

CLAY TURQUOISE Hg
DIATOMITE Li Au OIL
Pb Cu Ag

NEVADA BUREAU OF MINES & GEOLOGY
SPECIAL PUBLICATION MI-1984

Au

THE NEVADA MINERAL INDUSTRY 1984

Au MAGNESITE
Ag OPAL Hg Au BARITE
BARITE DIATOMITE
Au CRUSHED ROCK Mo
Mo GRAVEL
PERLITE Au OIL
CEMENT LIME
Hg WO₃ Au Si
GRAVEL Li SALT WO₃ Li
Fe Au MAGNESITE
GYPSUM TALC
OIL SAND FLUORSPAR Au
PUMICE

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NEVADA BUREAU OF MINES & GEOLOGY
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THE NEVADA MINERAL INDUSTRY— 1984

Metals
Industrial Minerals
Geothermal
Oil and Gas

Exploration
Development
Mining
Processing

John Schilling
Director/State Geologist

1985

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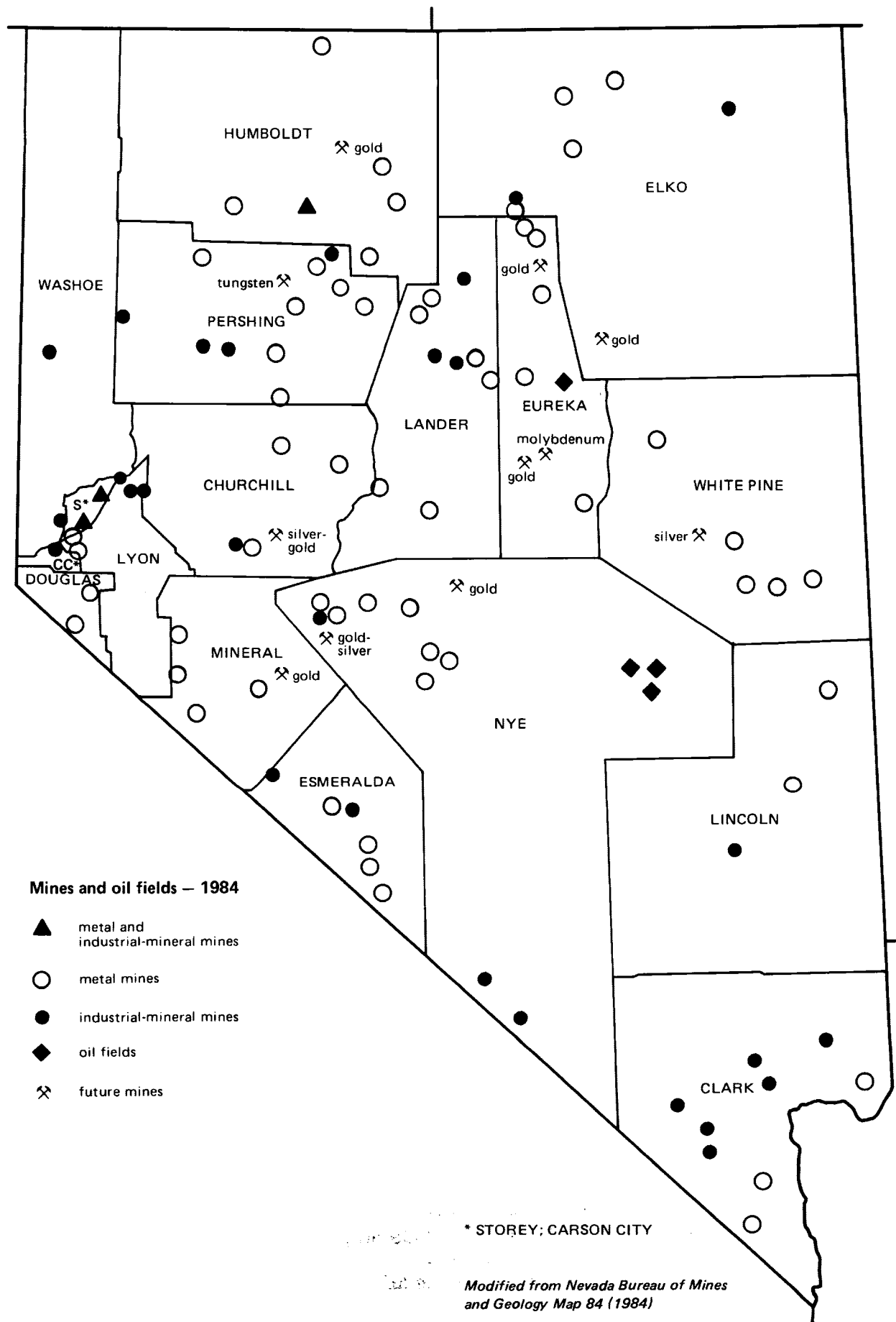
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This One



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INTRODUCTION

This report is the sixth of an annual series. Its purpose is to discuss 1984 activities in Nevada's mineral-resources industry. It describes mineral exploration and development programs, discovery of ore bodies, new mines opened, expansions and closings at existing mines, oil and gas drilling and production, and geothermal drilling and utilization.

Minerals

EXPLORATION

The year 1984 was a year of decline in Nevada, with continuing layoffs and the closing of exploration offices. However, because of the great interest in, and excellent potential for, finding gold deposits, mineral exploration was at a much higher level in Nevada than elsewhere in the West, though exploration for other metals and industrial minerals remained at depressed levels. The U.S. Bureau of Land Management reported that more claims were recorded in Nevada in 1984 than in any other western state.

Cuts of the last few years have been so deep that future needs for minerals will be difficult to meet—in order to find enough new mines to satisfy this demand, more exploration is needed now. Nevada should continue to encourage exploration now, if mining is to be economically important in the years ahead.

Exploration, by its nature, is a rather secretive undertaking; for this reason much of what goes on is not public knowledge. Only a few of the many exploration targets being examined in Nevada are mentioned below.

CLAIMS RECORDED BY BLM*

Year	New claims	Total active claims
1980	43,175	—
1981	49,284	—
1982	30,531	241,158
1983	35,127	245,576
1984	36,698	275,022

*U.S. Bureau of Land Management.

TOTAL CLAIMS FILED WITH BLM*

1976-1984	
Nevada	330,306
Utah	281,499
Arizona	231,325
Wyoming	228,094
Colorado	209,368
California	160,587
New Mexico	133,279
Montana	115,421
Idaho	100,571
Oregon	80,501

*U.S. Bureau of Land Management.



Drill at Simplot silica pit, Churchill County. Keith Papke photo.

Industrial Minerals

by Keith G. Papke

The year 1984 was a relatively quiet one for industrial minerals. The search for barite—which dominated industrial-mineral exploration for more than a decade and peaked in 1981—was at a relatively low level. Exploration was done mainly by scaled-down staffs of some of the major Nevada producers, who mostly confined their efforts to company-owned deposits. The short-term outlook for Nevada barite is poor due to the continued combined effects of reduced domestic drilling for oil and gas, large imports of barite especially from Mainland China, and high railroad-freight rates from Nevada to the Gulf Coast area. More than 90% of the barite consumed in the United States is used in drilling for oil or gas, and about 60% of this drilling is done in Texas, Oklahoma, and Louisiana. Reserves of barite in Nevada are large—approximately 90 million tons of relatively high-grade material, mostly accessible by open pit. (A comprehensive report [Bulletin 98] on Nevada barite was published by the Nevada Bureau of Mines and Geology in 1984.)

Exploration for other industrial minerals increased as demand for most of these commodities continued to expand rapidly from the low demands in 1982. Industrial minerals that appear to be most sought are swelling clays, diatomite, gypsum, limestone, salt, and silica. As might be expected because of Nevada's small population, most of the Nevada production of industrial minerals is of high-value commodities that are consumed out of the State.

Nevada is well endowed with industrial minerals, compared to many western states, due to the diverse geologic processes that have been operative in the State, e.g., hydrothermal activity, volcanism, and playa-lake development. Approximately 430 significant deposits containing 20 principal commodities have been identified. Data on most of these deposits is available in published form or as open-file information at the Nevada Bureau of Mines and Geology.

Metals

by Richard B. Jones

The following table lists exploration activity in Nevada (it is not an exhaustive tabulation, but only a sampling):

Churchill County

Fondaway Canyon	S6,T22N,R34E	Au	Tundra Gold Mines continued drilling.
Mopung Hills	S3,T23N,R29E	Au	Nassau drilling.

Clark County

Capitol Com	S8,T26S,R65E	Au	Amselco drilling 1983-84.
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Elko County

Sammy Creek	S2,11,T42N,R53E	Au	Bull Run Gold Mines/Freeport Minerals drilling.
Charleston	S25,T44N,R57E	Au	Remington Gold Corp. exploring.
Spruce Mtn.	S22,T31N,R63N	Au, Ag	National Treasurer Mines leased claims to Sante Fe Mining.
Jarbidge	S28,T46N,R58E	Au, Ag	Minerals West exploring new vein discovery.
Shanachie-O'Reilly	Wells area	Ag, Pb, Zn	Owned by Beaver Resources, Leased to Exxon Minerals. Drilling massive sulfide target.
Dexter	S34,T40N,R51E	Au, Hg	Goldbelt Mines drilling (26,000 ft) under option from Pecos Resources.
Rain	NW/4(?)T31N,R53E	Au	Newmont drilling on disseminated gold deposit.
(?)Moonlight Mine	S13,T39N,R46E	Au	Asarco exploring.

Esmeralda County

Weepah	S19,T1N,R40E	Au, Ag	Pacific Realm drilling.
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Eureka County

Geddes Bertrand	S11,T18N,R53E	Ag, Au	Joint venture (Amselco/T.R.V. Minerals) drilling.
Carlin area		Au	Newmont continued search with encouraging results.
Horse Canyon area	S32,T27N,R48E	Au	Placer Development discovered 540,000 tons of 0.05 oz/ton.
Carlin Mine area		Au	Western State Minerals discovery.

Humboldt County

(?)Horse Creek/ Ikes Canyon	S9,16,T46N,R34E	Au, Cu	Placer Development Ltd. has leased large claim block.
Halcyon Mine area	S11,12,T45N,R39E	Au	Asarco drilling for 2-3 years.
CX & Mag deposits	S28,T38N,R42E	Au	Pinson Mining Co. found 2 new Au ore bodies near Pinson Mine.

Lander County

Buckingham	S30,31,T32N,R44E	Au	Kenetic Minerals has option to explore. Drilling scheduled.
Buffalo Valley		Au	Joint venture (Lincoln Resources/Austin Resources). Drilling under-way—3 drills.

Mineral County

Walker Lake Reservation			Exotal signed contract to explore reservation.
Rawhide	S4,T13N,R32E	Au	Bear Creek Mining Co. drilling.
Lucky Boy	S17,T7N,R30E	Ag, Pb	Mt. Hope Mining Co. underground exploration at old mine site for high-grade Ag.
Silver Dyke	S4,T5N,R34E	Au, Ag	Joint venture Wesley Mines Ltd. (operator) with Franco-Nevada. Drilling (assays of 0.104 oz Au/ton, 10.06 oz Ag/ton).
Simon Property	~ S7,T8N,R37E	Ag, Pb	Fury Explorations drilling.
Jack Springs	Huntoon Valley	Au	Amselco drilled several holes.

Nye County

Warrior/Lantern Properties	~ S28,T9N,R37E	Au	Newhawk Gold Mines drilling.
Manhattan Gulch	~ S20,T8N,R44E	Au	Gold Seeker Resources exploring gold placers.
Golden King	~ S36,T4S,R55E	Au, Ag	Exxon took option from Royal Minerals on claim block.
Stonewall Project	~ S12,T5S,R43E	Ag	Magnum Resources Inc. exploring.
Grantsville	~ S3,T11N,R39E	Ag, Pb	Fury Explorations drilling. Estimated reserves: 350,000 tons, 6 oz Ag/ton.

Pershing County

Florida Canyon	S11,T31N,R33E	Au	Pegasus Gold Inc. drilling.
Mt. Tobin	(?)S6,T28N,R40E	Au, Ag	Queenstake Resources doing geochemical & geophysical surveys & minor drilling.
Nevada-Packard Mine	S28,T28N,R34E	Ag, Au	Lodestar Energy Inc. exploring mine. Announced 10 million tons, 2.2 oz Ag/ton.
Troy Canyon	S25,T28N,R34E	Au, Ag	Joint venture (Freeport Minerals/Invermay Resources).
Rochester	S21,T28N,R34E	Ag, Au	Coeur d'Alene Mines Corp. bought Asarco's interest and is exploring property. Announced 88 million tons, 1.5 oz Ag, 0.007 oz Au/ton.
Looney Mine	S19,T28N,R34E	Ag, Au?	Invermay Resources purchased old mine. Doing exploration plus testing tailings dumps.
Coyote claims	(?)S19,T28N,R34E	Ag	Rochester Minerals exploring new target.
Seven Troughs	(?)S30,T30N,R29E	Au	Tournigan Mining Exploration optioned patented/unpatented claims.
Bunce Gold Prospect	(?)West of Lovelock (?)(Velvet district)	Au	Joint venture (Noramax/Hillside Energy). Soil geochem values up to 3,700 ppb Au. Trenching, values of 0.036 oz Au/ton.
Calico Hills	~ S10,T35N,R24E	Au	Ferret drilling.
Fortune Cookie Mine	S17,T33N,R36E	Au	Joint venture (Homestake Gold Mining Co./Proquip) on placer deposit.

Storey County

Cedar & Sunday, JT claims	Virginia City area	Ag, Au	Greenwich Resources Inc. has claim groups in area.
Follies Mine	~ S18,T16N,R21E	Au, Ag	Victor Industries.
Brunswick Lode	~ S33,T17N,R21E	Ag, Au	Rea Gold Corp. drilling 4,000-ft-long quartz vein.
Flowery Gold Mine	S23,T17N,R21E	Au	East Comstock Gold Corp. optioned mine from Flowery Gold Mines Corp. 1984 exploration by Anaconda Co.

Washoe County

Olinghouse	~ S33,T21N,R23E	Au	Nevada Pacific Mining developing placer deposit.
Peavine	~ S35,T20N,R18E	Au?	Saga Exploration has large claim block.

