>contractor</i>	S2,T28N,R42E		ML	plant construction	34	Tom Turk, Project Manager P.O. Box 400 Battle Mountain, NV 89820
	Neilsons, Inc., <i>subcontractor</i>	S2,T28N,R42E		ML	plant construction	200	Clyde Rule, Project Manager P.O. Box 385 Battle Mountain, NV 89820
	Plateau Electrical Contractors, Inc., <i>subcontractor</i>	S2,T28N,R42E		ML	plant construction	40	Tom A. Martinez, President P.O. Box 836 Battle Mountain, NV 89820
	Dynatec Mining Corp., <i>contractor</i>	S1,2,11,T28N,R42E		UG	drifting	18	Alan R. Walsh, President 12567 West Cedar Drive, Suite 100 Lakewood, CO 80228
	W. S. Hatch Co., <i>contractor</i>	S2,T28N,R42E		OP	trucking	20	Ken Kelley, President General Delivery Austin, NV 89310
Robertson project	Coral Resources, Inc.	S12,13,24,25, T28N,R46E; S3-10,16-21, T28N,R47E	gold	OP,HL	cyanide multiple bench	7	David C. Arnold P.O. Box 8 Crescent Valley, NV 89821
	Vaughn Construction, <i>contractor</i>	S8,T28N,R47E		OP,HL	multiple bench	18	Otis Vaughn, President P.O. Box 679 Fernley, NV 89408
Thomas "W" mine	New Pass Resources, Inc.	S9,T20N,R40E	gold silver	UG		2	Don Jung, Manager P.O. Box 69 Austin, NV 89310
Toiyabe mine	Inland Gold & Silver Corp.	S5,6,T25N,R47E; S31,32,T26N,R47E	gold silver	OP,HL	cyanide	60	Larry Simpson N.A. Degerstrom, Inc. P.O. Box 29 Crescent Valley, NV 89821

DIRECTORY OF MINING OPERATIONS (continued)

Mine/plant name	Operator	Location	Commodity	Type	Process/ activity	Employees	Address
LINCOLN COUNTY							
Delamar perlite plant	Wilkin Mining & Trucking Co.	S7,T4S,R67E	perlite	ML	crushing expansion	7	Joseph D. Wilkin, Owner P.O. Box 472 Panaca, NV 89042
Mackie perlite mine	Wilkin Mining & Trucking Co.	S11,T5S,R62E	perlite	UG	room pillar	3	Joseph D. Wilkin, Owner P.O. Box 472 Panaca, NV 89042
LYON COUNTY							
Adams mine	Art Wilson Co.	S25,T16N,R20E	gypsum	OP,ML	multiple bench grinding screening	44	Art Wilson P.O. Box 1160 Carson City, NV 89702
Anderson pit & mill	Eagle Valley Construction Co.	S23,T16N,R21E	sand gravel gold	OP,ML	multiple bench crushing screening	12	Robert O. Foster P.O. Box 193 Dayton, NV 89403
Haywood Santiago plant	CR Minerals Corp.	S18,T16N,R21E	gold silver	HL	cyanide	24	Allen P. Vogel 13 Affonso Dr. #J-15 Carson City, NV 89706
Hazen pit - Clark	Eagle-Picher Minerals, Inc.	S8,17,T18N,R25E	diatomite	OP	single bench	2	Jack P. Richards P.O. Box 10480 Reno, NV 89510
Limestone mine	Nevada Cement Co.	S4,6,19,25, T19N,R25E	limestone	OP	multiple bench	3	David Dalton, President P.O. Box 840 Fernley, NV 89408
Nevada Cement plant	Nevada Cement Co.	S2,3,10,11,36, T20N,R24E; S31-33,T20N,R25E	cement	ML	rotary kiln	150	D. L. Dalton P.O. Box 840 Fernley, NV 89408
Tuttle mine	Tuttle's Golden Minerals	S20,21,29, T7N,R27E	montmorillonite	OP	single bench screening	2	James B. Tuttle, Owner P.O. Box 519 Hawthorne, NV 89415
MINERAL COUNTY							
Aurora mine	Nevada Goldfields, Inc.	S17,18,T5N,R28E	gold silver	OP,UG, ML	multiple bench	42	R. Dye, Mine Manager P.O. Box 3070 Hawthorne, NV 89415
Aurora mine (#2)	The Aurora Partnership	S17,T5N,R28E	gold	OP,HL	multiple bench cyanide	20	J. Burt, Manager P.O. Box 1628 Hawthorne, NV 89415
	Target Construction, Inc., <i>contractor</i>	S17,T5N,R28E		OP	multiple bench	14	Earl Fegert, General Manager 333 Holcomb Avenue, #100 Reno, NV 89502
Borealis mine	Echo Bay Mines Co.	S17,18,T6N,R29E	gold silver mercury	OP,HL	multiple bench cyanide	48	Greg Earle P.O. Box 2310 Hawthorne, NV 89415
	Las Vegas Paving Corp., <i>contractor</i>	S16,17,T6N,R29E		OP	construction	10	Robert Mendenhall, President 1770 Industrial Las Vegas, NV 89030
	Lost Dutchman Construction, Inc. <i>contractor</i>	S16,17,T6N,R29E		OP	multiple bench	25	J. R. Barkley, President P.O. Box 1538 Hawthorne, NV 89415

continued

DIRECTORY OF MINING OPERATIONS (continued)

Mine/plant name	Operator	Location	Commodity	Type	Process/ activity	Employees	Address
MINERAL COUNTY (continued)							
Candelaria mine	NERCO Metals, Inc.	S27,28,33-35, T4N,R35E; S2-5,T3N,R35E	gold silver	OP,HL	multiple bench cyanide crushing screening	197	Ralph L. Van Arsdale P.O. Box 1240 Hawthorne, NV 89415
	J. Wise Corp., <i>contractor</i>	S3,4,T3N,R35E; S33,T4N,R35E	gold silver	OP	drilling	3	W. L. Weisenburger, Secretary/Treasurer P.O. Box 2290 Hawthorne, NV 89415
	T-4 Drilling Co., <i>contractor</i>	S3,4,T3N,R35E S33,T4N,R35E		OP		3	Stephen R. Schlatter, Owner P.O. Box 188 Hawthorne, NV 89415
Denton-Rawhide mine	Kennecott Explorations (Australia) Ltd.	S4,5,8,9,16,17, T13N,R32E	gold silver	OP,HL	development cyanide	7	Naseem Mian P.O. Box 2490 Fallon, NV 89406
Dream Land mine	Merl Richard	S7,T6N,R35E	gold	UG,ML	cyanide grinding	5	Merl Richard P.O. Box 283 Mina, NV 89422
East Ridge mine	Tenneco Minerals Co.	S16,17,T6N,R29E	gold silver	OP,HL	multiple bench cyanide	24	Dan W. Martin, NV Operations Manager P.O. Box 976 Hawthorne, NV 89415
Eureka mill	Eureka Consolidated	S5,T6N,R35E	gold silver	ML	crushing flotation	18	William Moreland P.O. Box 394 Mina, NV 89422
Santa Fe mine	Corona Gold Inc.	S6,T8N,R35E; S36,T9N,R34E; S31,T9N,R35E	gold silver	OP,HL	multiple bench cyanide	28	Gregory A. Lang P.O. Box 3220 Hawthorne, NV 89415
	Brown & Root USA, Inc., <i>contractor</i>	S31,T9N,R35E		OP	multiple bench	75	Dean Domsten, Project Manager P.O. Box 2570 Hawthorne, NV 89415-2570
	Welsh Construction Co., <i>contractor</i>	S36,T9N,R34E		OP	leach pad construction	22	Robert D. Benbow, General Superintendent P.O. Box 1236 Winnemucca, NV 89445
Spot deposit	N. A. Degerstrom, Inc.	S11,T7N,R36E	gold	OP,HL	single bench cyanide	15	Daryle Peck P.O. Box 185 Mina, NV 89422
NYE COUNTY							
Basic Inc., Nevada Works pit and mill	C-E Refractories, Inc.	S26,34,T12N,R36E	magnesium oxide	OP,ML	calcining dead burning sizing separation	99	Don Pressey P.O. Box 177 Gabbs, NV 89409
Bullfrog mine	Bond Gold Bullfrog Inc.	S15,T12S,R46E	gold	OP,HL	development cyanide grinding	15	Jack Bingham P.O. Box 519 Beatty, NV 89003
	The Industrial Co. of Steamboat Springs, <i>contractor</i>	S15,T12S,R46E		OP	construction	6	Robert Dusbabek, Construction Manager P.O. Box 100 Beatty, NV 89003
Catherine mine	Marshall Earth Resources, Inc.	S1,T12N,R39E	gold silver	UG	drifting	4	Hugh R. Marshall, President Route 1, Box 29A Ione, NV 89310
Cind-R-Lite Co.	Cind-R-Lite Co.	S1,T15S,R49E	cinder	OP	multiple bench gravity	2	E. L. Selman 3333 Cinder Ln Las Vegas, NV 89103

DIRECTORY OF MINING OPERATIONS (continued)