White Pine County

Bourne & Shady Lady	~ S5,T23N,R57E	Au, Ag	Arun Mines sampling and drilling two zones.
Little Bald Mtn.	~ S28,T24N,R57E	Au, Ag	Northern Dynasty Explorations drilling new area. Possible 100,000–200,000 oz Au.
Bald Mtn.	S17,T20,T24N,R57E	Au, Ag	Placer Development Ltd. drilling.
Ward Mtn.	S15,T14N,R63E	Ag, Zn, Pb, Cu	Underground exploration of new ore body in old Ward Mine.
Mt. Hamilton	~ S3,T16N,R57E	Au, Ag	Nicor drilling on claims optioned from Queenstake Resources.
Hidden Treasure Mine	S30,T16N,R58E	Ag	F. W. Lewis Co. drilling 3 high-grade intercepts.



Old lime kiln, Mopung Hills, Churchill County. Keith Papke photo.

DEVELOPMENT/FUTURE MINES

by John Schilling

AMAX Inc. announced the discovery of a gold-silver ore body at its Sleeper property in the Awakening (Slumbering Hills) mining district, Humboldt County. Drilling through January 1985 indicates at least 4.2 million tons averaging 0.13 oz gold and 0.73 oz silver per ton, using a cutoff of 0.03 oz gold. Additional mineralization "may be" found laterally and at depth. Production will be from a central high-grade zone containing 1.4 million tons averaging 0.35 oz gold and 1.0 oz silver per ton, using a cutoff of 0.058 oz gold. Initial planning is for open-pit mining at the rate of 500 tons per day; production could begin in 8 months. (AMAX press release, 3 Feb 85)

American Pyramid Resources Inc.'s wholly owned subsidiary, Nevada Silver Inc., signed an agreement with **Southern Pacific Land Co.** for further development of the Bell Mountain silver-gold property in Churchill County east of Fallon. Southern Pacific must spend \$175,000 during 1984 and a total of \$4.4 million in return for a two-thirds interest in the property; Southern Pacific will be the operator if the deposit becomes a mine. (Mining Engineering, Jun 84)

Atlas Corp. announced the discovery of a new gold deposit, the Gold Bar, on the southwest flank of the Roberts Mountains, about 35 miles northwest of Eureka in Eureka County. Over 200 test holes have been drilled, and at least 2¼ million tons of ore averaging 0.09 oz gold per ton (or at least 250,000 oz gold) have been found. Drilling is expected to continue. Atlas has 20 employees in Nevada, including 8 at their exploration office in Reno (Reno Gazette-Journal, 7 Sep 84). The ore occurs essentially at the surface and has a thickness of up to 265 feet. Production is planned before the end of 1985. (Mining Engineering, Nov 84)

Aurun Mines Ltd. leased the Bluebird property in northwest Lander County (S23,T32N,R43E) from **Kenetic Minerals Inc.** Drilling has found 10 million tons averaging 0.11 oz gold per ton. (personal communication, Richard Jones)

Blackhawk Mines Corp., a wholly owned subsidiary of Amerigold Inc., has completed negotiations resulting in the assignment of **Southern Pacific Land Co.**'s 50% position in a joint venture to develop the main district at Goldfield, Nevada. **Pacific Gold and Uranium**, along with **Noranda Exploration**, are each 25% partners in the joint venture, which designates Blackhawk as the operator. Reserves total 2.1 million tons averaging 0.07 oz gold per ton. Reserves are based on 340 drill holes which outline 3 discrete ore bodies. (Nevada Mining Association Bulletin, Summer 84)

Duval Corp. continued development of its Fortitude gold-silver deposit south of Battle Mountain in Lander County. Stripping should be completed before the end of the year. The Fortitude ore body contains 15 million tons averaging 0.15 oz gold per ton; the ore body contains 2.4 million oz gold and

9.2 million oz silver. Capital expenditures will be about \$40 million. (Pennzoil Perspectives Magazine, May 84)

Exxon Minerals Co. continued development plans at its Mt. Hope molybdenum project in Eureka County. Exxon made a request to buy 2,440 acres of public land on which the open-pit mine and mill will be located; Exxon has an additional 4,000 acres of mining claims. A 450-unit camp will be built for single construction workers and a 415-space recreational-vehicle park for families. Once in operation, the mine will employ some 640 workers. The open-pit mine eventually will cover more than a square mile and be over 2,000 feet deep; 120,000 tons of rock will be removed daily, 30,000 tons of which would be ore. A 22-mile power line and an 11-mile water line also will be required. (Reno Gazette-Journal, 27 Jan 85)

FMC Corp. retained Pincoch, Allen & Holt, Inc. to make a mining feasibility study of its "Paradise Peak" gold-silver discovery south of Gabbs in northwestern Nye County. (Mining Engineering, Jun 84) The deposit is estimated to contain 1.2 million oz gold and 43.2 million oz silver; first production is slated for mid-1986. (FMC 1984 Annual Report) FMC believes that "Paradise Peak and Jerritt Canyon [will] remain economic at gold values well below \$300 per ounce." As much as 200,000 pounds of mercury will be produced annually as a by-product during the 12 years of operation. (Mining Record, 30 Jan 85) Late in the year, FMC contracted with Davy McKee Corp. for engineering, procurement, and construction services; construction will begin during the first quarter of 1985. (American Mining Congress Journal, 7 Nov 84) More than 300 construction workers will be hired to build the mill and other facilities; the mine will employ a permanent force of 200 after it goes into operation. FMC expects to mine about 1 million tons of ore per year. (Reno Gazette-Journal, 14 Aug 84)

Lacana Gold Inc. finished tests on 2,000 tons of material from the Santa Fe gold-silver property east of Luning in Mineral County in October. Lacana is the operator in a joint venture with Westley Mines Ltd., which retains a 40% interest. (Wallace [Idaho] Miner, 20 Dec 84)

Nevex Gold Co. announced plans to begin mining at the Haywood-Santiago Mine near Virginia City. The contractor, N.A. Degerstrom Inc. of Spokane, will mine and crush 210,000 tons of gold-silver ore between October 1984 and February 1985 and will build a heap-leaching pad. Heap leaching will begin in November 1984. Reported reserves are at least 445,000 tons averaging 0.12 oz gold and 0.7 oz silver per ton. (Spokane Chronicle, 12 Sep 84)

New Beginnings Resources is building a mill at the Sumich gold property (S27,T16N,R43E) in Lander County. Reserves are 1.5 million tons averaging 0.24 oz gold and 0.70 oz silver per ton. (personal communication, Richard Jones)

Newmont Mining Corp. early in the year began development of the Gold Quarry gold deposit 8 miles north of Carlin in northern Eureka County. The open-

pit mine and cyanide mill, with a capacity of 2.5 million tons of ore a year, is expected to cost \$130 million. Operations are scheduled to begin late in 1985, at a rate of 170,000 oz gold per year. The Gold Quarry deposit contains 8 million oz gold, making it one of the largest gold discoveries in recent years. Operating costs, including amortization of capital costs, are expected to be less than \$300 per oz. (Newmont Mining Corp., First-Quarter Report, 31 Mar 84) The Gold Quarry Mine will provide jobs for approximately 290 persons. (Elko Free Press, 22 Aug 84)

Pacific Silver is exploring the old Buckskin Mine in Douglas County and is constructing a mill at the mine site. Values are in gold and copper. (personal communication, Richard Jones)

Placer Development Ltd. concentrated its exploration efforts in Nevada in a search for gold-silver ore. Drilling on the summit of Mt. Tenabo, near the Horse Canyon Mine, Eureka County, discovered inferred reserves of 540,000 tons averaging 0.05 oz gold per ton. Drilling near the Bald Mountain Mine, White Pine County, found 6 deposits totalling 2.8 million tons averaging 0.09 oz gold per ton. (Mining Record, 17 Oct 84)

Silver King Mines Inc. sold a 40% interest in its Ward Mountain silver property to **Pacific Silver Corp.** for \$3.6 million. Construction is expected to begin early in 1986 on a 1,200-ton-per-day mill; production is expected to begin by late 1987. (Ely Daily Times, 26 Feb 85)

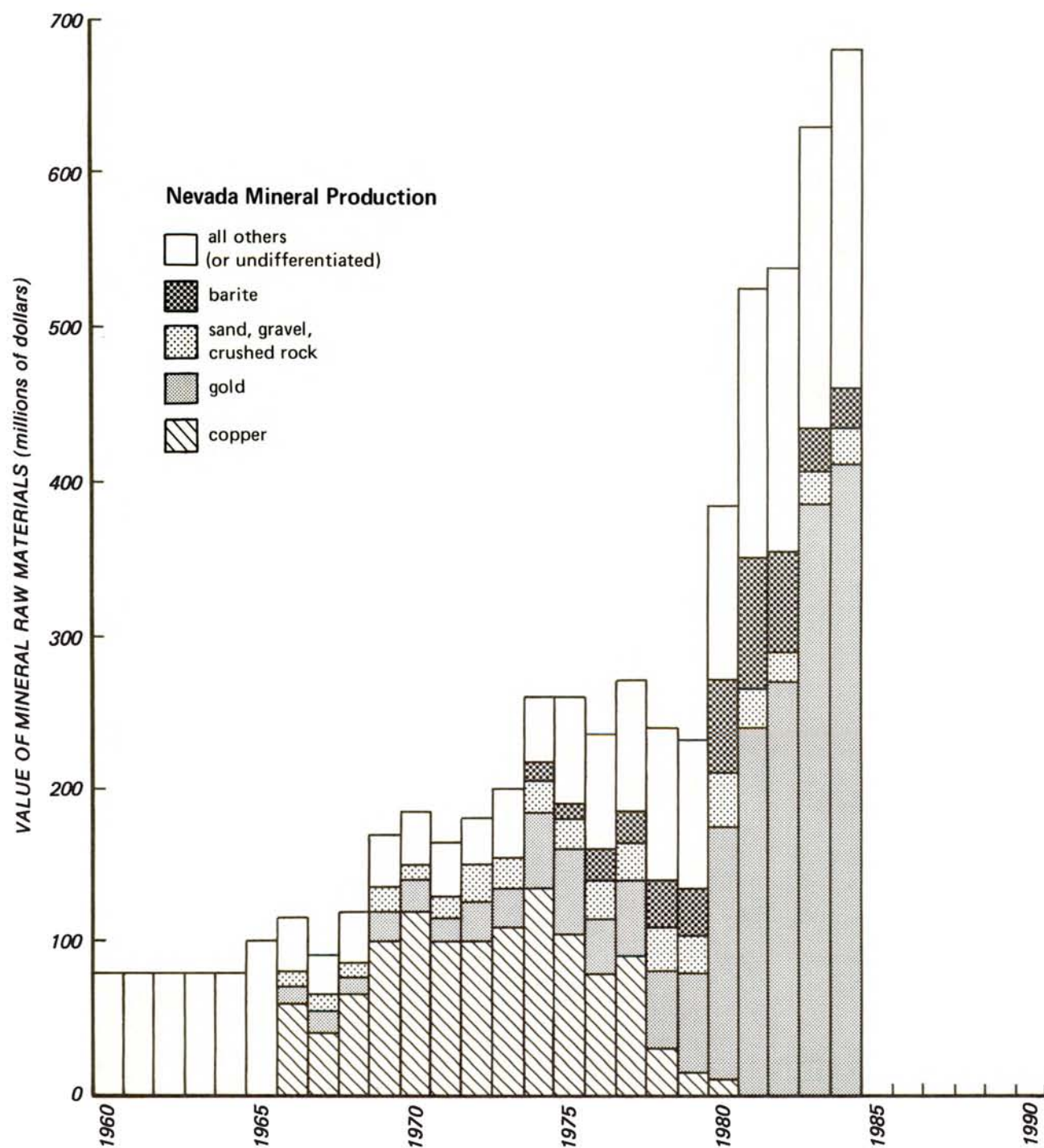
U.S. Steel did exploratory drilling in the Ivanhoe district in southwestern Elko County. Reportedly about 500,000 oz gold have been blocked out in rock grading from 0.07 to 0.1 oz per ton. Bear Creek also is active in the district.

U.S. Steel, drilling at Pumpkin Hollow, east of Yerington in Lyon County, reportedly has outlined 8 million tons averaging 3% copper, 0.02 oz gold, and 0.4 oz silver per ton.

Westley Mines Ltd. is drilling the Atchison gold property in the Santa Fe district, Mineral County, in a joint venture with Lacana Gold Inc. A mineralized zone 1,300 feet long and 10-50 feet wide is present at the surface. Drilling shows values of 0.023-0.033 oz gold per ton. (Wallace [Idaho] Miner, 20 Dec 84) Reserves reportedly are more than 7 million tons averaging 0.041 oz gold and 0.45 oz silver per ton, plus an additional 4.5 million tons averaging 0.066 oz gold and 0.94 oz silver per ton at depth. (Reno Gazette-Journal, 4 Jun 84)



FMC's Paradise Peak gold-silver discovery. FMC photo.



MINING/PROCESSING

The preliminary estimated value of Nevada's mineral production for 1984 was \$671 million. Final figures are expected to exceed \$700 million.

Metals

by John Schilling

New Mines & Other Facilities

Lacana Gold Inc. began operations at the Relief Canyon open-pit gold mine 20 miles east of Lovelock, Pershing County. Duval senior geologist, Jim McKee, discovered the deposit in 1979 on claims located by Falconi and Associates and additional acreage staked by Duval; widely spaced drilling indicated the presence of low-grade gold mineralization. In October 1982, Lacana optioned the property from Duval, and during 1983 drilled 50,000 feet of holes and conducted heap-leaching tests. Reserves total 8 million tons averaging 0.035 oz gold per ton and recoverable amounts of silver. Construction of the gold recovery plant and leach facilities began in June 1984. Leaching began in September, and the first bullion was poured in October. Over 1 million tons of ore will be mined each year, sufficient for a minimum life of 8 years with possible extensions; approximately 24,500 oz gold will be produced annually. Capital costs were \$1.9 million for pre-production development and \$4.8 million for construction. The mine will employ over 40 persons. (Lacana Gold Inc. booklet) Lacana announced the appointment of D. E. Hopkins as project manager

NEVADA'S ROLE IN U.S. MINERAL SUPPLY IN 1984

Commodity	Share of U.S. output (percent)	Rank in Nation
Barite	83	1
Diatomite	35	2
Fluorspar	1	3
Gemstones	15	2
Gold	58	1
Lithium	35	2
Magnesite	100	1
Mercury	99	1
Silver	13	3

and W. Coughlin as plant superintendent (Mining Engineering, Nov 84).

Rayrock Mines Inc. began production at the Dee gold mine, northwest of the Carlin gold mine, late in 1984. Rayrock is the managing partner; other partners are Dome Exploration Ltd., Lacana Gold Inc., and John S. Livermore. Reserves are 2.7 million tons containing 0.115 oz gold per ton, plus 3 million tons containing 0.025 oz per ton. The mine is named for Whit (Dee) DeLaMare, prospector for Cordex Exploration, who in 1980 found gold values in samples he had taken. After extensive drilling, construction of a mill and development of two open-pit mines began in 1983; more than \$22 million has been spent during development. The mine is expected to produce about 38,000 oz gold per year plus an equal amount of silver; mining is expected to last 9 or 10 years. The mine currently employs about 100 people. The annual payroll will be \$3 million, with total

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NEVADA'S MINERAL PRODUCTION¹

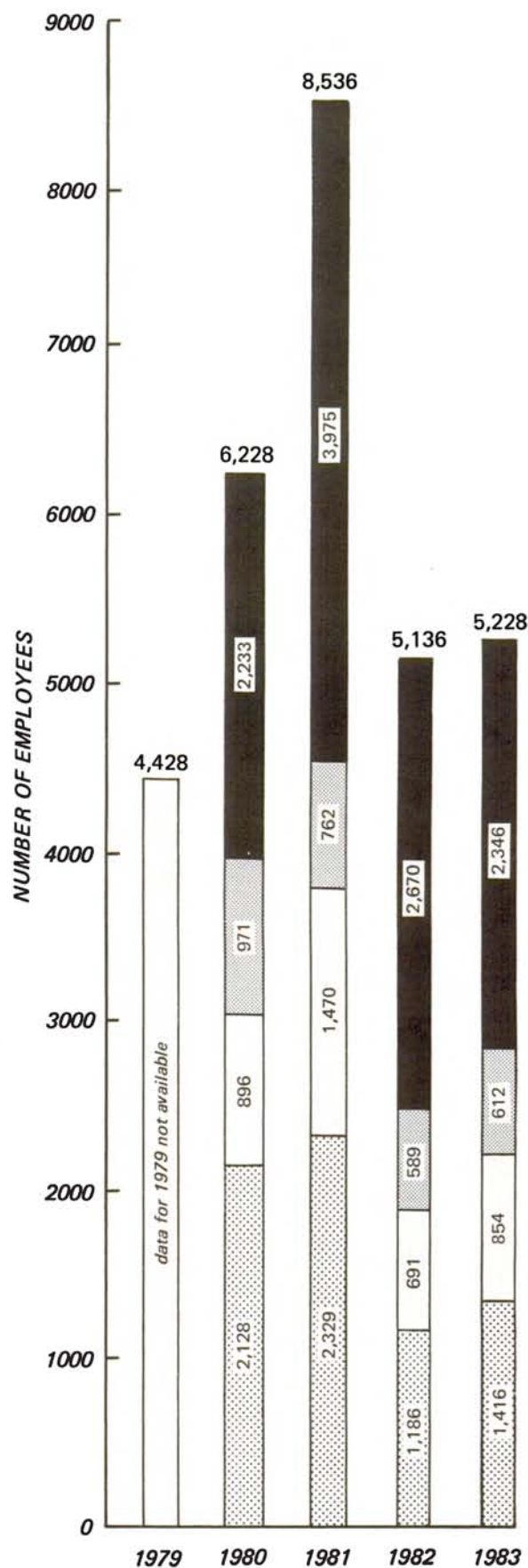
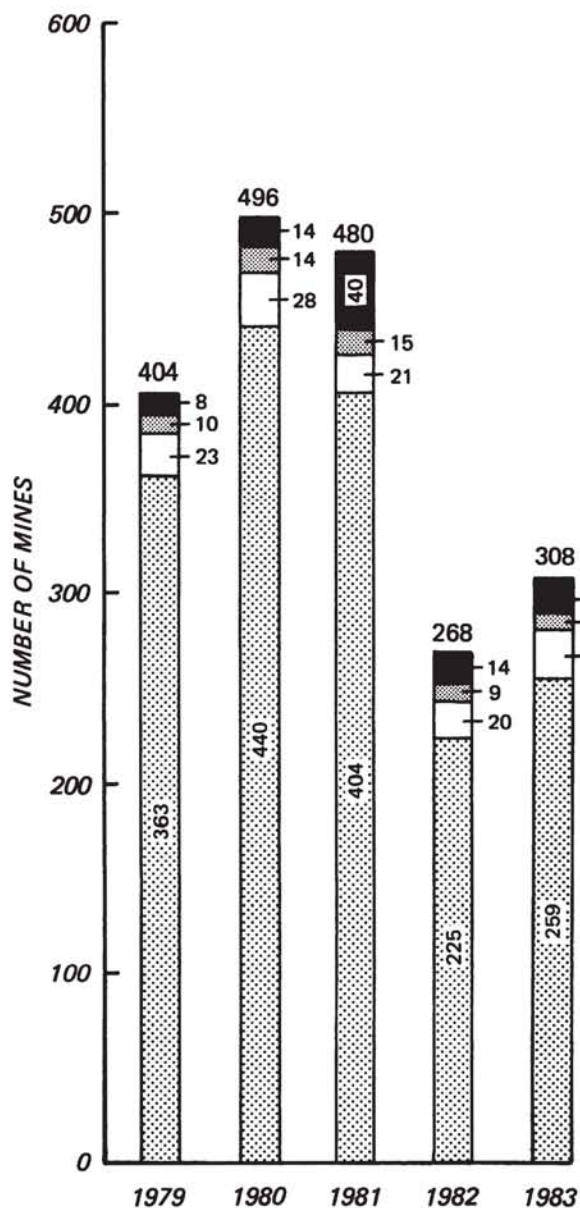
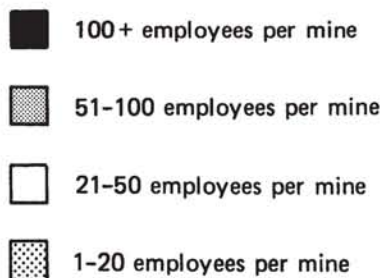
Mineral	Unit	1983		1983 ^P		1984 ^P	
		Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite	thousand short tons	663	\$21,736	651	\$20,004	768	\$18,211
Cement	W	W	W	W	W	W	W
Clays	thousand short tons	58	2,348	51	1,337	61	2,288
Copper	W	W	W	W	W	W	W
Diatomite	W	W	W	W	W	W	W
Fluorspar	W	W	W	W	W	W	W
Gemstones	—	1,200	—	1,200	—	1,200	—
Gold	troy ounces	920,331	390,220	732,915	311,489	1,093,647	410,118
Gypsum	thousand short tons	998	7,896	759	5,567	1,108	9,086
Iron ore	thousand long tons	W	W	W	W	W	W
Lead	14	7	14	7	W	W	W
Lime	W	W	W	W	W	W	W
Lithium	thousand pounds lithium carbonate	W	W	W	W	13,996	W
Magnesite	W	W	W	W	W	W	W
Mercury	76-pound flasks	25,070	W	25,000	W	20,000	W
Petroleum	thousand 42-gallon barrels	811	24,334	811	24,334	1,954	48,850
Perlite	W	W	W	W	W	W	W
Salt	W	W	W	W	W	W	W
Sand and gravel	thousand short tons	7,500	16,200	7,900	16,000	6,400	11,700
Silica sand	W	W	W	W	W	W	W
Silver	thousand troy ounces	5,164	59,073	2,962	34,063	3,055	25,202
Stone, crushed	thousand short tons	1,269	5,358	1,200	4,000	1,600	6,500
Zinc	W	W	W	W	W	W	W
Combined values indicated by symbol W			111,747		108,005		138,118
TOTAL			\$640,119		\$525,999		\$671,273

¹Production as measured by mine shipments, sales, or marketable production (including consumption by producers), as compiled by U.S. Bureau of Mines (Mineral Industry Survey, Nevada—1984) except for lithium (1984) and petroleum.

^PPreliminary.

W Withheld.

Number of Mines and Employees in Nevada's Mineral Industry



STATE OF NEVADA'S REVENUE FROM MINERAL INDUSTRY

Source	1978	1979	1980	1981	1982	1983	1984
Federal ¹	\$4,847,428	\$6,548,509	\$7,718,102	\$10,262,216	\$12,595,501	\$12,184,106	\$14,412,423
Net proceeds tax ² . .	1,967,717	1,976,912	3,243,145	1,912,754	1,799,735	4,156,623	3,223,986
Geothermal ³	240,000	829,892	753,000	29,937	944,305	642,256	491,302
Total	\$7,055,145	\$9,358,250	\$11,714,247	\$12,204,907	\$15,339,541	\$16,982,985	\$18,127,711

¹Royalties and rentals paid under Section 35 of the Mineral Leasing Act of 1920 (calendar year).

²On gross yield of mine less specified allowable deductions (for 1978-82: fiscal year starting July 1); for 1983-84 calendar year.

³Bonus bid payments and royalties from geothermal leases sales.



Pinson gold heap-leach pads; mill in distance. *Lacana photo.*

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Dee gold mill. *Lacana photo.*

expenditures of over \$7 million. (Elko Daily Free Press, 20 Oct 84)

Rayrock Resources began open-pit mining at the Preble deposit 12 miles south of the Pinson Mine in eastern Humboldt County. The Preble deposit will add 17,000 oz gold per year to Pinson's productions over the next 5 years. Reserves are 1,791,000 tons averaging 0.062 oz gold per ton. Other Pinson partners are Lacana Mining and United Siscoe Mines. (American Mining Congress Journal, 7 Mar 84)

Standard Slag Co. began heap leaching gold-silver ore at the Lewis open-pit mine near Sulphur in Humboldt County. The company received a \$2 million state-authorized loan to partially finance development—the first industrial development bonds for a mining operation in Nevada. The mine handles 3,500 tons of ore per day; reserves exceed 10 million tons. (American Metal Market, 2 Oct 84) The mine will employ 35 persons (The Humboldt Sun, 3 Apr 84).

Reopenings/Other Activities

Asamera Minerals (U.S.) Inc. in October reached the full production capacity of 350 tons per day at the Gooseberry underground gold-silver mine in Storey County. Reserves are 561,000 tons averaging 0.26 oz gold and 10.18 oz silver per ton; the vein has a known strike length of 3,000 feet and has been traced to a depth of 1,450 feet. (Wallace [Idaho] Miner, 11 Oct 84)

Carlin Gold Mining Co. produced less gold in 1984 than in 1983, due to the lower average price received (\$366 per oz in 1984 compared with \$424 in 1983). Carlin operates the Carlin, Blue Star, and Maggie Creek open-pit mines, the Carlin cyanide mill and smelter, and heap-leaching facilities at the Maggie Creek and Bootstrap Mines. During 1984, 878,528 tons of low-grade ore was heap-leached, yielding 29,982 oz gold. The company mined, milled, and produced:

	1984
Ore and waste mines (short tons)	9,640,283
Ore milled (short tons)	938,345
Grade of ore milled (troy oz per ton)	0.158
Mill gold production (troy oz)	127,633
Leach gold production (troy oz)	29,982
Total oz	157,615
(Newmont 1984 Annual Report)	

Carlin will heap leach gold during the winter months using a high-efficiency liquid heating system from Trane Thermal. The system will allow Carlin's mines to operate year-round and will result in significant production increases. (Mining Engineering, Aug 84)

Duval Corp. employees at the Battle Mountain mines won the Sentinels of Safety trophy for open-pit mines for 1983; Duval employees worked 400,930 employee-hours during the year without a lost-time injury. (American Mining Congress Journal, 29 Aug 84)

Minex Resources Inc. resumed heap leaching in May at the Fire Creek gold mine in Crescent Valley, northern Nye County. The mine is owned by Klondex Mines. Minex is the operator and had begun heap leaching in September 1983, but discontinued operations in November. (Elko Daily Free Press, 15 May 84) In the fall of 1983, Minex poured the first gold bar (210.84 troy oz) at the mine; a second bar (305 troy oz) was poured in October 1984. (American Metal Market, 2 Nov 84)

Nerco Minerals Co. announced the acquisition of a 50% non-operating interest in the Taylor silver mine, 14 miles southeast of Ely in White Pine County. Nerco acquired the interest from Agnew Enterprises. The mine will be a joint venture between Nerco and Silver King Mines Inc., which will continue as mine operator. Nerco also owns and operates the Candelaria silver mine near Hawthorne and is 50% owner of the Alligator gold mine in northwestern White Pine County. (Nevada State Journal, 3 Apr 84)

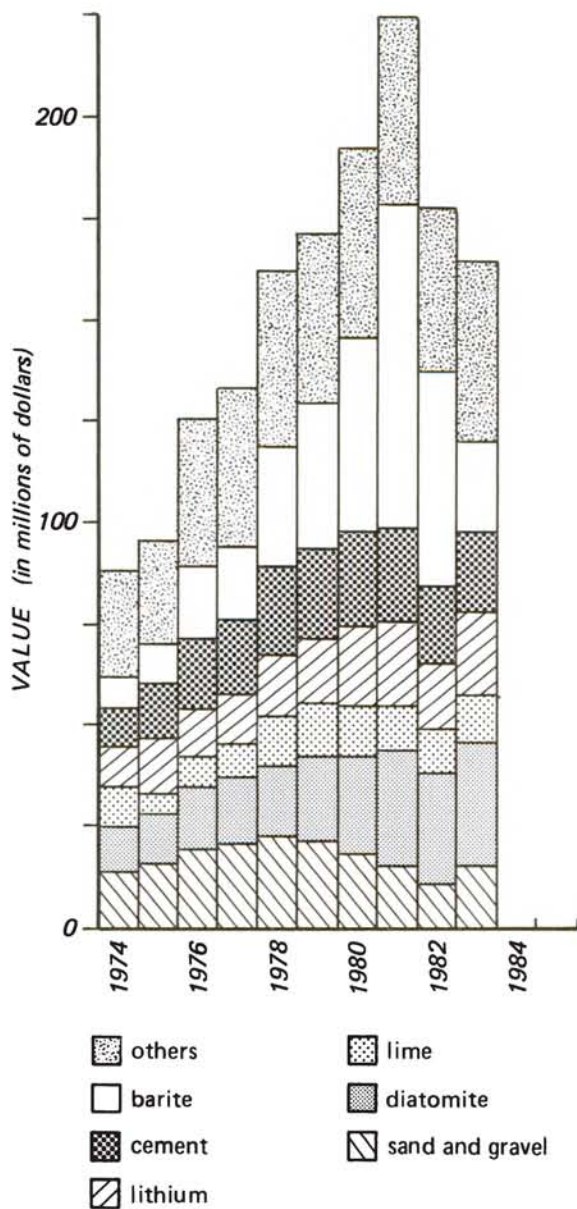
Placer USA Inc. produced 3,500 oz gold from 66,000 tons of ore at the Bald Mountain Mine in northwestern White Pine County during 2 months of operation (Mining Record, 17 Oct 84).