Mine/plant name	Operator	Location	Commodity	Type	Process/ activity	Employees	Address
NYE COUNTY (continued)							
Crowell Fluorspar mine	Crowell Daisy Co.	S23,T12S,R47E	fluorspar	UG	mine-run stoping	3	Jack I. Crowell P.O. Box 96 Beatty, NV 89003
Cyprus Tonopah mine	Cyprus Tonopah Mining Corp.	S5-8,T5N,R42E	molybdenum	OP	development grinding flotation	285	R. C. Kellner P.O. Box 1569 Tonopah, NV 89049
Gold Bar mine	Angst, Inc.	S36,T11S,R45E	gold	OP,HL	multiple bench cyanide	48	Joseph M. Zaccaria P.O. Box 1030 Beatty, NV 89003
Grantsville mine	Fury Exploration of Nevada, Inc.	S2,3,11, T11N,R39E	gold silver	OP,HL	cyanide	10	Bill Caughlin, Project Manager P.O. Box 2367 Fallon, NV 89406
IMV mine and plant	Industrial Mineral Ventures	S29,T17S,R49E	sepiolite saponite hectorite bentonite	OP,ML	single bench grinding processing	51	Thomas W. Powell 2030 E Flamingo Rd Suite 100 Las Vegas, NV 89119
lone placer, primary	Marshall Earth Resources, Inc.	S28,T13N,R39E	gold	ML	screening washing	6	Hugh R. Marshall, President Route 1, Box 29A lone, NV 89310
Lathrop mill	American Borate Co.	S36,T17S,R49E	calcium borate	ML	flotation calcination	30	Darrell Cypert Star Route 15 Box 610 Amargosa Valley, NV 89020
Manhattan mine	Echo Bay Minerals Co.	S19,20,29,30, T8N,R44E	gold	OP,ML	gravity flotation cyanidation	60	Clare A. Moore P.O. Box 56 Manhattan, NV 89022
	Delta Fire Systems, <i>contractor</i>	S20,T8N,R44E		ML		2	William Morrison, President 27 Glen Carren Circle Sparks, NV 89431
	Gibbons & Reed Co., <i>contractor</i>	S20,T8N,R44E		ML	construction	30	Jack Huff, Project Manager P.O. Box 3210 Tonopah, NV 89409
	Sundt Corp., <i>contractor</i>	S20,T8N,R44E		OP	construction	15	Fred Witzens, Project Superintendent P.O. Box 56 Manhattan, NV 89022
	T.C.C., <i>contractor</i>	S20,T8N,R44E		ML	construction	20	Gary Krueger, Project Manager 3702 S. West Temple Salt Lake City, UT 84115
New Discovery mine and mill	Vanderbilt Minerals Corp.	S13-24,T12S,R46E; S18,19,T12S,R47E	clay	UG,ML	grinding stoping	9	J. W. Lease P.O. Box 398 Beatty, NV 89003
Northumberland mine	Western States Minerals	S24,T13N,R45E	gold silver	OP,HL	multiple bench cyanide	60	Gaylen Cropper P.O. Box 109 Kingston Village Austin, NV 89310
P & S barite mine	The Standard Magnesia Co.	S11,14,15, T13N,R45E; S26,T19N,R28E	barite	OP,ML	flotation	10	Sergio M. Jaramillo P.O. Box 10477 Reno, NV 89510
Paradise Peak mine	FMC Gold Co.	S7,12,13,24, T10N,R36E; S3-22,T10N,R35E	gold silver mercury	OP,ML, HL	grinding cyanide merrill crowe retorting	201	David J. Collins P.O. Box 1237 Hawthorne, NV 89415

continued

DIRECTORY OF MINING OPERATIONS (continued)

Mine/plant name	Operator	Location	Commodity	Type	Process/ activity	Employees	Address
NYE COUNTY (continued)							
Round Mountain gold mine	Round Mountain Gold Corp.	S19,20,29,30, T10N,R44E; S12,24,25,36, T10N,R43E	gold silver	OP,HL, ML	multiple bench cyanide	511	Andre J. Douchane P.O. Box 480 Round Mountain, NV 89045
	Gibbons & Reed Co., <i>contractor</i>	S19,T10N,R44E		ML	construction	30	Jack Huff, Superintendent P.O. Box 369 Round Mountain, NV 89045
	Humboldt Ready Mix, Inc., <i>contractor</i>	S19,T10N,R44E		OS	crushing screening	4	T. G. Sheppard, President 605 W. Haskel Street Winnemucca, NV 89445
	The Industrial Co. of Steamboat Springs, <i>contractor</i>	S19,T10N,R44E		ML	construction	81	Cal Brown, Project Superintendent P.O. Box 449 Round Mountain, NV 89045
	Utah Construction & Development, <i>contractor</i>	S19,T10N,R44E		ML	construction	8	Lloyd Grenshaw, Construction Superintendent P.O. Box 230 Round Mountain, NV 89045
Shamrock Tunnel #2	Marshall Earth Resources, Inc.	S3,T12N,R39E	gold silver	UG		2	Hugh R. Marshall, President Route 1, Box 29A Lone, NV 89310
Sterling mine	Sterling Mine Joint Venture	S6,T13S,R48E	gold silver	UG,ML, HL	drifting cyanide	21	Greg Austin, President (Saga Exploration Co.) P.O. Box 187 Beatty, NV 89003
Stonewall mine	Marshall Earth Resources, Inc.	S2,T12N,R39E	gold silver	UG,ML	drifting	26	Hugh R. Marshall, President Route 1, Box 29A Lone, NV 89310
Sullivan mine	Cuervo Gold Inc.	S29,32,T11N,R36E	gold	OP,HL	cyanide	12	Pat Doherty P.O. Box 146 Gabbs, NV 89409
Zeolite mill	East West Minerals, Inc.	S1,T18S,R51E	zeolite	ML		4	Gordon Presley, Vice President Star Route 15, Box 7006 Armagosa, NV 89020

PERSHING COUNTY

American Antimony mine	American Antimony	S28,T26N,R34E	antimony	ML	gravity	2	Frank Caldon & Roy Jones, Owners P.O. Box 1148 Lovelock, NV 89419
Buff 1-13	Vanderbilt Minerals Corp.	S2,T27N,R32E	clay	OP	grinding	9	J. W. Lease P.O. Box 398 Beatty, NV 89003
Colado mine	Eagle-Picher Minerals, Inc.	S8,T28N,R29E	diatomite	OP	multiple bench	22	Massoud M. Moezzi P.O. Box 959 Lovelock, NV 89419
Colado plant	Eagle-Picher Minerals, Inc.	S6,T27N,R32E	diatomite	OP	crushing drying classifying calcination	101	Robert N. Maher Drawer "A" Lovelock, NV 89419
Dusty mine	Dusty Mining Co.	S24,T32N,R31E; S20,30,T32N,R32E	gold	OP	single bench gravity	3	Ed Speir P.O. Box 1149 Lovelock, NV 89419
Empire mine	United States Gypsum Co.	S36,T31N,R24E	gypsum	OP	multiple bench grinding calcination	65	Michael D. Phillips P.O. Box 130 Empire, NV 89405
Florida Canyon mine	Pegasus Gold Corp.	S1-3,11,12, T31N,R33E	gold silver	OP,HL	multiple bench cyanide	72	John Rice P.O. Box 330 Imlay, NV 89418
	N. A. Degerstrom, Inc., <i>contractor</i>	S2,T31N,R33E		OP	multiple bench	53	James J. Wolfe, Superintendent P.O. Box 1150 Lovelock, NV 89419

DIRECTORY OF MINING OPERATIONS (continued)

Mine/plant name	Operator	Location	Commodity	Type	Process/ activity	Employees	Address
PERSHING COUNTY (continued)							
Imlay Canyon mine	T & T Mining	S31,T32N,R34E	gold	OP,ML	gravity	3	J. A. Thornhill and G. C. Thompson, Partners P.O. Box 111 Imlay, NV 89418
Pershing mine	A & G Mining Co.	S9,T26N,R34E	gold	OP,HL	single bench cyanide	2	Phillip Geertson, Owner Route 2, Box 29 Adrian, OR 97901
Relief Canyon mine	Pegasus Gold Corp.	S16-18,20,21, T27N,R34E	gold silver	OP,HL	multiple bench cyanide	26	John Rice P.O. Box 330 Imlay, NV 89418
	Morrison-Knudsen Co., Inc., <i>contractor</i>	S16,T27N,R34E		OP	multiple bench	56	John O'Laughlin, Project Manager P.O. Box H Lovelock, NV 89419
	N. A. Degerstrom, Inc., <i>contractor</i>	S16,T27N,R34E		ML	crushing	10	Robert Wallin, Area Manager P.O. Box 1150 Lovelock, NV 89419
Rochester mine	Coeur-Rochester, Inc.	S15,16,21,22, T28N,R34E	silver gold	OP,HL	cyanide	309	Robert Martinez, General Manager P.O. Box 1057 Lovelock, NV 89419
Saundra Lee & Phase II mines	Michael Benickie	S18,T32N,R32E	gold silver	OP,ML	single bench gravity	1	Michael Benickie, Owner/Operator 5444 Woods Drive Sparks, NV 89431
Sexton mine and mill	Nutritional Additives Corp.	S5,8,T34N,R38E	dolomite	OP	single bench grinding	4	W. Glen Sexton P.O. Box 802 Winnemucca, NV 89445
Trinity silver mine	U.S. Borax & Chemical Corp.	S3,T29N,R30E	silver gold	OP,HL	single bench cyanide	26	Richard C. Jensen Drawer L Lovelock, NV 89419
	Iron King Assay, Inc., <i>contractor</i>	S9,T29N,R30E		ML	crushing	4	Robert G. Crook, President Drawer L Lovelock, NV 89419
	Lost Dutchman Construction, <i>contractor</i>	S9,T29N,R30E		OP,ML	single bench crushing screening	25	Greg Stach, Project Superintendent P.O. Box 158 Lovelock, NV 89419
STOREY COUNTY							
Clark mill	Eagle-Picher Minerals, Inc.	S35,T20N,R22E	diatomite	ML	crushing drying classifying calcination	50	Jack P. Richards P.O. Box 10480 Reno, NV 89510
Clark mine	Eagle-Picher Minerals, Inc.	S28,33,34, T20N,R23E	diatomite	OP	multiple bench	9	Jack P. Richards P.O. Box 10480 Reno, NV 89510
Gooseberry mine	Asamera Minerals (U.S.) Inc.	S25,T19N,R22E	silver gold	UG,ML, HL	flotation cyanide	29	Rick Karlson 6121 Lakeside Drive Suite 130 Reno, NV 89511
WASHOE COUNTY							
Clay mine	Art Wilson Co.	S13,T27N,R19E	halloysite	OP	single bench	4	Art Wilson, Owner/Operator P.O. Box 1160 Carson City, NV 89702
Empire mill	United States Gypsum Co.	S11,T31N,R23E	gypsum board	ML	grinding calcination	65	Michael D. Phillips P.O. Box 130 Empire, NV 89405
Green Hill mine	Cliff Resources, Inc.	S20,29,30,32, T21N,R23E	gold silver	PL,ML	single bench gravity	35	James MacKay P.O. Box 549 Fernley, NV 89408
Hog Ranch mine	Western Hog Ranch Co.	S24,T38N,R22E	gold	OP,HL	multiple bench cyanide	62	Dan W. Martin, President Mine Site Box 9 Gerlach, NV 89412
	Ledcor Construction, Inc., <i>contractor</i>	S24,T38N,R22E		OP,ML	multiple bench crushing screening	70	Don Hall, Project Supervisor P.O. Box 138 Gerlach, NV 89412

continued

DIRECTORY OF MINING OPERATIONS (continued)

Mine/plant name	Operator	Location	Commodity	Type	Process/ activity	Employees	Address
WHITE PINE COUNTY							
Alligator Ridge mine	NERCO Minerals	S22-26,35,36, T22N,R57E	gold silver	OP,ML, HL	CIL circuit cyanide	130	Tom DeMull P.O. Box 146 Ely, NV 89301
Bald Mountain mine	Placer Dome U.S. Inc.	S16,17,18, T24N,R57E	gold silver	OP,HL	multiple bench cyanide	151	A. L. Walsh, Mine Manager P.O. Box 2706 Eiko, NV 89801
	Brown & Root USA, Inc., <i>contractor</i>	S16,17,18, T24N,R57E		OP	multiple bench	41	Ken Snyder, Project Manager P.O. Box 1200 Ely, NV 89301
	Pollocks Drilling, <i>contractor</i>	S16,17,18, T24N,R57E		EX	rotary drilling	5	Oren Pollock, Owner P.O. Box 123 Ely, NV 89301
Golden Butte	Alta Bay Venture	S2,3,T23N,R61E	gold	OP,HL	development cyanide	50	Joseph A. Pescio P.O. Box 324 East Ely, NV 89315
Golden Eagle mine	Terra Mining & Processing, Inc.	S26,T14N,R67E	gold	OP,ML	single bench gravity	10	Dell Fox, Superintendent 842 Avenue "F" Ely, NV 89301
Green Springs mine	USMX, Inc.	S28,T15N,R57E	gold silver	OP,HL	multiple bench cyanide	56	Paul Valenti P.O. Box 809 Ely, NV 89301
	Bodell-Wheelwright Construction, Inc., <i>contractor</i>	S28,T15N,R57E		ML	construction	8	Kent Wheelwright, President P.O. Box 577 Ely, NV 89301
	Lost Dutchman Construction, Inc., <i>contractor</i>	S28,T15N,R57E		OP	multiple bench	31	Kim Gash, Superintendent P.O. Box 328 Ely, NV 89301
Illipah mine	Alta Gold Co.	S3-5,T18N,R58E	gold	OP,HL	multiple bench cyanide	36	Mike Iannacchione P.O. Box 120 Ely, NV 89301
	W. E. Vining Co., <i>contractor</i>	S4,T18N,R58E		OP	multiple bench	20	W. E. Vining, President P.O. Box 2499 Carson City, NV 89702
Little Bald Mountain mine	Northern Dynasty Mines (US) Inc.	S26,27,T24N,R57E	gold silver	UG,HL	cyanide	15	Ronald D. Damele P.O. Box 314 Eureka, NV 89316
Osceola mine & mill	Robert Ostlund	S2,T14N,R67E	gold	OP,ML	single bench gravity	2	Robert Ostlund, Owner Baker Stage Route Ely, NV 89301
Robinson project	Alta Bay Venture	S10,11,15, T16N,R62E	gold	OP,ML, HL	CIP mill cyanide	188	Gary Cummings P.O. Box 324 East Ely, NV 89315
White Pine gold mine	White Pine Gold Mining Co.	S1,T24N,R57E; S6,T24N,R58E; S36,T25N,R57E; S31,T25N,R58E	gold silver	OP,HL	cyanide	32	Doug Jensen P.O. Box 305 Ely, NV 89315
	Gilbert Western Corp., <i>contractor</i>	S36,T25N,R57E		OP,HL		40	Val Hanni, Project Superintendent P.O. Box 908 Ely, NV 89301

Oil and Gas

by Becky Weimer Purkey



Chadco, Inc. Zuspahn No. 24-3, Trap Spring Field, Nye County. Nevada Department of Minerals photo.

During 1988, 16 wells totaling 99,456 feet were drilled in the search for oil and gas in Nevada. This footage is a 4 percent increase from 94,296 feet drilled in 1987. The average depth of the wells drilled was 6,216 feet, an increase from the average depth of 5,547 feet in 1987. On the average, two drill rigs were active at any given time in Nevada throughout 1988.

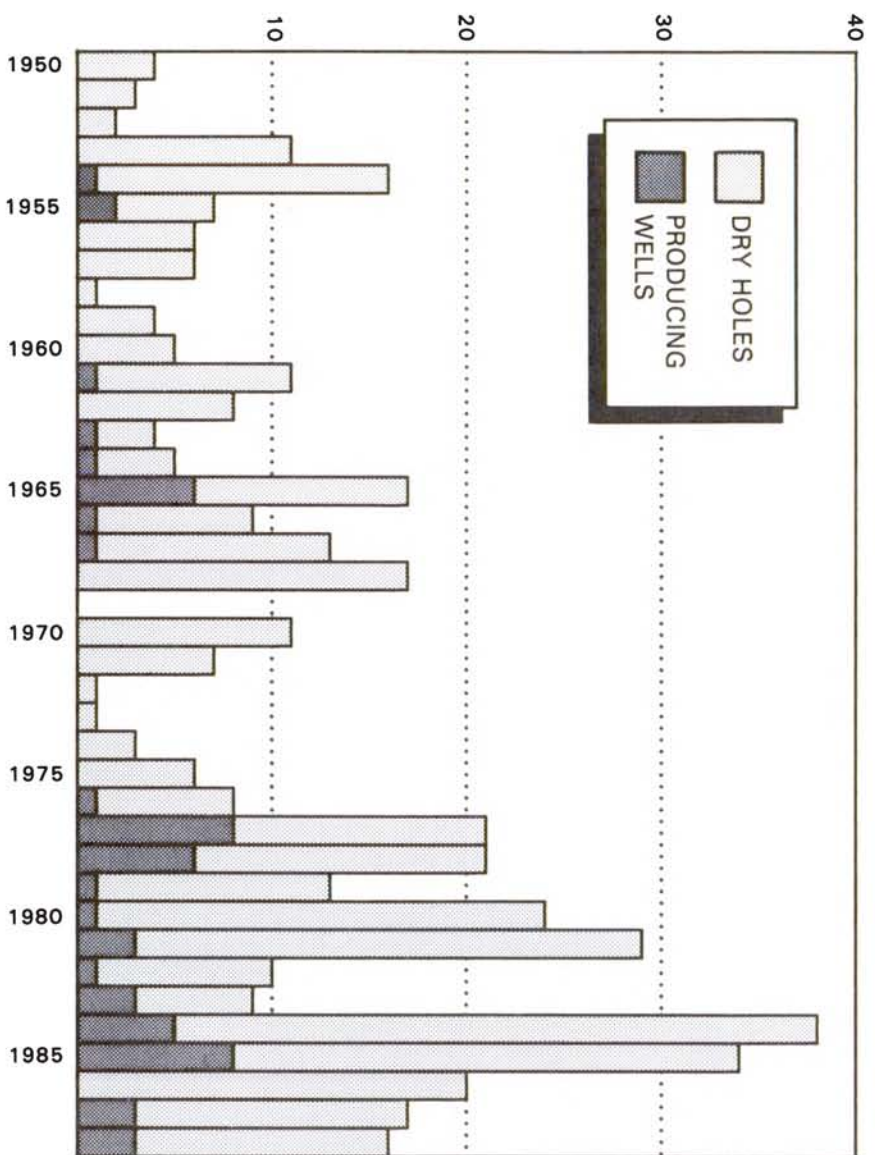
In the Rocky Mountain region, the momentum created by relatively high crude oil prices in the fourth quarter of 1987 carried over into the first six months of 1988 in terms of rig employment and well completions, up nearly 30 percent from the same period in 1987.

As part of phase one of its Piñon Area Development Contract, **Exxon Corp.** completed the **Aspen Unit No. 1** (SE¼NE¼ sec. 21, T28N, R54E) to 12,281 feet, making it the deepest well drilled in Nevada in 1988. The drill site is in Huntington Valley in Elko County, about 14 miles east-northeast of the

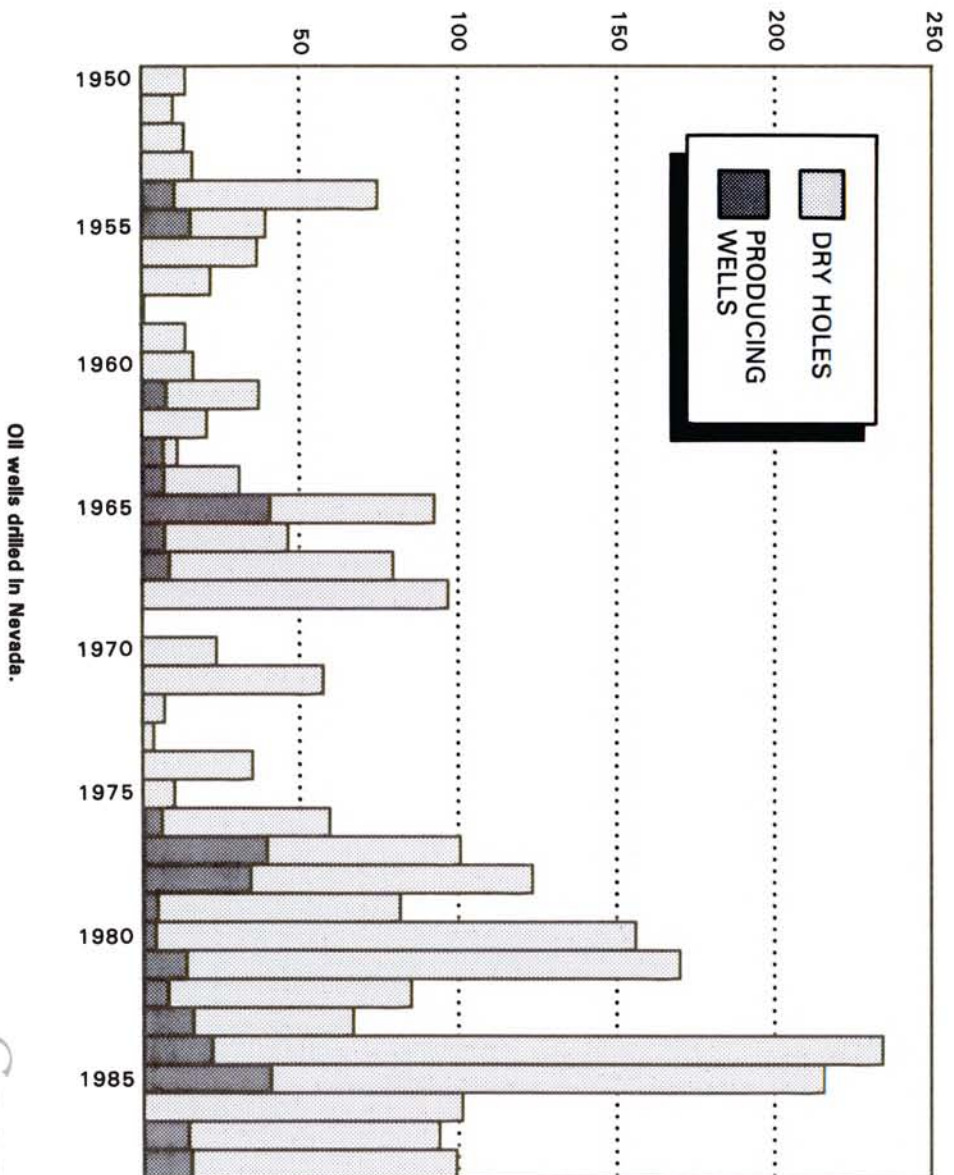
Blackburn field in Pine Valley (Eureka County). Oil shows were recorded in sandstones from 630 to 680 feet and intermittently from 1,270 to 2,110 feet in the Diamond Peak Formation.