Sunshine Mining Co. processed a record 20,840 tons of ore at the 16-to-1 Mine near Silverpeak in October. Mill modifications earlier in the year have greatly improved throughputs. (Kellogg [Idaho] Evening News, 8 Jan 85)

Industrial Minerals by Keith G. Papke

The value of industrial-mineral production in Nevada for 1984 is estimated by me at \$190 million, based in part on preliminary data collected by the U.S. Bureau of Mines. This figure is considerably higher than the \$168 million estimated for 1983, but well below the all-time high of \$225 million estimated for 1981. The top chart on page 13 shows industrial-mineral production from 1974 through 1983, whereas the bottom chart shows industrial-mineral production versus population growth for the past 50 years. The steady growth of the diatomite industry in the past 10 years is noteworthy; in 1983 diatomite replaced barite as the State's most valuable industrial mineral. "Active Mines and Oil Fields" (Map 84), published by the Nevada Bureau of Mines and Geology in 1984, shows industrial-mineral, metal, and oil producers in the State.

The principal commodities produced, in terms of value, were barite, cement, diatomite, and lithium carbonate. Nevada also produced the following: bentonite, kaolin and sepiolite clays; decorative and crushed stone; fluorspar; gemstones; gypsum; lightweight aggregate; limestone, lime, dolomite, and dolomitic lime; magnesite and magnesium oxide; perlite; pyritic soil additive; salt; sand and gravel; and silica. Borate mined in Death Valley, California, and hectorite (a lithium-bearing swelling clay) and



Nevada industrial-mineral production

zeolite mined at 2 separate localities just south of the State line were processed at 3 plants in southern Nye County. Nevada ranked first in the United States in value of barite and magnesite production, second in diatomite, gemstones, and lithium carbonate, third in fluorspar, and sixth in gypsum.

Barite. In 1984 the tonnage of barite produced in Nevada increased about 15% over 1983, although the total value is reported to have declined by an equal percentage. Nevada continued to produce about 85% of the total United States output of barite. The number of oil and gas drill rigs that were operated in the continental United States stayed fairly constant during the year, 2710 at the start of the year and 2650 at the end, but imported barite met about 65% of the domestic needs. Most of the Nevada barite production was attained by Dresser Industries, Inc., Milchem, Inc., and NL Industries, Inc. A lawsuit that closed the Chromalloy American Corp. barite mine north of Wells was decided

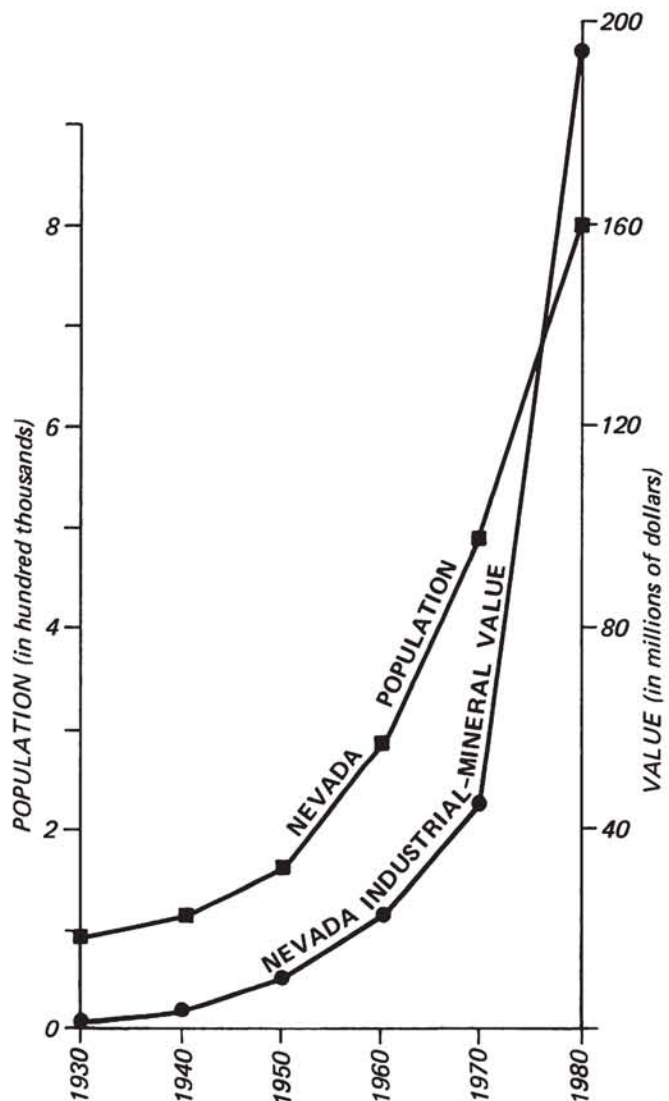
in district court in terms generally favorable to Chromalloy.

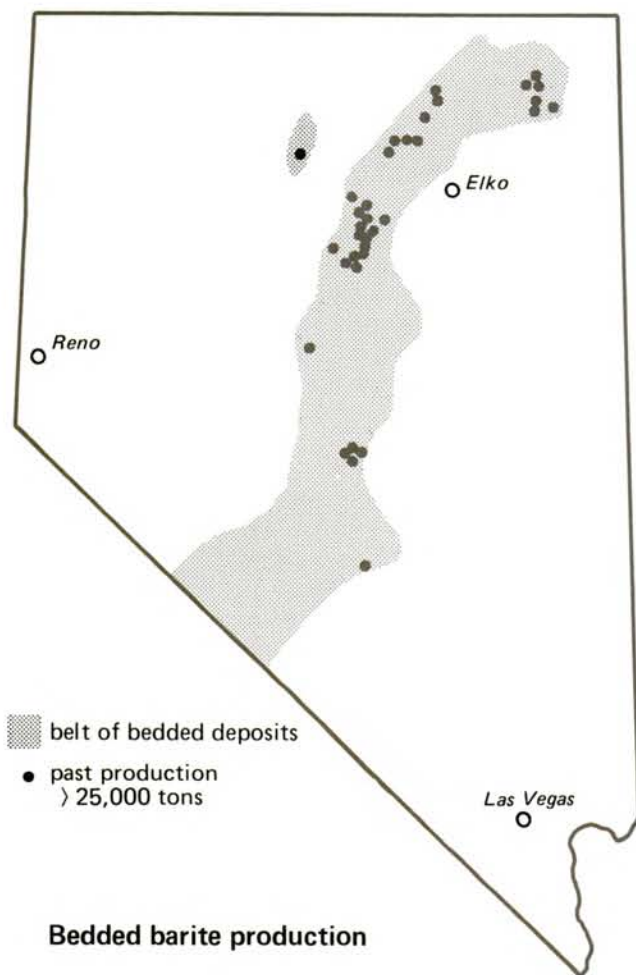
Diatomite. Three companies produced diatomite from Miocene or Pliocene freshwater lake deposits. Eagle-Picher Industries, Inc., with plants in Pershing and Storey Counties, was the largest producer. Grefco, Inc., with a mine and plant in Esmeralda County, and Cyprus Industrial Minerals, Inc., with 2 mines in Churchill County and a plant in Lyon County, also produced diatomite.

Cement. Nevada Cement Co., with a plant near Fernley in Lyon County, continued to produce at about the same level, utilizing freshwater limestone mined nearby and clay mined in central Washoe County. Nevada Cement operates the only cement plant in Nevada.

Lithium Carbonate. Foote Mineral Co. at Silverpeak in Esmeralda County recovered lithium carbonate by solar evaporation and chemical processing of lithium-rich brines pumped from beneath the Clayton Valley dry lake.

Gypsum. Three companies operated wallboard plants in Nevada: Genstar Building Materials Co. and Pacific Coast Building Products, Inc., in Clark County, and U.S. Gypsum Co. in northern Washoe County. Demand for wallboard was at a high level during





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the year and—although the data are not shown in the statistics concerning industrial-mineral production in Nevada—the conversion of gypsum to wallboard is an important industry in Nevada. During the year, U.S. Gypsum Co. began to supply its wallboard plant at Fremont, California, with calcined gypsum from the Washoe County operation, and Pacific Coast Building Productions, Inc. began to supply its wallboard plant at Newark, California, with calcined gypsum from the Clark County operation.

Carbonate Rocks. Genstar Cement and Lime Co. produced carbonate rocks and lime at 3 locations in

Clark County: dolomite at Sloan, limestone at Apex, and lime at Henderson. A deposit of dolomite near the Apex plant was being explored. In the late part of the year, Marblehead Lime Co. opened a large limestone mine near Pilot Siding in eastern Elko County. The crushed rock is hauled 60 miles by truck to their lime plant in Utah. Dolomite mined and ground at 2 small operations near Winnemucca is used mainly as a feed additive for dairy cattle.

Construction Materials. Production of sand, gravel, crushed rock, and lightweight aggregate for the construction industry improved during the year. Norwest Exploration of Reno announced plans to open a lightweight-aggregate pit north of Lockwood, Washoe County; 250,000 tons of material per year would be processed.

Magnesite. C-E Basic's magnesite operation at Gabbs in northwestern Nye County continued to operate at a low and intermittent level. This mine is the only domestic source of rock magnesite; the material is used in refractories in the steel and in other industries and to make magnesium oxide.

Silica. Simplot Silica Products enjoyed a good year, producing high-grade silica for glass plants in southern California and for the foundry industry.

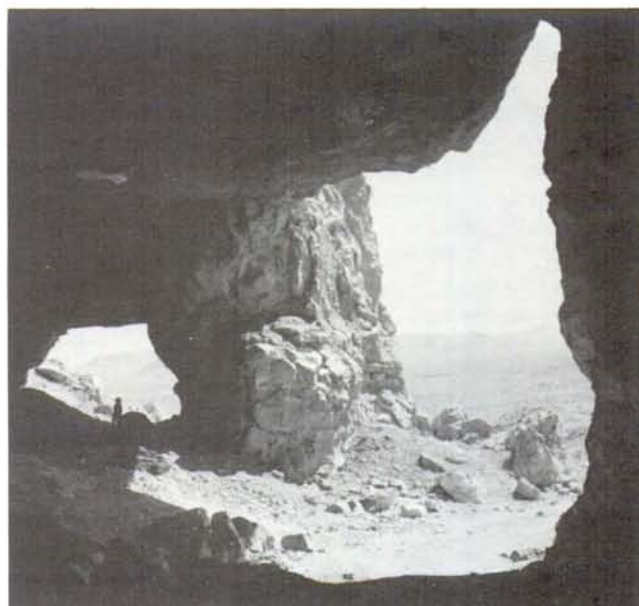
Clays. The largest producer of Nevada clays, Industrial Mineral Ventures, Inc., mined and processed sepiolite and bentonite in southern Nye County. Hectorite mined nearby in California and bentonite from Wyoming were processed at the plant to make high-value organo-clad clays.

Zeolites. Zeolite International, Inc. screened and bagged clinoptilolite (one of the zeolites); the mill in southern Nye County and the mine, several miles south in California, are leased from Anaconda Minerals Co. Vanderbilt Minerals Co. continued to produce bentonite clay, mostly from their underground mine near Beatty.

Fluorspar. J. Irving Crowell, Jr., and Son mined fluorspar in the Daisy Mine, an underground mine near Beatty.



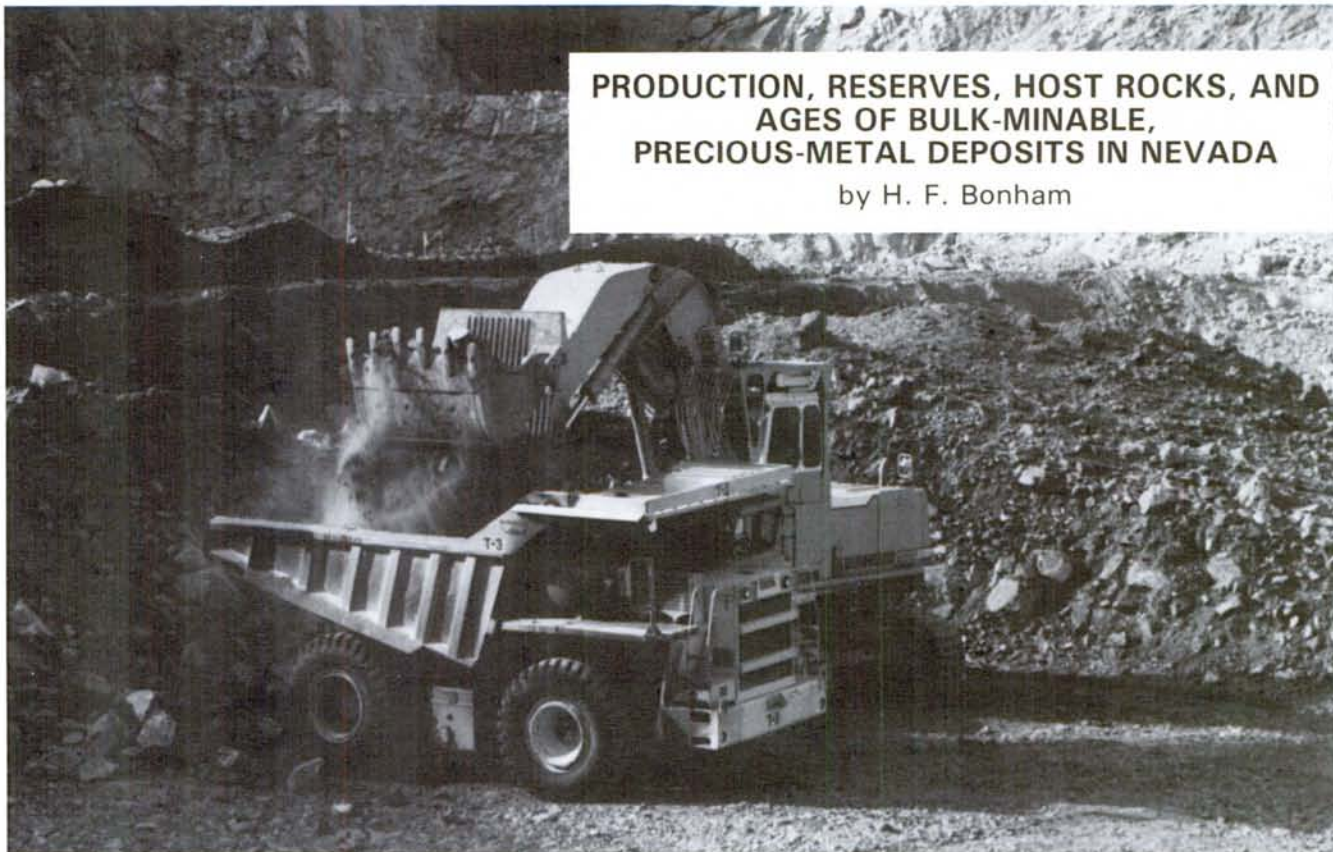
Diatoms magnified 400 times. Keith Papke photo.