The majority of wells drilled in 1988 had shows. The **Amerind Oil Co. Hanks No. 1** well in SE¼SW¼ sec. 2, T8N, R57E in Nye County recovered traces of oil from Paleozoic carbonates during swabbing between 4,370 and 4,450 feet. Oil shows on limestone were noted at various intervals from 4,450 to 4,665 feet. The well was drilled to a total depth of 4,665 feet. Palynological analyses indicated the samples from 4,370 to 4,450 feet to be uppermost Devonian Guilmette Formation. This well was drilled as an offset to the Kate Spring field in Railroad Valley. Marathon's Kate Spring No. 1 discovery well (sec. 2, T8N, R57E) was completed in January 1986, producing heavy oil from the Pennsylvanian Ely Limestone between 4,722 and 4,824 feet. In late 1987 David M. Evans completed the Taylor No. 1

NUMBER OF WELLS DRILLED



FOOTAGE DRILLED, IN THOUSANDS OF FEET



Oil wells drilled in Nevada.

well, a west offset to Kate Spring No. 1, and it is producing oil from the Guilmette at 4,623 to 4,643 feet.

The **Pennzoil Exploration & Production Co. Abel Spring Unit No. 41-4** in NW¼NE¼NE¼ sec. 4, T5N, R55E in Nye County recorded live oil in samples of Guilmette dolomite at 4,460 feet.

The **Foreland Corp. Southern Pacific Land Co. No. 2-27** well in Eureka County (NE¼SE¼ sec. 27, T29N, R52E) was drilled as an east offset to the North Willow Creek field discovery in Pine Valley, primarily to evaluate Devonian carbonates that were not reached at that new field's discovery well. Oil shows were encountered in the No. 2-27 well at various intervals from 4,523 to 6,900 feet.

At the **Texaco Producing, Inc. T.P.I. Jake's Valley No. 1** well (now converted to a water well operated by Gardner Ranches, Inc.) in NE¼NE¼ sec. 18, T16N, R60E in White Pine County, oil stains were encountered on various lithologies at numerous intervals from 3,375 to 7,600 feet. This well site is only 13 miles south-southeast of the deep Blair Exploration White Pine Fed. No. 1 dry hole completed to 11,090 feet in 1987. The Blair well recorded traces of oil from 3,350 to 4,480 feet and from 5,200 to 7,700 feet.

Tarry oil stains were noted in conglomerates in the **BTA Oil Producers Railroad JV-P No. 1** well at 5,890 to 5,980 and 6,420 to 6,440 feet. This well, located in SE¼NE¼SE¼ sec. 18, T7N, R57E in Nye County, was drilled as a northwest offset to the Bacon Flat field discovery well.

Oil stains were recorded from 3,710 to 3,750 feet in the Oligocene tuff of Pritchards Station in the **Diversified Operating Co. Playa No. 1** well in NE¼SW¼ sec. 3, T8N, R56E in Nye County. The Playa No. 1 location is about 1½ miles south of the Trap Spring field.

Diversified Operating Co. also drilled the **Soda Springs No. 1-A** well (SW¼SE¼ sec. 15, T8N, R57E) in Nye County as a re-entry into the Marathon

Oil Co. Soda Springs No. 1 well. The site is about 2 miles south-southeast of the David M. Evans Taylor Fed. No. 1 producer in the Kate Spring field. Originally, Marathon drilled to a depth of 8,080 feet. A drill-stem test between 7,699 and 7,796 feet recovered oil and gas cut mud with 2,000 cc of oil and 1.0 cubic feet of gas in the sample chamber. Marathon set 7-inch casing to a depth of 8,052 feet and perforated several Paleozoic intervals between 7,130 and 7,765 feet before plugging the wildcat (Petroleum Information, 1-25-88, p. 1). In its redrill of this well, Diversified encountered oil shows at various intervals from 6,860 to 7,730 feet. A drill-stem test run from 7,690 to 7,800 feet recovered 2,100 cc of oil in the sample chamber.

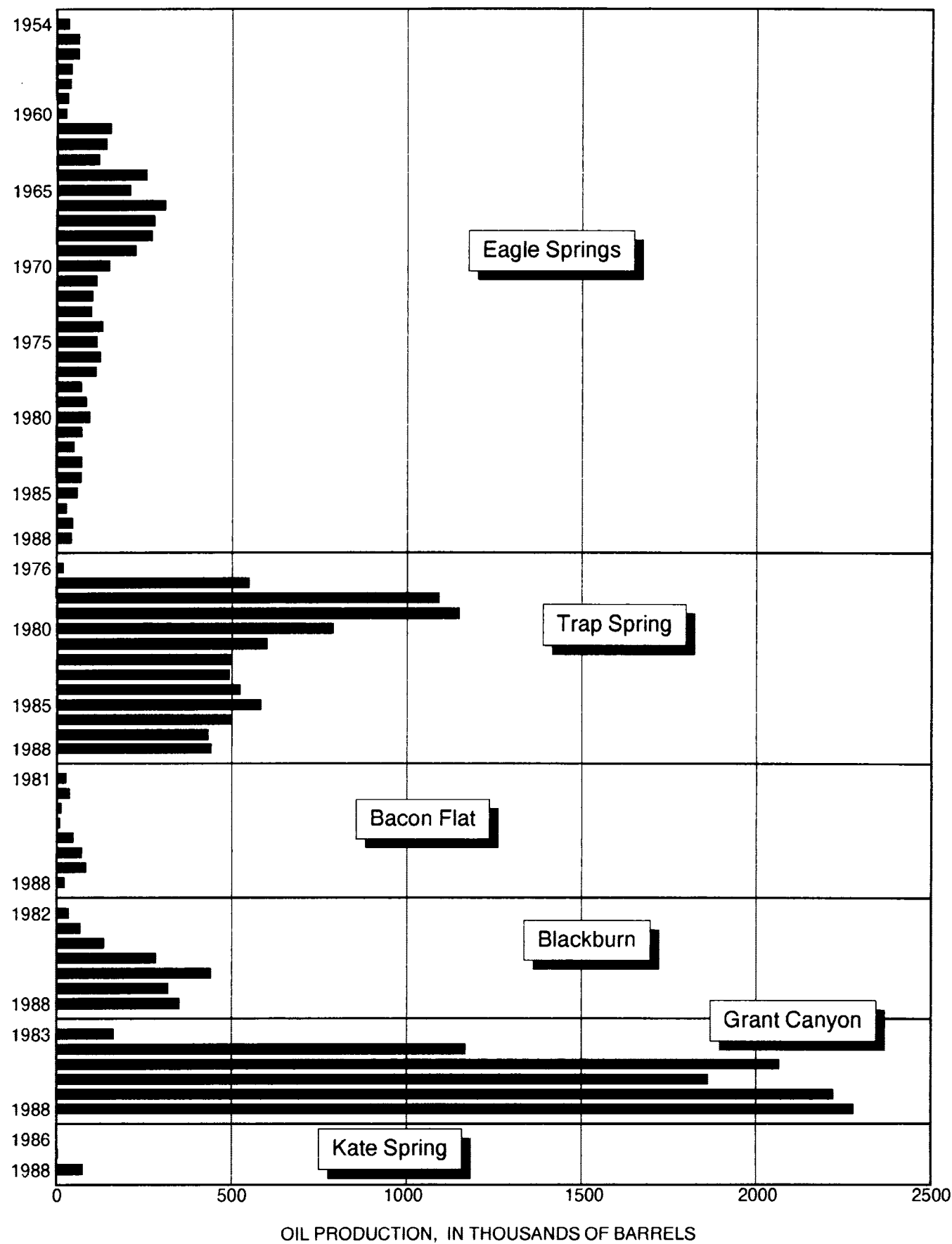
Foreland Corp. drilled the **S.P. Land Co. No. 2-5** well in NW¼NE¼ sec. 5, T30N, R 52E in Eureka County as a west offset to the producing Foreland S. P. Land Co. No. 1-5 well. The producing interval for the No. 1-5 well is in the Oligocene Indian Well Formation (tuff) above 1,800 feet, making it the state's shallowest producing well. After crossing a fault and entering into the Chainman Formation, oil shows were encountered in the No. 2-5 well at three intervals between 2,780 to 4,000 feet. Foreland concluded that the well needed to be about 120 to 150 feet to the east to tap productive facies. Extremely carbonaceous shales were encountered in the "oil-producing window" from 3,010 to 3,880 feet. A highly altered and mineralized igneous intrusive was encountered at 3,274 feet, and the drilling was stopped at 4,000 feet after entering the Woodruff Formation (limestone) at 3,879 feet.

The **Foreland Corp. Willow Creek Fed. No. 1-34** wildcat drilled in the NE¼SW¼ sec. 34, T29N, R52E in Eureka County reported oil shows from 7,840 to 8,840 feet in the Chainman Formation. The well was drilled to a depth of 10,100 feet before being plugged.

OIL AND GAS WELLS DRILLED AND COMPLETED DURING 1988

County	Company	Well	Permit no.	Depth (feet)
Clark	Ruby Drilling Co.	Federal No. 36-1	509	119
Elko	Exxon Corp.	Aspen Unit No. 1	505	12,281
Eureka	Foreland Corp.	*Foreland-S.P. Land Co. No. 1-27	503	7,678
Eureka	Foreland Corp.	Foreland-Willow Creek Fed. No. 1-34	493	10,100
Eureka	Foreland Corp.	S.P. Land Co. No. 2-5	512	4,000
Eureka	Foreland Corp.	S.P. Land Co. No. 2-27	517	8,661
Lincoln	Maxus Exploration Co.	Moore-McCormack Fed. No. 6-1	524	7,798
Nye	Pennzoil Explor. & Prod. Co.	Abel Spring Unit No. 41-4	519	5,348
Nye	Marathon Oil Co.	Blue Chip No. 1	510	3,928
Nye	Amerind Oil Co.	Hanks No. 1	520	4,665
Nye	Makoil, Inc.	*Munson Ranch No. 14-32X	522	3,920
Nye	J.R. Bacon Drilling, Inc.	*Munson Ranch No. 14-42	523	3,843
Nye	Diversified Operating Corp.	Playa No. 1	515	5,000
Nye	BTA Oil Producers	Railroad JV-P No. 1	506	6,595
Nye	Diversified Operating Corp.	Soda Springs No. 1-A (15-15)	514	7,800
White Pine	Texaco Producing, Inc.	T.P.I. Jake's Valley No. 1	516	7,720
			Total	99,456

*Producing well



Production of Nevada's major oil fields; production of the Tomera Ranch and North Willow Creek oil fields is too small to show in this figure.

PRODUCTION OF NEVADA'S OIL FIELDS¹
(barrels)

Period	Eagle Springs (1954) ²	Trap Spring (1976)	Currant (1979)	Bacon Flat (1981)	Blackburn (1982)	Grant Canyon (1983)	Kate Spring (1986)	Tomera Ranch (1987)	N. Willow Creek (1988)	Total	Change
thru 1984	3,721,833	5,710,219	641	89,064	238,074	1,331,900	—	—	—	11,091,371	
1985	58,807	582,822	0	47,942	284,013	2,065,747	—	—	—	3,039,564	+ 59%
1986	28,408	498,996	0	72,643	441,163	1,862,784	1,521	—	—	2,905,515	— 4%
1987	45,821	432,690	0	84,156	318,553	2,221,642	5,494	1,032	—	3,109,388	+ 7%
1988	43,451	441,832	0	24,255	351,582	2,280,323	75,725	4,737	9,457	3,231,362	+ 4%
TOTAL	3,898,320	7,666,559	641	318,060	1,633,385	9,762,396	82,740	5,769	9,457	23,377,200	

¹Compiled from Producers' Monthly Reports filed with the Nevada Dept. of Minerals.

²Field discovery date.

OIL PRODUCTION IN NEVADA

The total net production in Nevada in 1988 was 3,231,362 barrels of oil according to the Producers' Monthly Reports filed with the Nevada Department of Minerals. This is a 4 percent increase over 1987 production. There is no commercial production of natural gas in Nevada.

The average net wellhead price for Nevada crude was \$9.00/barrel in 1988. Most of the crude oil produced in the state is transported by tank truck to the **Petro Source Refining Corp.** 8,000-barrel/day **Eagle Springs Refinery** near Currant in Railroad Valley. No. 1 and no. 2 diesel, kerosene, stove oil, asphalt, bottom oil, and naphtha are the major products of the refinery and are marketed in 11 western states. The remainder of Nevada crude oil is refined at Crysen Refining in Salt Lake City, Utah.

Early in 1989 Petro Source Refining Corp. built Nevada's first asphalt processing unit at their Eagle Springs Refinery. At the same time **Petro Source Refining Partners** purchased Nevada's only other existing petroleum refinery, the **Tonopah Refinery** operated by **Nevada Refining Co.**, for use as a storage facility for the processed asphalt. The Tonopah facility has been renamed the **Petro Source Refinery**, and is Nevada's first instate source of asphalt.

The fields within Railroad Valley in Nye County continue to account for more than 89 percent of the state's total crude oil output. The **Grant Canyon No. 3** (SW ¼ SW ¼ sec. 16, T7N, R57E) has had production as high as 4,100 barrels of oil per day, and is the nation's most prolific onshore, free-flowing well.

Out of 56 wells capable of producing within Nevada in 1988, 39 were active. The remaining 17 were shut-in most or all of the year. Several companies continued to suspend production on their leases (currently approved through May 31, 1989) in Railroad Valley, taking advantage of the 1986 Reagan initiative to lessen the burden on domestic oil production. Under this 1986 policy, which is authorized by the Mineral Leasing Act of 1920, any oil and gas leaseholder with wells on federal land may opt to suspend production temporarily, rather

than prematurely abandon the lease because of poor domestic oil prices. The purpose of this policy is to preserve our domestic oil and gas reserves and provide for the collection of royalties and taxes on these leases in the future.

In the Trap Spring field, **Apache Corp.** suspended production on the Trap Spring No. 1, No. 1-R, No. 4, and No. 17 wells for all of 1988. **Makol, Inc.** suspended production on the Britton No. 13-21 well for 8 months during 1988, and suspended production on the Zuspann No. 24-1, Zuspann No. 24-3, and JN No. 1 wells for the entire year.

In the Grant Canyon field, **Apache Corp.** suspended production all year on the Grant Canyon No. 1 well.

In the Eagle Springs field, **John A. Lyddon** suspended production on its 4 wells (No. 1-35, No. 15-35, No. 35-35, and No. 62-35) all year. **Draycutt Corp.** suspended production of 3 of its 9 wells (No. 2, No. 4, and No. 34) all year.

In the Kate Spring field, **Marathon Oil Co.** shut in the Kate Spring No. 1 well for all of 1988, except for the month of August.

On the positive side, three new wells, including one in a new field, were put into production in Nevada in 1988. Nevada now has 8 active oil fields.

NEW PRODUCERS

Nevada's first new producer of 1988 was the **Foreland Corp. Southern Pacific Land Co. No. 1-27** well (originally permitted by Dixie Operating Co.) in NW ¼ SE ¼ sec. 27, T29N, R52E in northern Pine Valley in Eureka County. This well established another new field, the **North Willow Creek**, and became the second producer located on privately owned land in Nevada.

The well is producing 28° to 30° gravity oil with little to no water from the Oligocene Indian Well Formation (tuff) and the Mississippian Chainman Shale between 5,818 and 6,358 feet. Total depth drilled was 7,678 feet, and large gas kicks were encountered during drilling. First official production began in April with a total of 438 barrels. During the rest of the year, monthly production varied from

2,900 to as low as 90 barrels due to a number of mechanical and engineering problems.

Foreland has plans for a ten-well program in Pine Valley, including five development tests in the Tomera Ranch and North Willow Creek areas, and five exploratory tests designed to evaluate a number of structures in the 10-mile gap separating the two fields (Petroleum Information, 11-9-88, p. 3).

Two new producers came on line in the Railroad Valley Trap Spring field in October 1988. A newcomer to Nevada, **J.R. Bacon Drilling, Inc.** completed the **Trap Spring (Munson Ranch) Federal No. 14-42** well in SE¼NE¼ sec. 14, T9N, R56E. This well is producing 26° gravity oil from 3,670 to 3,843 feet (total depth) in the Oligocene tuff of Pritchards Station. The other producing well, the **Makohl, Inc. Munson Ranch No. 14-34X** in SW¼SE¼ sec. 14, T9N, R56E, is producing oil from 3,740 to 3,920 feet (total depth) in Tertiary volcanics.

FEDERAL LEASES

Nevada federal acreage under competitive oil and gas leases totaled 302,263 acres (190 leases) in fiscal year 1988 (October 1987–September 1988), an increase of 145 percent over fiscal year 1987. The acreage under noncompetitive (including simultaneous) leases during fiscal 1988 amounted to 7,700,205 acres (2,993 leases), up 29 percent over fiscal 1987. The above figures, provided by the Nevada state office of the Bureau of Land Management (BLM), reflect the implementation of the Federal Onshore Oil and Gas Act of 1987.

In June 1988, the BLM issued final rules for this act. The most significant changes concerned the procedures for leasing federal lands. The federal on-

shore leasing reform law requires all available tracts to be offered at competitive sales before being offered noncompetitively.

In the first six months of 1988, the BLM conducted eight test sales around the U.S. using both the direct method and the formal nomination process, netting the federal government over \$23 million from bonus bids in the process.

After evaluating the results of these sales, the BLM opted for the direct sale method for all of its oral-bid competitive oil and gas lease offerings. Under the direct method, the agency is required to offer for lease all available parcels in the sale area. Parcels receiving no bids at competitive sales will be available for noncompetitive leasing for a period of two years without further competition (Petroleum Information, 7-29-88, p. 3).

Although the direct sale method will be used for oral auctions, the new rules give the BLM director leeway to implement a nomination process, following an announcement by him and 30 days for public review.

The BLM may accept informal suggestions from operators that it add particular parcels to a sale list for oral auction. In those cases, companies won't have to submit bids or fees, and BLM will not give the tracts priority for noncompetitive issuance if they are not sold at the auction.

Successful bidders at BLM auctions must pay \$75 per lease plus a minimum \$2/acre bonus. Applicants for noncompetitive bids must pay a \$75 fee. In both cases, the lessee must pay the \$1.50/acre rental in advance.

Lease terms remain the same at 5 years for competitive sales, and 10 years for noncompetitive sales. The rules permit lease assignments of less

FEDERAL OIL AND GAS LEASES IN EFFECT IN FISCAL YEARS 1987 AND 1988¹

County	NUMBER OF LEASES								ACREAGE							
	Competitive		Noncompetitive		Over-the-counter		Simultaneous		Competitive		Noncompetitive		Over-the-counter		Simultaneous	
	FY87	FY88	FY87	FY88	FY87	FY88	FY87	FY88	FY87	FY88	FY87	FY88	FY87	FY88	FY87	FY88
Carson City	0	0	—	0	0	—	0	0	0	0	—	0	0	—	0	0
Churchill	0	0	—	10	77	—	16	12	0	0	—	21,207	185,143.04	—	38,594.31	20,701
Clark	0	0	—	55	75	—	70	54	0	0	—	86,666	132,730.19	—	115,725.42	58,827
Douglas	0	0	—	0	0	—	0	0	0	0	—	0	0	—	0	0
Elko	0	14	—	172	194	—	188	204	0	26,982	—	407,212	520,447.92	—	481,266.33	533,295
Esmeralda	0	0	—	1	1	—	0	0	0	0	—	1,287	1,287.00	—	0	0
Eureka	0	30	—	248	169	—	185	225	0	58,807	—	853,313	398,317.76	—	498,162.04	771,080
Humboldt	0	0	—	10	16	—	0	0	0	0	—	6,541	10,502.25	—	0	0
Lander	0	0	—	11	8	—	7	8	0	0	—	37,833	16,086.30	—	9,817.09	29,541
Lincoln	0	12	—	187	234	—	107	121	0	23,631	—	481,619	550,265.70	—	277,859.41	388,605
Lyon	0	0	—	0	0	—	0	0	0	0	—	0	0	—	0	0
Mineral	0	0	—	0	0	—	0	0	0	0	—	0	0	—	0	0
Nye	20	81	—	332	293	—	563	639	2,071.28	92,614	—	861,596	556,606.23	—	790,206.22	1,179,532
Pershing	0	0	—	11	22	—	2	1	0	0	—	18,665	47,068.06	—	13,438.23	6,402
Storey	0	0	—	0	0	—	0	0	0	0	—	0	0	—	0	0
Washoe	0	0	—	1	1	—	0	0	0	0	—	1,040	1,040.00	—	0	0
White Pine	0	53	—	226	183	—	419	465	0	100,229	—	604,782	374,962.07	—	969,934.16	1,330,461
TOTAL	20	190	—	1,264	1,273	—	1,557	1,729	2,071.28	302,263	—	3,381,761	2,794,486.52	—	3,195,003.21	4,318,444

¹Data from the U.S. Bureau of Land Management

FY87 = Oct. 1986–Sept. 1987; FY88 = Oct. 1987–Sept. 1988.

than 640 acres—2,560 acres in Alaska—if it would lead to development and production, or if it is the entire lease.