Arden Hill gypsum mine. Keith Papke photo.

PRODUCTION, RESERVES, HOST ROCKS, AND AGES OF BULK-MINABLE, PRECIOUS-METAL DEPOSITS IN NEVADA

by H. F. Bonham



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Deposit name	Announcement date	Reserves (estimated or announced)	Production period	Production	Host rock	Mineralization age
Alligator Ridge	Jan 83	5 million tons 0.09 oz Au/ton	1981-83	2 million tons 0.11 oz Au/ton to 1 Jan 83; 60,000 oz Au, 14,000 oz Ag/year	Pilot Shale	early Oligocene?
Atlanta	1980	1.1 million tons 0.08 oz Au, 1.6 oz Ag/ton	1980-84	88,000 oz Au, 1,710,000 oz Ag to Oct 80	Pogonip Group, Ely Springs, Laketown dolomites, Oligocene silicic tuff, dacite dikes	early Miocene?
Aurora	1983	1.5 million tons 0.129 oz Au, 0.3 oz Ag/ton	1930's 1983	500,000 tons 0.2 oz Au/ton 85,000 tons 10,000 oz Au	andesite, rhyolite	10 m.y.
Bald Mtn.	1984	<i>Placer-Amex</i> : 2.8 million tons, 0.09 oz Au/ton <i>Northern Dynasty</i> : 200,000 oz Au, 0.15 oz Au/ton	1984	66,000 tons 3500 oz Au	Cambrian limestone and shale	early Oligocene?
Bell Mtn.	1982	1 million tons 0.055 oz Au, 1.4 oz Ag/ton (possible additional 1 million tons 0.022 oz Au, 1.0 oz Ag/ton <i>Sphinx zone</i> : 500,000 tons 0.14 oz Au, 3.3 oz Ag/ton)		no production	rhyolitic tuff	Miocene

continued

PRODUCTION, RESERVES, HOST ROCKS, AND AGES OF BULK-MINABLE, PRECIOUS-METAL DEPOSITS IN NEVADA (continued)

Deposit name	Announcement date	Reserves (estimated or announced)	Production period	Production	Host rock	Mineralization age
Borealis	1981	2.1 million tons 0.08 oz Au, 0.5 oz Ag/ton	1981-84	2.1 million tons 170,000 oz Au	rhyolite flow dome, andesite flows, breccias, volcanoclastic rocks	5 m.y.
Blue Star	Jan 85	1.8 million tons 0.12 oz Au/ton (included in Carlin figures)	1974-84	intermittent	lower Paleozoic sandy siltstone and carbonate rocks, granodiorite	37.5 m.y.
Bootstrap		300,000 tons 0.15 oz Au/ton; 900,000 tons 0.028 oz Au/ton	1974-84	heap leaching low-grade ore	dacitic dikes, Paleozoic siltstone and laminated limestone and chert	Cretaceous? or early Tertiary
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		30,000 oz Au, 270,000 oz Ag/year (projected by Cominco)	basaltic andesite, sinter, and silicified sediments	14.6 m.y.
Candelaria	1982	18.5 million tons 1.09 oz Ag, 0.009 oz Au/ton		1.7 million oz Ag, 9000 oz Au/year	Candelaria Formation serpentinite, granitic dikes	Cretaceous
Carlin	1984	4.5 million tons 0.16 oz Au/ton	1965-84	14 million tons 4,300,000 oz Au	Roberts Mtn. Formation	Cretaceous or Tertiary
Fortitude (Copper Canyon) (Battle Mtn.)	1984	16 million tons 0.15 oz Au, 0.57 oz Ag/ton	1978-84	<i>Tomboy-Minnie deposits</i> : 3.9 million tons 0.09 oz Au, 0.28 oz Ag/ton	Battle Formation, Antler Peak Limestone, Pumphnickel Formation	37 m.y.
			1984	70,000 oz Au, 1.2 million oz Ag/year		
Cortez		mined out	1968-82	3,562,100 tons 0.279 oz Au/ton	Roberts Mtn. Formation	34 m.y.
Dee	1982	2.5 million tons 0.12 oz Au/ton; 1.1 million tons 0.028 oz Au/ton heap leach		30,000 oz Au/year	Vinini Formation, Devonian carbonates, dacitic dikes	Cretaceous or Tertiary
Fire Creek	1982	350,000 tons 0.06 oz Au/ton	1983-84	767 oz Au	basaltic andesite	Miocene
Getchell	1983	3.25 million tons 0.18 oz Au/ton (possible 10 million tons 0.16 oz Au/ton)	1938-50, 62-67	788,875 oz Au 2,113,030 tons 0.37 oz Au/ton	Preble Formation, granodiorite dikes, granodiorite	90 m.y.
Gold Acres and Little Gold Acres	1942-84	2 million tons (carbonaceous) ~ 0.1 oz Au/ton		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	Roberts Mtn. Formation, Wenban Limestone, Valmy Formation, quartz porphyry dikes	92.8-94 m.y.
Gold Bar	1984	2.8 million tons 0.09 oz Au/ton		new discovery	Lone Mtn. Dolomite Roberts Mtn. Formation	?
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 m.y.
Gold Quarry	1984	183 million tons 0.043 oz Au/ton (of this, 45 million tons 0.078 oz Au/ton)	1985	170,000 oz Au/year	Ordovician to Devonian chert, shale, siltstone, and impure carbonates, in part, Vinini Formation	Cretaceous or Tertiary

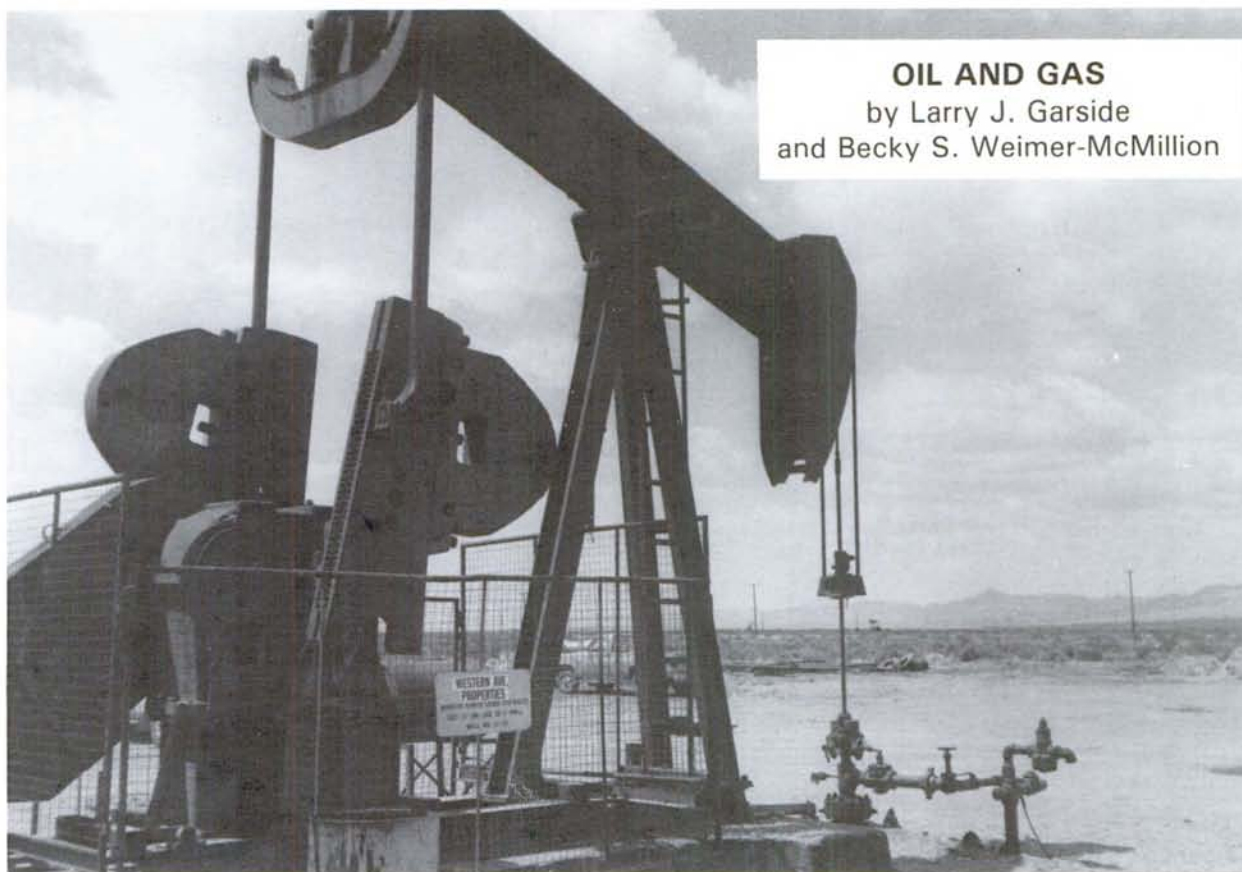
PRODUCTION, RESERVES, HOST ROCKS, AND AGES OF BULK-MINABLE, PRECIOUS-METAL DEPOSITS IN NEVADA (continued)

Deposit name	Announcement date	Reserves (estimated or announced)	Production period	Production	Host rock	Mineralization age
Gold Strike	1983	250,000 tons 0.1 oz Au/ton; 3 million tons 0.04 oz Au/ton	1980-83	36,400 oz Au	Vinini Formation, granodiorite, latite, skarn	78.4 m.y.
Hasbrouck	1982	5 million tons 0.06 oz Au, 1.5 oz Ag/ton		no production	Siebert Formation, tuff and volcaniclastic rocks	16 m.y.
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 open pit table)		no production	Valmy Formation	Oligocene?
Hog Ranch	1984	2.5 million tons 0.085 oz Au/ton		new discovery	rhyolite, explosion breccia, sinter	15-16 m.y.
Horse Canyon	1984	3.94 million tons 0.055 oz Au/ton	1984	40,000 oz Au/year	Vinini Formation, Wenban limestone	34 m.y.?
Ivanhoe	1983	500,000 oz Au 0.07-0.1 oz Au/ton		no production	rhyolitic tuff, flows, volcaniclastic rocks	Miocene
Jerritt Canyon	1981	12.5 million tons 0.231 oz Au/ton	1981-84	962,500 tons/year	Hanson Creek and Roberts Mtn. Formations	Cretaceous or Tertiary
	1985	4.5 million tons 0.14 oz Au/ton (additional reserves)				
Lewis	1984	10 million tons 0.04 oz Au/ton	1984	3500 tons/day	Pleistocene silt, sand and gravels, tuffaceous rocks, sinter	1 m.y.
Maggie Creek	1984	3.6 million tons 0.079 oz Au/ton	1984	1,250,000 tons/year	Ordovician to Devonian siltstone, chert, sand- stone, impure limestone	Cretaceous or Tertiary
Manhattan	1983	5 million tons 0.036 oz Au/ton	1905-59 1983	500,000 oz Au 26-27,000 oz Au/year	Gold Hill Formation	16 m.y.
McCoy	1981	2.5 million tons 0.08 oz Au, 1 oz Ag/ton		no production	Augusta Mtn. Formation granodiorite	36 m.y.
Northumberland	1981	17 million tons 0.045 oz Au/ton	1939-42 1981-84	220,284 tons 32,7000 oz Au 950,000 tons/year	Roberts Mtn. Formation Hanson Creek Formation granodiorite, tonalite, quartz porphyry dikes	85 m.y.
Paradise Peak (Goose)	1984	10 million tons 0.1 oz Au, 3 oz Au/ton		scheduled to commence production in 1986	rhyolite ash-flow tuff, flows and air-fall tuff, andesite flows	Miocene
Pinson	1980	3.245 million tons 0.119 oz Au/ton		1500 tons/day 56,000 oz Au/year	Comus Formation	90 m.y.
	1984	CX zone: 490,000 tons 0.106 oz Au/ton; 500,000 tons leach ore				
	1985	1,049,000 tons 0.09 oz Au/ton				
Preble	1985	1.8 million tons 0.062 oz Au/ton	1985	360,000 tons/year 17,000 oz Au/year	Preble Formation	90 m.y.?

continued

PRODUCTION, RESERVES, HOST ROCKS, AND AGES OF BULK-MINABLE, PRECIOUS-METAL DEPOSITS IN NEVADA (continued)