Applications for permits to drill will be posted in the administering BLM office and the surface managing agency's office for at least 30 days prior to BLM approval. Prior to application approval, an acceptable surface use plan and drilling plan will be required from all operators (Oil & Gas Journal, v. 86, no. 27, p. 22).

The Nevada state office of the BLM described the oil and gas industry's activity on Nevada public lands as "cautious, persistent and committed" in fiscal year 1988. Companies are practicing methodical and long-term exploration strategies, data collection, and analysis before making the decision to drill. Active drillers are still choosing to stick with proven producing areas.

BLM DEVELOPMENT CONTRACTS

Since 1986, four companies have negotiated development contracts with the BLM in Nevada, all in the northeastern quadrant of the state. These contracts are authorized by a 1931 amendment to the Mineral Leasing Act of 1920, and encourage long-term exploration in frontier areas. Many of the lease applications within development contract areas are for lands that have never been leased. BLM discourages including producing oil lands in contract development areas.

A development contract gives a company no special rights to obtain a lease within a contract area. Approvals for any ground surface disturbance as a result of exploration and/or drilling must be obtained according to existing legal permitting procedures. The only benefit to companies involved in development contracts is that the acreage involved in the contract is not included as part of the 246,080-acre maximum federal leasehold allowed per state. A contract allows a company to explore its primary target and at the same time pursue other areas of interest.

In return for larger acreage rights, the companies contract to perform an agreed-upon dollar amount of development work to define an area. This work may include drilling. If they fail to do the work agreed upon, the companies must pay the federal government the money they agreed to spend. The companies agree to share all information gathered with the BLM.

The four companies working in northeastern Nevada are presently doing extensive seismic work in their areas, and have also apparently joined in a large photo-mapping project (Oil and Gas Investor, May 1988, v. 7, no. 10, p. 28).

In July 1986 **Exxon Co., USA** was the first to line up a Nevada parcel, the 638,880-acre Piñon development contract area in Elko, Eureka, and White Pine Counties. Exxon has agreed to spend \$4.5 million over the next 10 years in three separate phases: \$1 million in the first 2-year phase, \$2

million in the next 3-year phase, and \$1.5 million in the last 5 years. Exxon has the option to terminate the contract agreement after each phase.

In February 1988 Exxon was approved for another 600,000-acre development contract area in the Pancake Range southwest of their Piñon area, with the same conditions applying as in the Piñon area. Phase one of this contract ends in January 1990.

In December 1987 the **Anschutz Corp.** was approved for the Bristlecone development area, a 2.5-million-acre parcel wedged between Railroad and Pine Valleys in the Mesozoic thrust-compressional belt. This contract is patterned after the Exxon contracts. Generally, Anschutz is interested in the Paleozoic rocks. They ran a regional seismic survey in late 1988, and will probably drill as part of their program (Oil and Gas Investor, May 1988, v. 7, no. 10, p. 30; AAPG Explorer, July 1988, p. 15).

Finally, **Mobil Oil** and **Chevron USA** jointly picked up 1.8 million acres, most of which is inside the Anschutz area. Mobil has a 10-year contract with the BLM in three phases. The first phase began in September 1987 and lasts for four years.

REGULATION

The oil and gas industry won a regulatory victory in June 1988 when the U.S. Environmental Protection Agency (EPA) recommended to Congress that oil field wastes not be regulated as hazardous material. The EPA concluded that regulation of drilling and production wastes is being adequately addressed by existing state and federal laws, and to impose additional federal hazardous waste regulations would cause a "severe economic impact" on the industry and U.S. oil production. According to EPA's economic models, federal hazardous waste regulation in the oil industry would cause domestic production to decline 1.4 to 12 percent, with a corresponding annual direct cost of \$700 million to \$4.5 billion passed on to consumers (Petroleum Information, 7-13-88, p. 3).

The EPA concluded that under the Resource Conservation and Recovery Act (RCRA), federal hazardous waste laws would be too inflexible to enable the EPA to design a hazardous waste regulatory program to reduce "serious economic impacts on the oil industry in light of Congress' concern for the protection of the nation's current and future energy supplies". The EPA recommended that existing regulations for surface water discharge and underground injection be strengthened, and that regulations under RCRA's nonhazardous authority should be developed.

U.S. OIL PRODUCTION AND CONSUMPTION

Crude oil production in the U.S. declined for the third consecutive year, averaging 8,111,000 barrels/day in 1988, according to the American Petroleum Institute (API). That's a drop of 2.9 percent from the 1987 average of 8,349,000 barrels/

day and marks the lowest level of domestic output since 1976, the year before production began at Alaska's Prudhoe Bay field. By year-end 1988, U.S. production had fallen by more than one million barrels daily from early 1986 levels.

The declining trend in crude oil production in the lower 48 states accelerated in 1988, according to the API. The annual rate of decline is estimated at about 400,000 barrels/day, compared to about 240,000 barrels/day during 1987. For 1988, the 48 contiguous states' production fell to 6.1 million barrels/day, the lowest level since 1950.

Alaskan production increased by about 60,000 barrels/day due to additional production from the Endicott field, which began production in late 1987. Alaska now accounts for one-fourth of total U.S. production. (Petroleum Information, 1-27-89, p. 3.)

IMPORTS

The continuing decline in U.S. production was matched last year by the ongoing increase in imports of petroleum products. According to the API *Monthly Statistical Report*, imports (crude oil and petroleum products) in 1988 averaged 7,192,000 barrels/day, the highest level since 1979, account-

ing for 42 percent of U.S. consumption. Domestic demand for petroleum products (including foreign imports and domestic production) has continued to rise. Deliveries to U.S. buyers averaged 17,198,000 barrels/day in 1988, a 3.2 percent increase over the 1987 average of 16,665,000 barrels/day. (Petroleum Information, 1-27-89, p. 3). This growth in domestic use has been attributed to a combination of low world oil prices, adverse weather conditions, increased consumption, and the decline in domestic crude oil production.

In March 1988, the API said that petroleum imports from Arab members of Organization of Petroleum Exporting Countries (OPEC) had nearly quintupled since the beginning of 1985. OPEC production again remained over quota in 1988, helping to erode U.S. prices for crude oil. Since 1986, as lower oil prices encouraged consumption and discouraged production in the U.S., imports have risen by more than 2 million barrels daily, according to the API (Petroleum Information, 1-27-89, p. 3).

In addition, the Saudis made it known in early 1988 that they were seeking marketing and refining operations abroad, primarily in the U.S. and western Europe. The utilization rate for the nation's refineries in August was 88 percent, the highest in nearly 10 years (Petroleum Information, 9-23-88, p. 3).

Geothermal Energy

by Ronald H. Hess and Larry J. Garside



Oxbow Geothermal's power plant in Dixie Valley, Churchill County. Photo by Dick Benoit, Oxbow Geothermal Corp.

Forty-six geothermal well permits were issued by the Nevada Department of Minerals during 1988: 13 industrial class, 4 commercial class, 6 domestic class, and 23 unclassified. The unclassified group consisted of observation, thermal gradient, and injection wells. As of the end of August 1988, there were 157 noncompetitive and 66 competitive federal geothermal leases totaling 380,733 acres, a decrease of 245,000 acres since fiscal year 1980. (U.S. Bureau of Land Management.)

Only two industrial-class geothermal production wells were drilled in 1988 with a total proposed footage of slightly over 3,000 feet, only one-third of the total footage drilled for production wells in 1987, itself a low year. This decrease continues to result from the development of shallower resources and the utilization in new power plants of wells drilled in previous years. Exact footage drilled is unknown due to confidentiality requirements on information submitted for state regulatory purposes. Industrial-class injection wells completed this year probably had a greater drilled footage than industrial production wells, another indication of the maturing nature of the geothermal industry in the state.

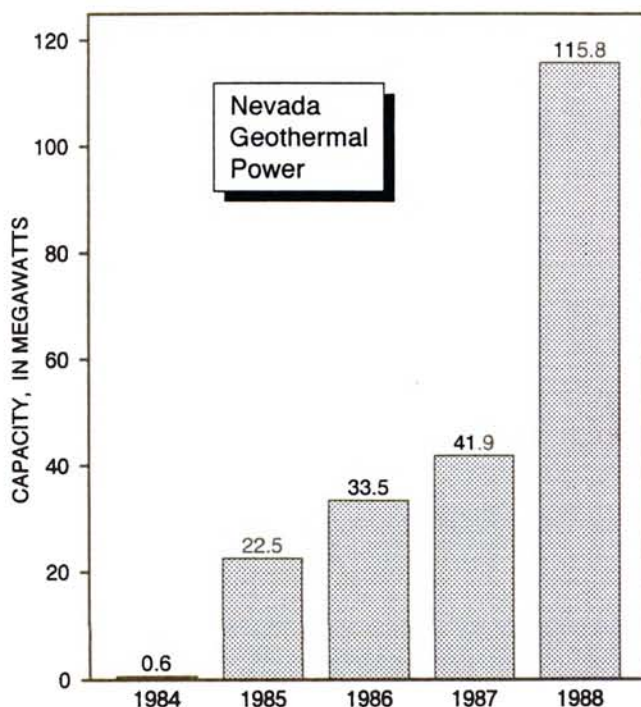
In 1988, Nevada had nearly a threefold increase over 1987 in the amount of geothermal generating capacity on line. The major factor in this increase was the 60-megawatt Oxbow Geothermal plant in Dixie Valley. Also added near the end of 1987 or early in 1988 were 2 Ormat plants (Empire and Soda Lake) and the Yankee/Caithness plant at Steamboat Springs.

U.S. Senate Bill 1889, titled "A Bill to Amend the Geothermal Steam Act of 1970 to Provide for Lease Extensions and For Other Purposes," was sponsored by Senators Melcher of Idaho and Hecht of Nevada, and signed by President Reagan on September 22, 1988. The act removes bona fide sales of geothermal steam as a requirement for geothermal lease extensions and provides for lease extensions by the Secretary of the Interior if certain conditions are met; it also prohibits the issuance of a geothermal lease in a National Park if significant adverse effects are likely.

In April, **Sierra Pacific Power Co.** issued a request for proposals to purchase a total of 125 megawatts of electricity over the next 5 years. Qualifying facilities for sale of this electricity could include

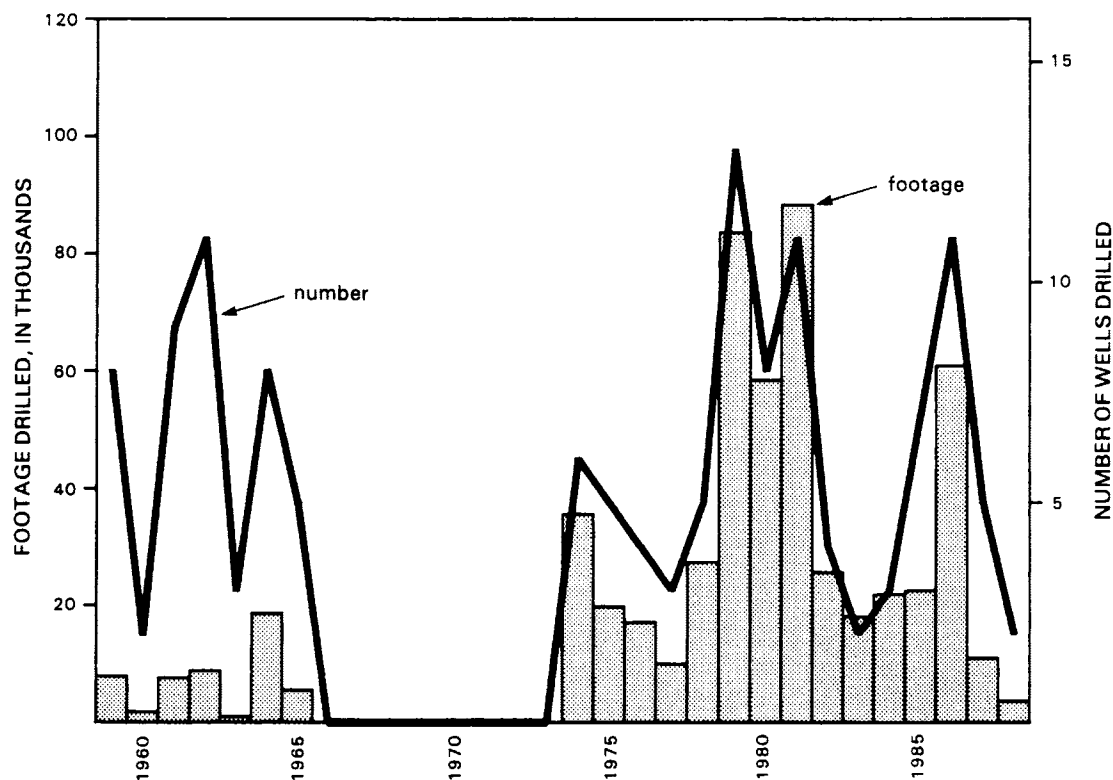
GEOTHERMAL WELLS DRILLED IN 1988

Company name	Well name	Proposed depth (ft)	Location	Type
CHURCHILL COUNTY AMOR IV Corp.	Well #21A-6	3,000	NW¼ NW¼ sec. 6 T19N,R31E	industrial production
AMOR IV Corp.	Well #17A-31	3,000	SW¼ SW¼ sec. 31 T20N,R31E	industrial injection
ELKO COUNTY Pace Enterprises		1,500	SW¼ NE¼ sec. 11 T34N,R55E	commercial
LYON COUNTY Tad's Enterprises, Inc.	Well #15-15A		NW¼ SW¼ sec. 15 T15N,R25E	industrial injection
Tad's Enterprises, Inc.	Well #15-15		NW¼ SW¼ sec. 15 T15N,R25E	industrial injection
NYE COUNTY Round Mountain Gold Corp.	Well #41-36	1,500	NE¼ NW¼ sec. 36 T10N,R43E	commercial
Round Mountain Gold Corp.	Well #71-36	1,500	NE¼ NE¼ sec. 36 T10N,R43E	commercial
Round Mountain Gold Corp.	Well #41A-36	1,800	NE¼ NW¼ sec. 36 T10N,R43E	commercial
Round Mountain Gold Corp.	Well #62-36	1,000	NE¼ NE¼ sec. 36 T10N,R43E	commercial
WASHOE COUNTY AMOR II Corp.	Well #32A-21		NE¼ NW¼ sec. 21 T29N,R23E	industrial injection
AMOR II Corp.	Well #53A-21	600	SW¼ NE¼ sec. 21 T29N,R23E	industrial



geothermal producers. The **Nevada Geothermal Industry Council** filed a cease and desist order with the Nevada Public Service Commission concerning this method of selecting qualified power suppliers. The Commission held a hearing and released a decision in late 1988 prohibiting Sierra Pacific Power Co. from using the request-for-proposal process to displace qualifying facilities with nonqualifying facilities; the process was not considered by the Commission to be a formal system of competitive bidding. Additionally, the Commission stated that if a qualifying facility currently under contract to Sierra Pacific fails to meet contract terms, other qualifying facilities should be given the opportunity to act as a replacement. The Commission also suggested that Nevada qualifying facilities are generally more secure power sources than imports because they are located in the service territory and are largely renewable geothermal energy, which is not weather sensitive like hydroelectric power or subject to unpredictable price jumps like fossil fuels.

According to a study by the **Oregon Institute of Technology Geo-Heat Center**, the output of Nevada's direct use applications of geothermal



Industrial-class geothermal wells drilled in Nevada.

energy (those not utilized for the production of electric power) is 844 billion Btu per year from 26 sites. The applications include space heating, district heating, heat pump use, greenhouses, industrial processes, aquaculture, and swimming pools.

Churchill County

The **Munson Geothermal Inc. Brady Hot Springs** geothermal power project has been delayed indefinitely due to that company filing for Chapter 11 bankruptcy in March 1988. Prior to filing, Munson Geothermal had negotiated a 10-megawatt purchase agreement with Sierra Pacific Power Co. but has been unable to complete the project. The corporation is presently undergoing reorganization in an attempt to bring this plant on line. In 1987, Brady Hot Springs Geothermal Associates acquired some of Munson's geothermal leases and subsequently requested approval from the Public Service Commission of Nevada to construct a 6-megawatt (net) geothermal power plant at Brady Hot Springs. (Geothermal Resources Council Bulletin, August 1988, and NBMG MI-87).

The **Oxbow Geothermal Corp. Dixie Valley** plant came on line in 1988, producing approximately 55 megawatts (net). The power is produced in a double-flash turbine generator using geothermal fluids produced from six production wells. This is the largest geothermal power plant in the state and has effectively doubled the amount of geothermal power generated in Nevada. The power is purchased by **Southern California Edison Co.** via a wooden H-frame, 230-KV, 214-mile-long privately owned power line. The power line has a capacity of 150 megawatts. Estimates by Oxbow geologists indicate that there is a geothermal energy reserve in Dixie Valley sufficient to supply more than 200 megawatts for 30 to 60 years. (Geothermal Resources Council Bulletin, June 1987 and Reno Gazette-Journal, August 6, 1988).

In the **Stillwater KGRA** (Known Geothermal Resource Area), **Ormat Energy Systems Inc.** worked toward the installation of modular Ormat Energy Converters that will have a total generating capacity of 11 megawatts. The field will consist of four



Cooling tower of the Ormat Energy Systems, inc. Soda Lake geothermal power plant near Fallon. L. J. Garside photo.

geothermal production wells and the energy produced will be sold to Sierra Pacific Power Co. Ormat reported on November 9, 1988 that a \$36 million construction loan had been obtained from the Bankers Trust Company and Bank of Nova Scotia and that they now planned to be in full operation by the second quarter of 1989. (Geothermal Resources Council Bulletin, December 1988 and Geothermal Resources Council, Nevada Section Bulletin, v. 1, no. 4).

Elko County

A new **aquaculture project** was begun in 1988 on the **Y-3-II Ranch** near Jackpot. The well utilized has an artesian flow of 1,135 gallons per minute at 107°F. The project is in the pilot stage with eight $\frac{1}{8}$ -acre raceways. They obtain fingerling catfish from Leo Ray, another Nevada catfish producer, and sell grown fish to Leo Ray (EG&G Idaho Regional Geothermal Progress Monitor, October-December 1988).

Nye County

Round Mountain Gold Corp. continued to expand its utilization of geothermal fluids to heat heap-leach

solutions at the Round Mountain mine. Four additional commercial wells were drilled this year to increase the flow rate of the geothermal fluids from 700 to 3,000 gallons per minute. The geothermal fluids will be pumped through a series of exchangers to heat the leaching solutions used to chemically extract precious metals from the ore. This allows year-round operation in an area that would normally require wintertime shutdown due to freezing conditions. The increase in solution temperature also has the additional benefit of improving the efficiency of the chemical reaction, thereby increasing the recovery rate.

Washoe County

Ormat Energy Systems Inc., operator of the **GDA-Ormat Steamboat Springs** plant, won the U.S. Department of Energy 1988 Award for Energy Innovation. The nonpolluting 7-megawatt plant has been operational for 4 years. It also received the Governor's Energy Award from Governor Richard Bryan and a letter of commendation from Senator Chic Hecht.

The GDA-Ormat Steamboat plant underwent an expansion project that included the installation of two modular Ormat Energy Converters. This is in

addition to the seven original converters and should increase plant output by 2 megawatts, which will be purchased by Sierra Pacific Power Co. This plant uses an air-cool condensing system which allows for reinjection of 100 percent of the geothermal fluids used in the power production process. This process helps insure a low overall impact on the environment. (Reno Gazette-Journal, September 9, 1988, 1988 and Geothermal Resources Council Bulletin, September/October 1988).