Deposit name	Announcement date	Reserves (estimated or announced)	Production period	Production	Host rock	Mineralization age
Quito	1984	1.5 million tons 0.2 oz Au/ton		exploration phase	Antelope Valley Limestone	?
Rain		8.3 million tons 0.083 oz Au/ton		no production	Webb Formation	early Oligocene?
Ratto Canyon	1984	~ 200,000 oz Au		exploration phase	Dunderberg Shale, Hamburg Dolomite	?
Rawhide	1984	> 600,000 oz Au 0.06 oz Au/ton		exploration phase	rhyolitic tuff, flows, breccia	Miocene
Relief Canyon	1983	9 million tons 0.032 oz Au/ton	1984	24,500 oz Au/year 1 million tons/year	Natchez Pass Limestone, Grass Valley Formation	?
Rochester	1981	75 million tons 1.5 oz Au/ton		no production	Koipato Group, Weaver Rhyolite	Late Cretaceous
Round Mtn.	1977	12 million tons 0.061 oz Au, 0.07 oz Ag/ton	1977-84	313,480 oz Au 160,419 oz Ag	rhyolite ignimbrite	25 m.y.
	1984	195 million tons 0.043 oz Au, 0.08 oz Ag/ton	1984	70,000 oz Au/year		
Santa Fe	1984	8 million tons 0.032 oz Au, 0.26 oz Ag/ton		evaluation phase	Luning Formation	Miocene
Sleeper	1985	4.2 million tons 0.13 oz Au, 0.73 oz Ag/ton (of which 1.4 million tons contains 0.35 oz Au, 1.0 oz Ag/ton)		exploration phase	Mesozoic slate and phyllite	Tertiary
Standard		mined out	1932-51	884,000 tons 46,602 oz Au 102,721 oz Ag	Natchez Pass Limestone, Grass Valley Formation	73 m.y.
Sterling	1983	200,000 tons 0.20 oz Au/ton (possible 300,000 tons additional reserves of similar grade)	1984	58,000 tons 9000 oz Au/year	Wood Canyon and Bonanza King Formations	14 m.y.
Taylor	1980	10 million tons 3 oz Au/ton	1980	1200 tons/day	Guilmette and Joana limestones, rhyolite dikes	Eocene or Oligocene
Tonkin Springs	1983	1.84 million tons 0.089 oz Au, 0.204 oz Ag/ton		exploration phase	Vinini Formation, dacitic dikes	?
Windfall		3 million tons 0.03 oz Au/ton	1908-16	65,000 tons 0.365 oz Au/ton	Hamburg Dolomite	Eocene or Oligocene
			1975-84	3 million tons 0.03 oz Au/ton		



OIL AND GAS

by Larry J. Garside
and Becky S. Weimer-McMillion

EXPLORATION

During 1984, 36 wells totaling 221,655 feet were drilled in the search for oil and gas in Nevada. This footage drilled is a 319% increase from 1983 and an all-time high for the State (see bar graph). The previous high was 160,595 (28 wells) in 1981. The 1984 footage is 38% higher than that year. The average depth of wells drilled was 6,157 feet, an increase from 5,876 feet in 1983. Nevada's tremendous increase in exploration was due, in part, to the discovery of the Grant Canyon field in Railroad Valley in late 1983. Three wells in this field have already produced (through 1984) over 1.3 million barrels of oil. Also, there was increased interest this year in frontier exploration areas, such as Nevada, by some oil companies. Exploration interest continued into early 1985 as well.

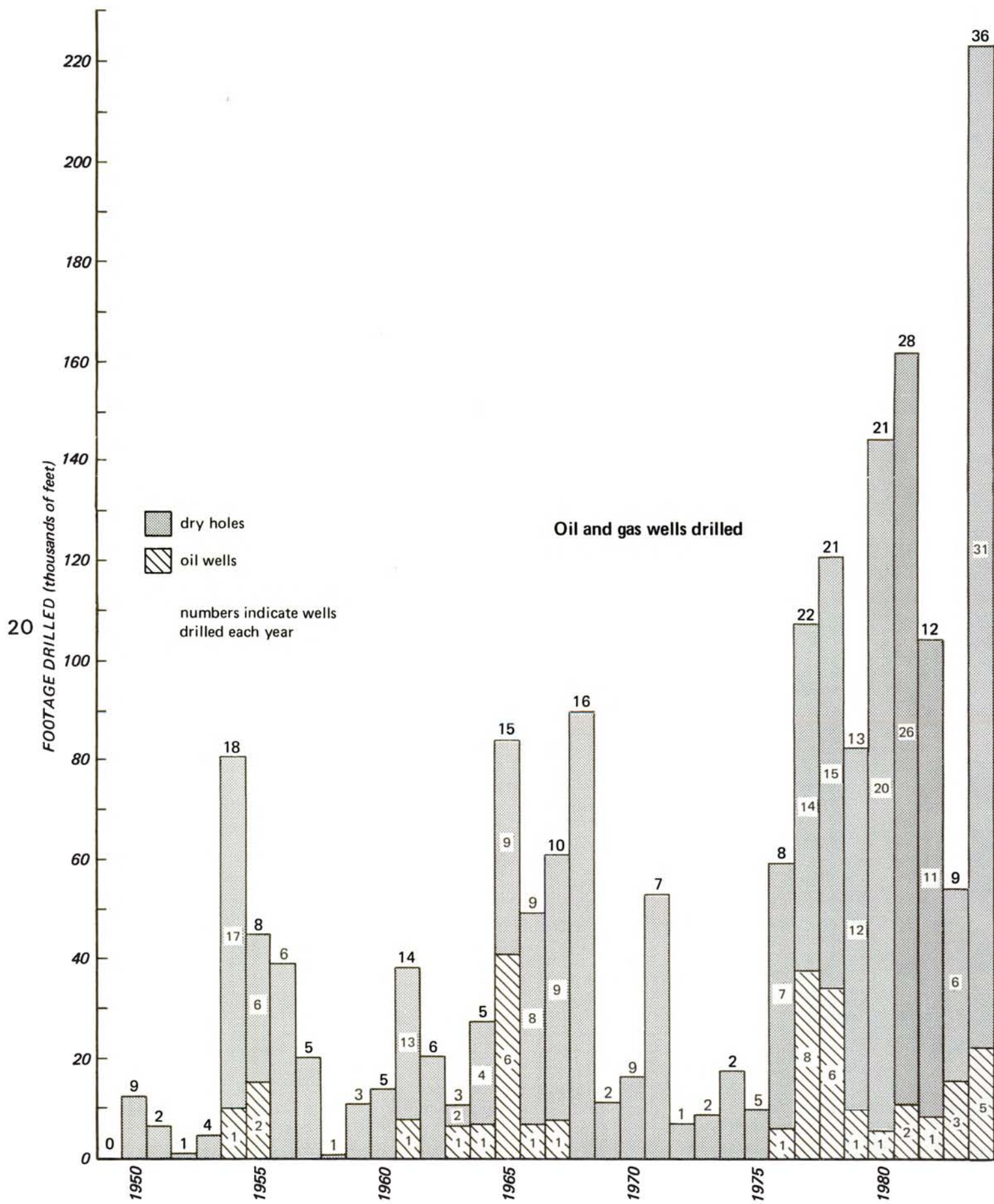
The total Nevada acreage under oil and gas leases (simultaneous drawing plus noncompetitive, see table) decreased from 17.5 million in fiscal year 1983 to 16.3 million in fiscal year 1984, a decrease of 7.4%.

A recent article by F. G. Poole and G. E. Claypool describes recent work on the sources of petroleum in Nevada. The article, entitled "Petroleum Source-rock Potential and Crude-oil Correlation in the Great Basin," was published by the Rocky Mountain Association of Geologists in a collection of papers on the hydrocarbon source rocks of the greater Rocky

Mountain region. The paper reports on a number of Nevada outcrops that contain oil and tarry or solid bitumen as well as subsurface oil shows in exploratory wells.

In May, 10 to 12 barrels of high-gravity crude oil was produced during testing of the Husky Oil Co. (now Marathon Oil Co.) Soda Springs Unit No. 1 well. This well is located in Railroad Valley slightly more than 1 mile northeast of the Grant Canyon field and approximately 3 miles southwest of the Eagle Springs field. The drill-stem test is reported to be from fractured quartzite at approximately 7,700 feet. The gassy oil recovered has a 45° API gravity, a low pour point, and low sulfur content (0.03% sulfur). The tested interval may be in the Lower Cambrian Prospect Mountain Quartzite (F. G. Poole and G. C. Claypool, 1984, "Petroleum Source-rock Potential and Crude-oil Correlation in the Great Basin": Rocky Mountain Association of Geologists, p. 198; Hotline Energy Reports, 19 May 84).

In April and May, Marlin Oil Co. reported good oil shows at their Federal No. 1-4 well in southeastern Elko County. They first encountered shows in Permian rocks, and these shows continued in Pennsylvanian and Mississippian units. The well encountered 10 reservoir-quality zones within a 1500-foot interval in the Mississippian Diamond Peak Formation below approximately 6,600 feet. The well did not encounter any Tertiary section. There was a rumor of up to several inches of oil on the mud pit while drilling. Although noncommercial



OIL AND GAS WELLS DRILLED AND COMPLETED DURING 1984

Company	Well	Permit No.	Depth(ft)	County
Sun Exploration & Production Co.	Toano Federal No. 1	348	10,911	Elko
Sun Exploration & Production Co.	Shafter Federal No. 1	349	8,000	Elko
Amoco Production Co.	East Bailey Ranch No. 1	357	9,000	Eureka
Shell Western Exploration & Production Co.	USA No. 41-24	362	3,235	Nye
Shell Oil Co.	USA No. 34-25	363	2,677	Nye
Husky Oil Co.	Willow Spring No. 1	365	4,715	Nye
Marathon Oil Co.	Soda Springs Unit No. 1	366	8,087	Nye
Marlin Oil Co.	Federal No. 1-4	367	9,080	Nye
Husky Oil Co.	South Trap Spring No. 1	368	4,319	Nye
Husky Oil Co.	Big Meadow No. 1	369	4,986	Nye
Hunt Oil Co.	Diamond Valley No. 1-11	370	6,552	Eureka
Amoco Production Co.	White River Unit No. 3	371	8,700	Nye
Bullwacker Oil Co.	Bullwacker No. 1	372	4,582	Nye
Western Avenue Properties	*Munson Ranch No. 13-32	373	4,515	Nye
Mapco Oil & Gas Co.	Grant Canyon No. 2	374	6,389	Nye
Mapco Oil & Gas Co.	*Grant Canyon No. 3	375	4,302	Nye
Mapco Oil & Gas Co.	*Grant Canyon No. 4	376	4,220	Nye
Diamond Shamrock Exploration Co.	Kimbark KOG Federal No. 1-28	377	12,573	Elko
Marathon Oil Co.	Currant Creek No. 1	378	4,915	Nye
Husky Oil Co.	Highway Unit No. 1	379	3,040	Nye
Marathon Oil Co.	Duckwater Creek No. 1	380	6,000	Nye
Buckhorn Petroleum Co.	Nyala No. 1-R	381	5,676	Nye
Western Avenue Properties	*Munson Ranch No. 13-31	382	4,480	Nye
Humboldt Associates	Ellison No. 2	383	1,020	Humboldt
Mapco Oil & Gas Co.	Thorn No. 1	384	5,584	Nye
Depco, Inc.	Willow Wash Federal No. 42-24	385	7,834	Eureka
Marathon Oil Co.	Beaty Canyon No. 1	396	5,000	Nye
Placid Oil Co.	Steptoe Federal No. 17-14	397	11,700	White Pine
Union Texas Petroleum	Nevada-Federal No. 15-1	398	7,220	Nye
Mapco Oil & Gas Co.	Grant Canyon No. 5	400	4,804	Nye
Arco Oil & Gas Co.	Stag Mountain Federal No. 1	404	10,000	Elko
Jayhawk Exploration, Inc.	Federal Koch No. 2-29	405	6,886	Nye
Western Avenue Properties	*Munson Ranch No. 12-34	406	4,424	Nye
Arco Oil & Gas Co.	Tobin No. 1	408	2,065	Pershing
Mapco Oil & Gas Co.	Grant Canyon No. 8	414	7,044	Nye
Celcius Energy Co.	Duckwater Federal No. 9-1	419	7,120	Nye

*Producing Well

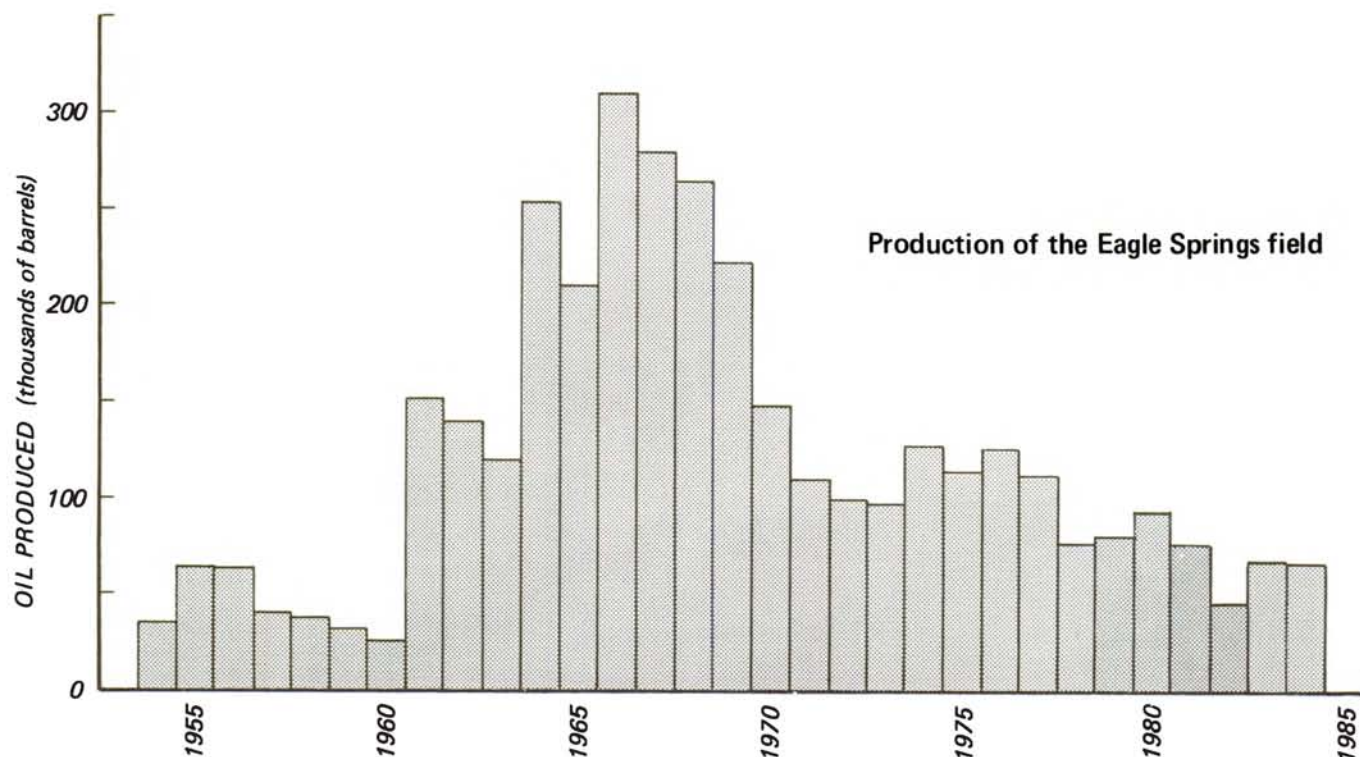
quantities of oil were recovered during tests, there was no trap present, and the well was plugged and abandoned (Rocky Mountain News, 15 Apr 84; Hotline Energy Reports, 14 Jul 84 and 24 Nov 84). Marlin completed a well 6 miles to the south of Federal No. 1-4 in early 1985, but no information has been released.

Western Nevada received some attention in 1984 when Arco Oil and Gas Co. drilled the Tobin No. 1 in the northern Dixie Valley portion of southeastern Pershing County. Arco has another well planned in nearby Pleasant Valley, and three 5,000-foot tests have been staked in Churchill County's Fairview Valley (at the southern end of Dixie Valley) by Dixie Valley Limited Partnership of Woodinville, Washington. Possible Triassic source rocks are found in the mountain ranges flanking the northern part of Dixie Valley. In particular, the Favret Formation contains ammonoids which commonly yield liquid hydrocarbons when broken (Hotline Energy Reports, 17 Nov 84).

PRODUCTION

Nevada's oil production for the calendar year 1984 was 1,907,817 barrels (see table, bar graphs), a 134% increase from 1983. Thirty-eight wells in five producing fields were operated during the year. Approximately 1 million barrels of the increased production was from the Grant Canyon field. The third high-volume producer in that field was completed by **Mapco Oil and Gas Co.** in September. The flowing well produced 1,967 barrels of oil per day with no gas or water. It was probably completed in the Devonian Simonson Dolomite. Two dry holes and one temporarily abandoned well have been drilled while defining the limits of the pool (Hotline Energy Reports, 29 Sep 84).

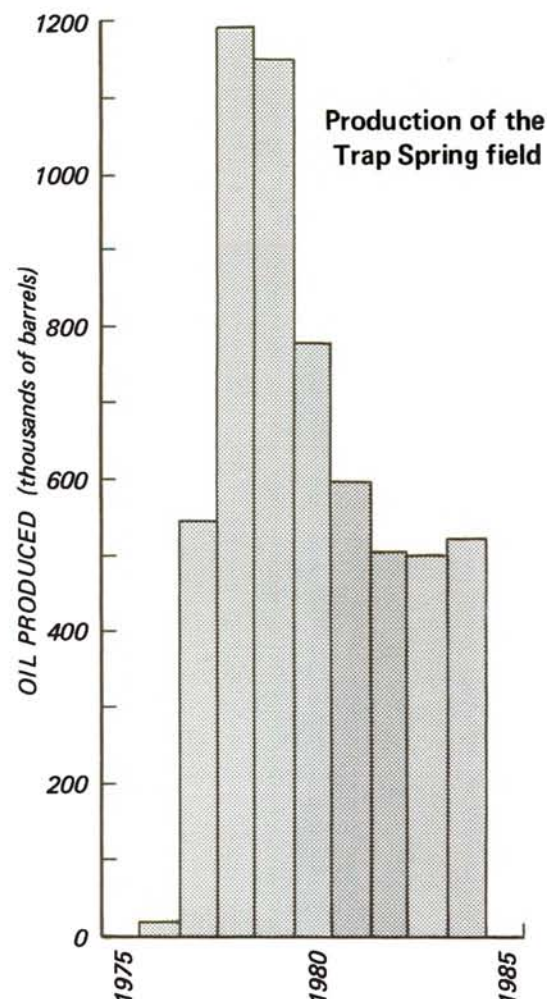
Western Avenue Properties completed three producing wells in the Trap Spring field in 1984, bringing the total of their wells to nine. The two new wells produce 5,000 to 7,000 barrels per month, in contrast to older wells in the field, which generally



produce a few hundred barrels per month. The additional output of the two new wells tripled the production from Western Avenue's portion of the field.

Amoco Production Co. did not drill any more offset wells in 1984 to its two-well Blackburn field in Eureka County. However, one dry hole was drilled by Amoco approximately 12 miles to the north of the field.

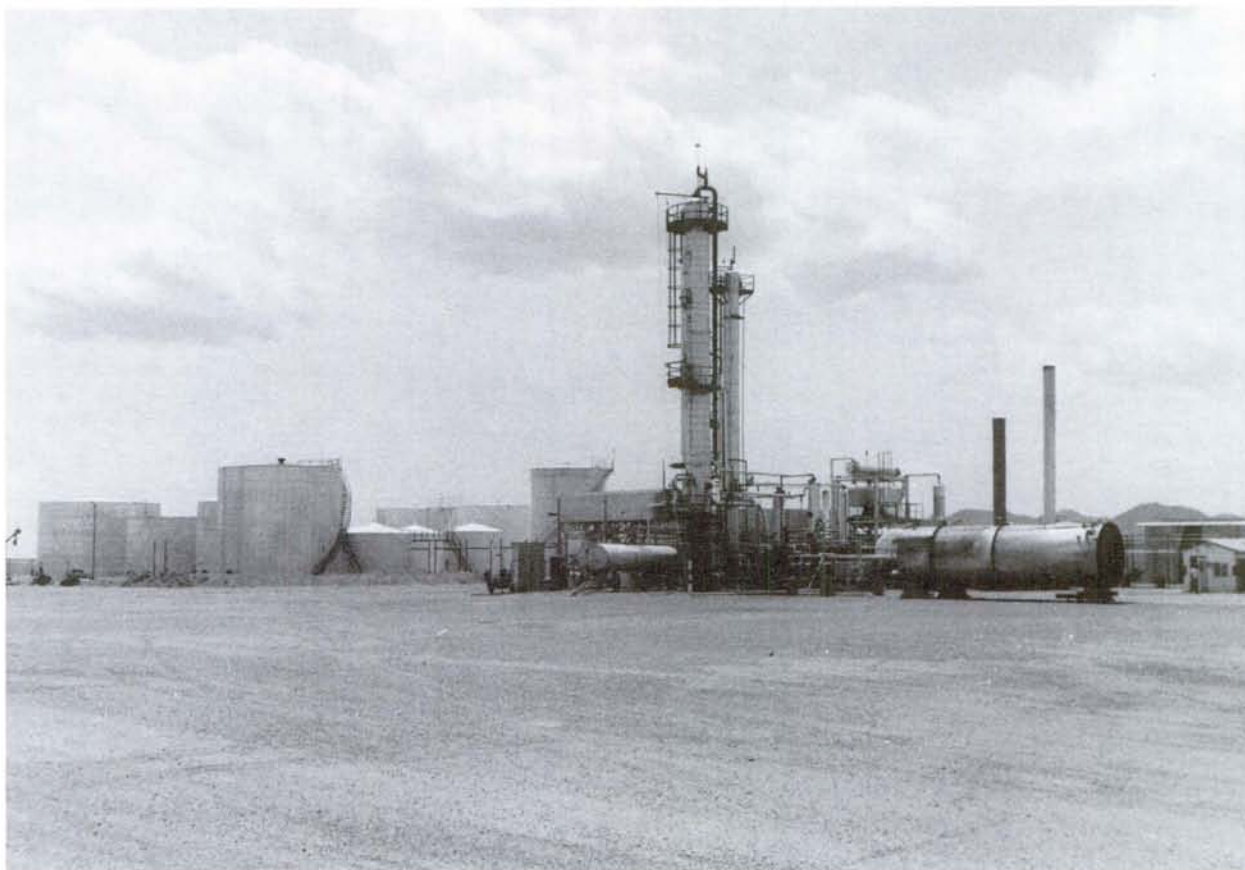
Buckhorn Petroleum, the Denver-based subsidiary of MidCon Corp., has acquired interests held by Northwest Exploration Co. (a subsidiary of the Williams Companies) in the Railroad Valley area of Nye County. These properties consist of portions of 11 producing oil wells in the Trap Spring, Bacon Flat, and Grant Canyon fields, as well as associated undeveloped acreage (Petroleum Information, 12 Apr 84). Harper Oil Co., also a subsidiary of MidCon



NEVADA'S OIL PRODUCTION¹

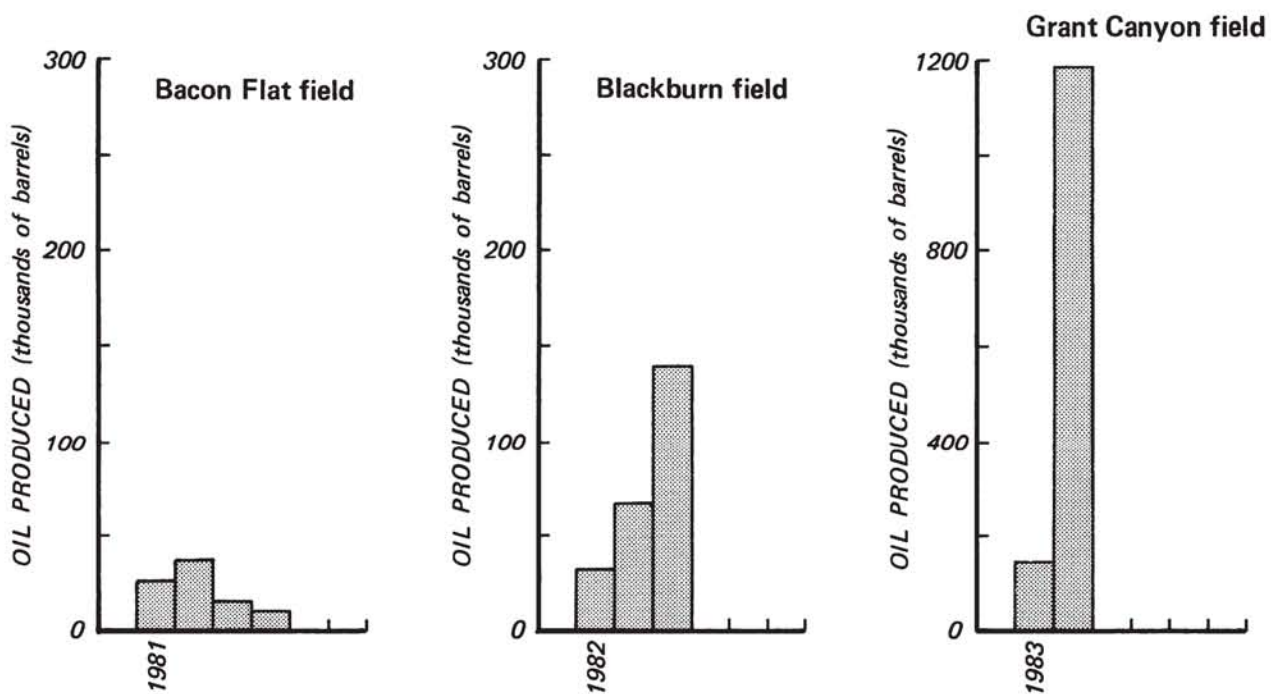
Field (discovery date)	1983		1984	
	year	cumulative	year	cumulative
Eagle Springs (1954)	71,786	3,652,169	69,673	3,721,842
Trap Spring (1976)	492,759	5,185,601	523,039	5,708,640
Currant (1979)	6	641	0	641
Bacon Flat (1981)	13,795	78,535	10,855	89,390
Blackburn (1982)	72,193	102,533	135,541	238,074
Grant Canyon (1983)	163,189	163,189	1,168,709	1,331,898
	813,728	9,182,668	1,907,817	11,090,485
			134% increase	

¹Production (in 42-gal. barrels) as reported by the Nevada Department of Minerals.



Tonopah oil refinery. Paul Iverson photo.

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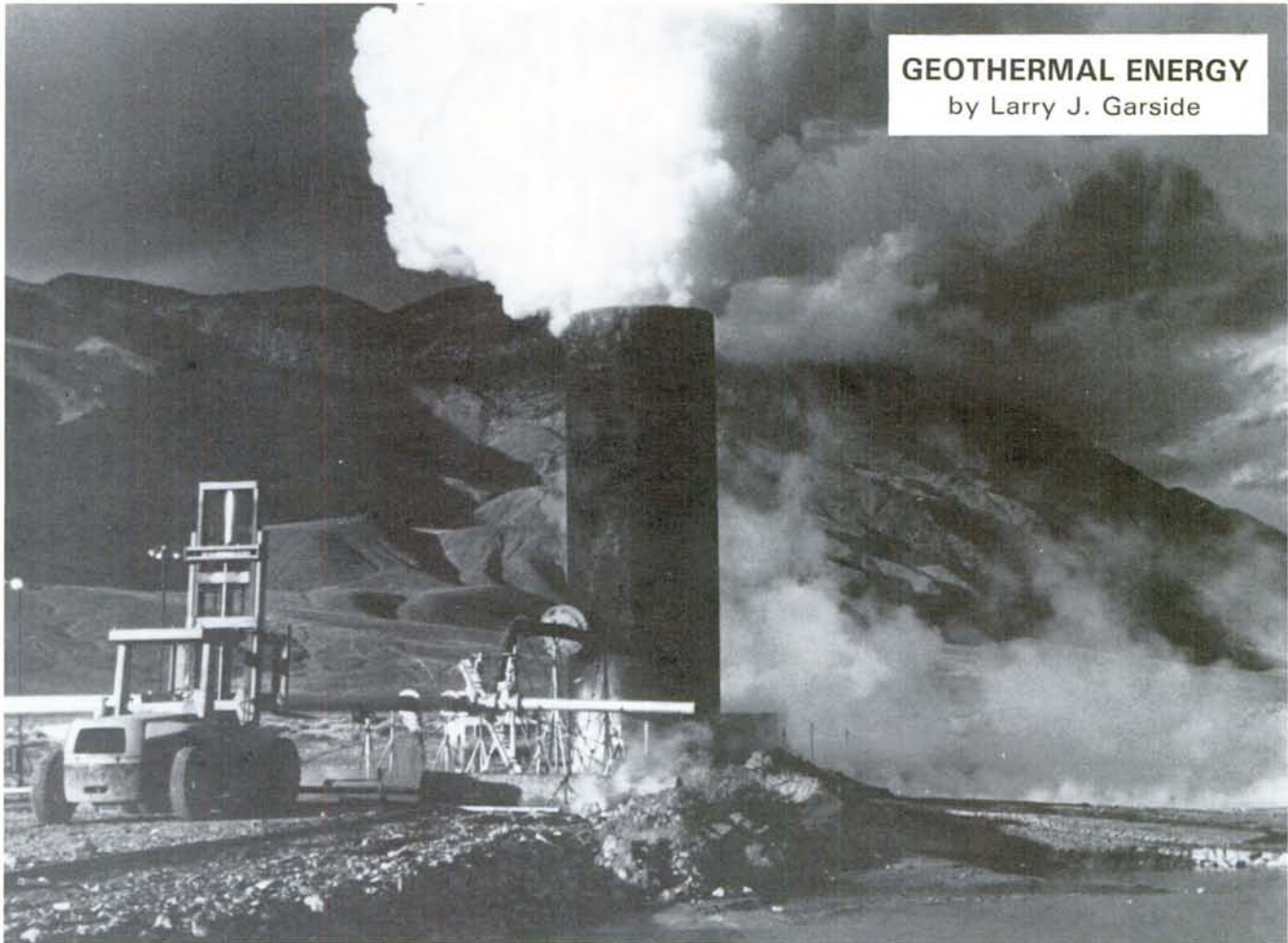
Corp., took over Buckhorn's interests. Marathon Oil Co. acquired the Husky Oil Co. interests in the Railroad Valley fields as part of a takeover of Husky. Presently, Marathon is the operator at the Currant

field, and Mapco Oil and Gas Co, who acquired interests of other owners in the fields, is the operator of the Bacon Flat and Grant Canyon fields and part of the Trap Spring field.