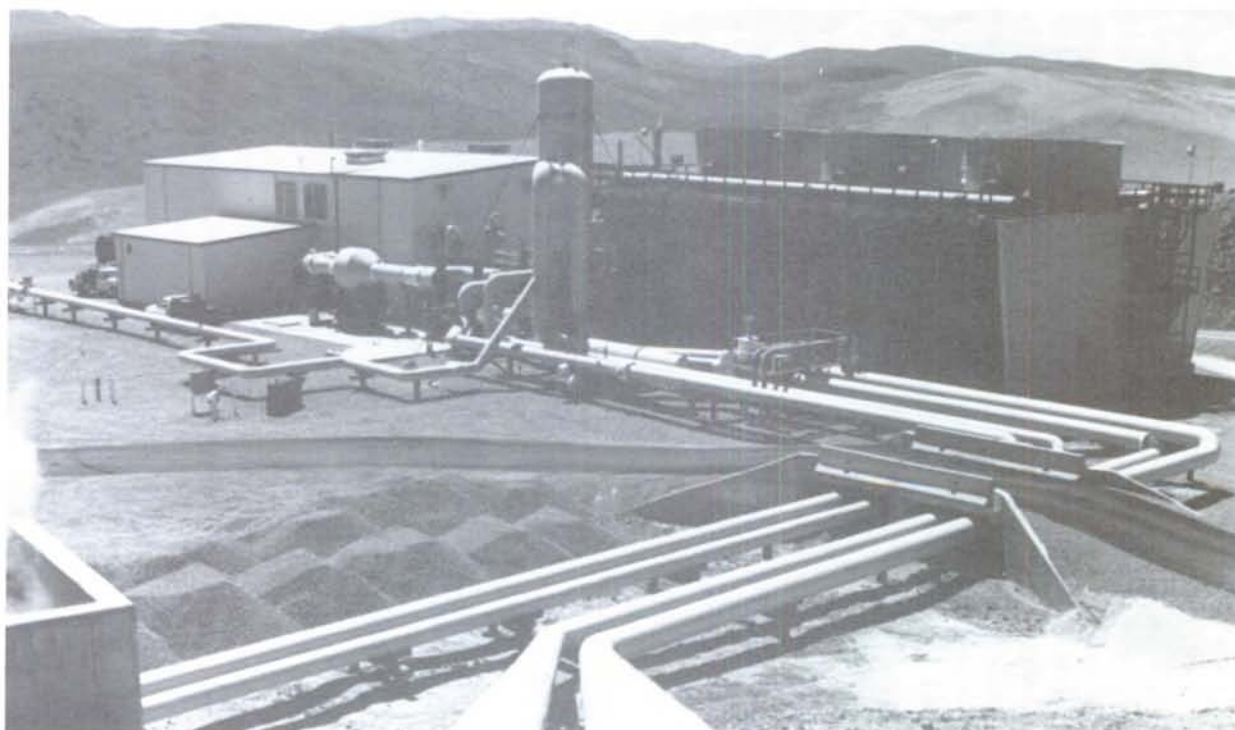
Ormat Energy Systems, Inc. has brought on line the **Empire** geothermal power project. This plant, located 10 miles south of Gerlach in Washoe County, uses four 1.2-megawatt Ormat Energy Converters to produce 4.8 megawatts (gross). Ormat qualified for a 30-year, long-term avoided cost rate purchase agreement with Sierra Pacific Power Co. for the purchase of the plant's net output. Ormat has also applied for another power purchase agreement that would allow for a future increase in output to 10 megawatts. (Regional Geothermal Progress Monitor Activities Report, January-March 1988, and NBMG MI-87).

Salem Plaza Condominiums in Reno drilled an injection well for their geothermal space- and water-heating project in August. The project will serve 150 condominiums in the complex, located in the Moana

geothermal area. The production well, drilled in 1981 to 1,490 feet, produces geothermal fluids at a temperature of 160°F (Geothermal Resources Council Bulletin, August 1988).

In the **Steamboat KGRA, Yankee/Caithness Joint Venture** installed a Geothermal Energy Corp. single-flash turbine system which came into production in January 1988. This plant produces 13.2 megawatts (gross) which is put out over a 2½-mile power line that connects to a Sierra Pacific Power Co. substation. The Public Service Commission of Nevada has approved a 30-year contract whereby Sierra Pacific will purchase the net output. (Cowan, C. J., A Decade of Geothermal Development in Nevada: 1978-1988 and Regional Geothermal Progress Monitor Activities Report, January-March, 1988).

A series of complaints from residents in nearby Pleasant Valley of a rotten egg smell from the Yankee/Caithness plant led to a \$750 fine by health officials early in 1988. This odor was created by the release of steam containing hydrogen sulfide in excess of the 5.5 pounds per hour maximum limit mandated by the health department. Due to this ongoing problem the plant was issued a series of temporary operating permits to allow installation of scrubbers and other equipment that would reduce the amount of hydrogen sulfide released. By



Yankee/Caithness geothermal power plant, Steamboat Springs, Washoe County. Yankee/Caithness photo.

September, after the installation of \$500,000 worth of new equipment and a slight lowering of plant efficiency, hydrogen sulfide emissions had been reduced to approximately 1 pound per hour. District health officials have since issued the plant a 1-year operating permit with the condition attached

that Yankee/Caithness acquire the necessary equipment to reinject the steam that is the source of the emissions. The plant is currently on line employing 13 people and producing 12.5 megawatts. (Reno Gazette-Journal, April 28, and September 8, 1988).

DIRECTORY OF GEOTHERMAL POWER PLANTS

Plant name (year on line)	Gross (MW)	Location	Operator	Address	Remarks
Beowawe (1985)	16	S13,T31N,R47E	Chevron Resources	Jim DeGraffenreid P.O. Box 6 Beowawe, NV 89821	Production from 2 wells—one at 8,300 feet, the other at 9,600 feet. Maximum bottom-hole temperature 410°F.
Desert Peak (1985)	10	S21,T22N,R27E	Chevron Resources	Von Maynard, Superintendent P.O. Box 2627 Sparks, NV 89432-2627	
Dixie Valley (1988)	60	S7,T24N,R37E S33,T25N,R37E	Oxbow	Don Wells, Plant Manager 200 South Virginia St., Suite 450 Reno, NV 89501	Estimated 30 to 60 year reservoir reserve with a 200+ MW production capacity. Now producing from 6 wells.
Empire (1987)	4.8	S21,T29N,R23E	Ormat	Monte Morrison, Operations Coordinator 610 East Glendale Avenue Sparks, NV 89431	
Soda Lake (1987)	3.6	S33,T20N,R28E	Ormat	Monte Morrison, Operations Coordinator 610 East Glendale Avenue Sparks, NV 89431	
Steamboat (1986)	7	S29,T18N,R20E	Ormat	Monte Morrison, Operations Coordinator 610 East Glendale Avenue Sparks, NV 89431	Three production wells provide 340°F fluid to one plant. Owned by Far West.
Wabuska (1984)	1.2	S15,16,T15N, R25E	Tad's	Grace Townsend Caldwell, Plant Manager 10 Julian Lane Yerington, NV 89447	Plant operates on geothermal fluids at 224°F from 350-foot depth.
Yankee/Caithness (1988)	13.2	S5,6,T17N,R19E	Yankee/Caithness	Ted DE Long, General Manager P.O. Box 18160 Reno, NV 89511	
TOTAL	115.8				

Power from the Beowawe and Dixie Valley plant is purchased by Southern California Edison Co.; power from the other plants is purchased by Sierra Pacific Power Co.

Sources: Geothermal Resources Council Bulletin, March 1988; Geothermal Resources Council, Nevada Section, Bulletin, March 1988; Operators; and NBMG files.

For additional information on Nevada's mineral resources and mineral industries see the following NBMG publications:

Statewide Commodity Bulletins

Barite (B98)	Radioactive minerals (B81)
Fluorspar (B93)	Talcose minerals (B84)
Gypsum (B103)	Thermal waters (B91)
Montmorillonite, bentonite, and fuller's earth (B76)	Tungsten (B105)
Oil and gas (B104)	Zeolites (B79)

County Mineral Resource Bulletins

Carson City (B75)	Eureka (B64)	Nye (B77, B99B)
Churchill (B83)	Humboldt (B59)	Pershing (B89)
Clark (B62)	Lander (B88)	Storey (B70)
Douglas (B75)	Lincoln (B73)	Washoe (B70)
Elko (B54)	Lyon (B75)	White Pine (B85)
Esmeralda (B78)	Mineral (B58)	

Special Publications

Oil and gas wells drilled in Nevada since 1986 (L-8)
Geothermal wells drilled since 1979 (L-5)
Nevada mining and you (SP8)
Economic impacts of Nevada's mineral industry (SP9)
Economic impacts of Nevada's mineral industry—1988 update (L-9)
Nevada ore and concentrate buyers, custom mills, and smelters available to mine operators (L-7)

NBMG maintains an open-file office with the following information available to the public:

NBMG, USGS, BLM, USBM, and DOE open-file reports on Nevada geology and mineral resources
petroleum and geothermal exploration and production
mining district records and maps
mineral resources and reserves
mineral resource assessments
core and cuttings library
mining claim data
wilderness study areas
general geologic studies
indexes and ordering information for maps, air photos, and remote sensing imagery

The Nevada Bureau of Mines and Geology (NBMG) is part of the Mackay School of Mines at the University of Nevada, Reno and is the state geological survey. NBMG scientists conduct research and publish reports on mineral resources and various aspects of general, environmental, and engineering geology.

Current activities in mineral resources and general geology include detailed geologic mapping and stratigraphic studies in Nevada, comparative studies of bulk mineable precious-metal deposits, geochemical investigations of mining districts, resource assessments, igneous petrologic studies, hydrothermal experiments, research on the origin of hydrothermal platinum-group-element occurrences, and examination of the origin and distribution of borate deposits in Nevada.

Environmental, engineering, and urban geology projects include investigations of earthquake hazards and related aspects of neotectonics, examination of issues involved in siting nuclear and hazardous wastes, mapping of geomorphic features, radon hazard studies, and studies of landslide hazards.

Geologic information activities include creating and updating databases on mining districts, active mines and prospects, and geothermal and petroleum exploration and production; implementation and development of statewide geographic information systems; and maintenance of core and cuttings facilities, rock and mineral collections for research, aerial photographic imagery and maps, and extensive files on Nevada geology and resources.

NBMG cooperates with numerous state and federal agencies in providing geologic and resource information and in conducting research. Research results are published as NBMG bulletins, reports, maps, and special publications as well as in federal publications and scientific journals. In addition to addressing the needs for geologic information by conducting research, publishing reports and maps, and creating computer databases, staff members assist the public, industry, and government agencies by answering specific questions regarding Nevada geology and resources and by providing some chemical and mineralogical analyses.

Individuals interested in Nevada geology are encouraged to visit or write NBMG or call (702) 784-6691. NBMG offices are located in the west wing of the Scrugham Engineering-Mines Building on the University of Nevada, Reno campus. When visiting NBMG by car please stop at the information booth just inside the Center Street entrance on the south end of the campus. The attendant will issue you a temporary parking permit and give you directions to parking areas and the NBMG offices. Address mail to: Director/State Geologist, Nevada Bureau of Mines and Geology, University of Nevada, Reno, NV 89557-0088. A publication list will be sent upon request.

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