FEDERAL OIL AND GAS LEASES IN EFFECT BY COUNTY¹

COUNTY	NUMBER OF LEASES						ACREAGE					
	Noncompetitive		Competitive		Simultaneous drawing		Noncompetitive		Competitive		Simultaneous drawing	
	FY83	FY84	FY83	FY84	FY83	FY84	FY83	FY84	FY83	FY84	FY83	FY84
Carson City	0	0	0	0	0	0	0	0	0	0	0	0
Churchill	247	201	0	0	12	15	498,508	404,028	0	0	25,433	26,603
Clark	1,089	877	0	0	25	28	1,893,281	1,502,315	0	0	58,231	59,732
Elko	1,453	1,344	0	0	53	69	3,354,410	3,185,280	0	0	142,413	216,640
Esmeralda	6	4	0	0	1	1	22,828	23,541	0	0	2,560	640
Eureka	632	610	0	0	9	22	1,143,792	1,127,509	0	0	42,555	74,964
Humboldt	191	129	0	0	1	1	606,449	347,002	0	0	640	640
Lander	234	225	0	0	7	6	503,857	524,967	0	0	23,078	39,880
Lincoln	1,162	1,007	0	0	23	29	2,692,688	2,337,995	0	0	115,123	131,270
Lyon	0	0	0	0	0	0	0	0	0	0	0	0
Mineral	6	5	0	0	0	0	6,020	8,952	0	0	0	0
Nye	1,630	1,588	2	0	48	88	2,648,280	2,681,957	400	0	60,204	125,560
Pershing	107	73	0	0	6	3	290,896	235,977	0	0	39,899	25,514
Washoe	9	2	0	0	0	0	63,760	2,230	0	0	0	0
White Pine	1,597	1,499	0	0	101	144	2,956,951	2,827,979	0	0	257,925	373,122
Total	8,363	7,564	2	0	286	406	16,681,720	15,209,732	400	0	768,061	1,074,565
	9.6% decrease				42.0% increase		8.8% decrease				39.9% increase	

¹From the U.S. Bureau of Land Management (FY = fiscal year, 1 Oct to 30 Sep).



GEOTHERMAL ENERGY

by Larry J. Garside

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EXPLORATION

Geothermal resource exploration and development drilling increased slightly in 1984; the total footage of three large-diameter wells drilled was 21,746 feet (see bar graph). One of these wells, the AMAX Exploration Inc. Unit 88-11 was a new field wildcat. The other two wells (see table) could be considered development wells in established fields.

Steam Reserve Corp., a wholly owned geothermal subsidiary of **AMAX Exploration, Inc.**, reported completion of a commercial geothermal well on its Fish Lake prospect in Esmeralda County, Nevada. The well is located about 45 miles west of Tonopah, Nevada. The well bottomed at 8,149 feet in a fracture zone in the Paleozoic Harkless Formation. Well temperatures near 400°F have been reported. The well has indicated the capability of supporting 3 to 4 MW of generating capacity under self-flow. Pumped flows will significantly enhance the capacity. One MW of electrical generating capacity corresponds roughly to the needs of 1,000 people (The Geyser, Sep 84).

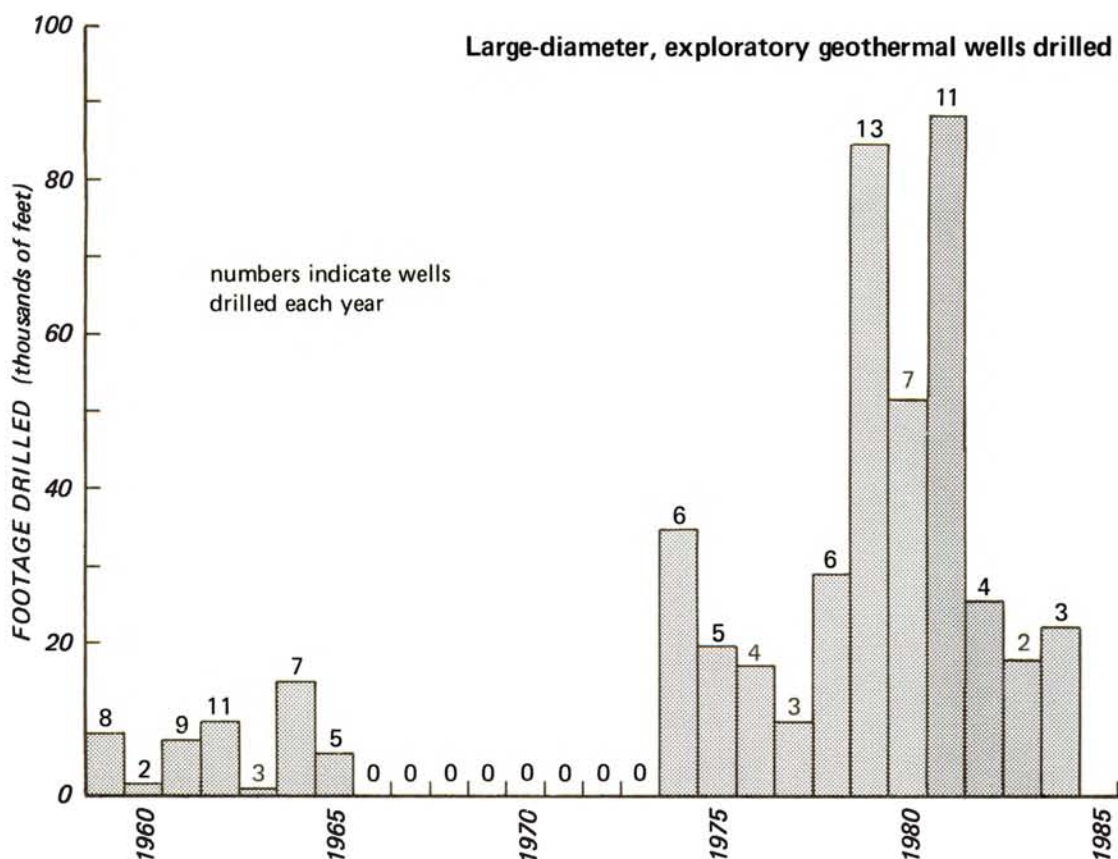
Chevron Resources Co. and **O'Brien Resources Corp.** announced in March the signing of a letter of

intent to allow O'Brien to earn up to a 50% interest in Chevron's 17,000 acres of lease holdings in the Beowawe geothermal area. According to O'Brien Resources president F. D. Corman, the joint venture plans an initial development of 5 to 10 MW (The Mining Record, 21 Mar 84).

DEVELOPMENT

The Bureau of Land Management, in October signed an authorization permitting **Phillips Petroleum Co.** to build a 9-MW geothermal generating plant in Churchill County. Phillip's Geothermal Division said construction would start at once. The plant, which will be part of the Desert Peak federal geothermal unit, should be ready for operation by late 1985. The plant will be located about 30 miles northeast of Fernley and will produce enough energy to supply the domestic needs of approximately 9,000 people. The company will reportedly spend \$20 million on the plant and has already spent approximately \$15 million on field development.

In May, the Nevada Public Service Commission ratified a contractual agreement between Phillips and Sierra Pacific Power Co., which will purchase



the energy produced by the geothermal plant. Plans call for the power to be transported a short distance from the plant by Phillips to Sierra Pacific transmission lines. Southern Pacific Railroad owns the land the plant will occupy and leases the property to Phillips.

The Bureau of Land Management will verify the amount of production after the plant commences operation and will continue to monitor the project to ensure proper management of the geothermal energy resource and that all permit requirements are met. The royalties will be split 50-50 between the Federal Government and the State of Nevada (Intermountain Pay Dirt, Dec 84).

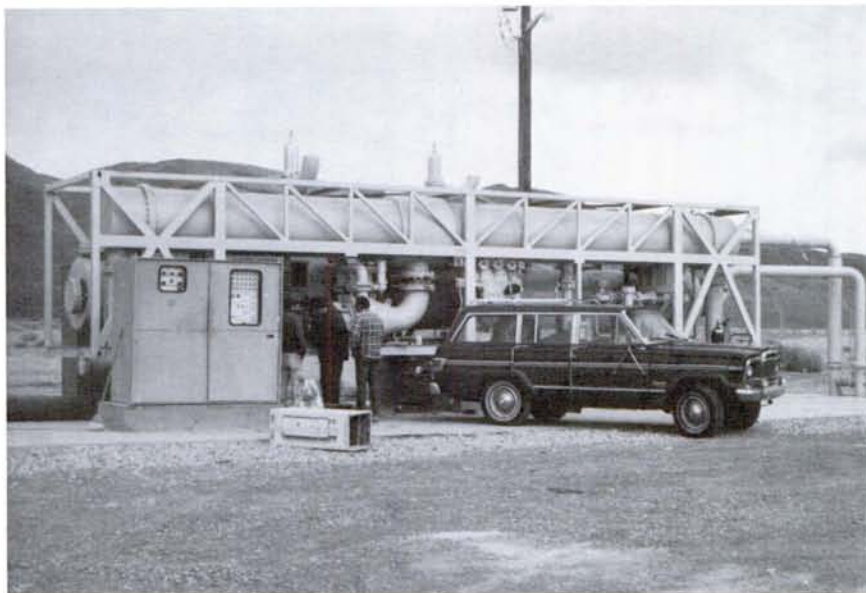
In January of 1985 the **Nevada Commission on Mineral Resources** adopted a considerably modified set of temporary regulations concerning the drilling of geothermal wells. The Mineral Resources Commission had adopted regulations earlier in 1984, but the Nevada Legislative Commission failed to approve

the proposed regulations. The Legislative Commission, however, did suggest that temporary regulations, in effect until August 1, 1985, were within the Mineral Resources Commission's power. The Nevada Department of Minerals will administer the new regulations, which cover domestic, commercial, and industrial geothermal wells. The regulations were modified during the January meeting to attempt to meet objections raised by well drillers and domestic and small commercial users.

Geothermally heated water is being used to grow the blue-green algae *Spirulina* at **Wabuska**, 12 miles north of Yerington. TAD's Enterprises plans to sell algae in health food stores. Dr. Glen Bedell, biology professor at the University of Nevada-Reno, suggests that the algae also has considerable potential as a livestock feed. He reports that 1 acre of Nevada desert turned into a geothermal pool nurturing algae can produce more protein than 70 acres of prime Midwest farmland. The algae is 70% protein by dry

LARGE-DIAMETER GEOTHERMAL WELLS DRILLED IN NEVADA IN 1984

Company Name	Well Name	Depth(ft)	Location	County
Phillips Petroleum Co.	Desert Peak No. 67-21	4,097	S21,T22N,R27E	Churchill
Monterey Energy Co.	Dixie Federal No. 76-28	9,500	S28,T25N,R37E	Churchill
AMAX Exploration, Inc.	Unit No. 88-11	8,149	S11,T1S,R35E	Esmeralda



ORMAT geothermal generating unit at Wabuska, Lyon County. Larry Garside photo.

weight, and 37% of this is usable protein. This is a high protein content compared to other sources (Reno Gazette-Journal, 26 Feb 84).

Elko's new \$3.5 million sewage treatment plant has been named project of the year by the Nevada Chapter of the American Public Works Association. The plant, designed by Chilton Engineering, uses geothermal energy from underground hot water, and methane, a by-product of the sewage treatment process, to heat and power the plant. The plant's 2.5 million gallons-per-day capacity should meet Elko's demands for the next 20 years (Reno Gazette-Journal, 12 Nov 84).

U.S. Senator (Nevada) Chic Hecht conducted a field hearing in April in Sparks concerning the potential for geothermal development in Nevada and other western states. The hearing was held by the Energy and Mineral Resources Subcommittee of the U.S. Senate Committee on Energy and Natural Resources. Testimony was received from researchers, developers, and government agencies during the 1-day hearing. According to Senator Hecht, four major concerns emerged from the hearing: 1) In order to attract more private investment, Sierra Pacific Power Co. must be able to purchase geothermal power at a higher rate than currently allowed by the Public Utility Regulatory Policies Act. 2) The power transmission systems existing currently in Nevada are insufficient to carry geothermal power to population centers. 3) The renewable energy tax credit on geothermal power development needs to be extended. 4) Current law requires geothermal developers to relinquish their federal leases if they cannot bring their projects to commercial production during the 10-year primary lease term. Many lessees have not been able to do so for reasons beyond their control and have asked that the 10-year term be extended (Senator Hecht's Washington Report, Aug 84).

A 750-kW ORMAT binary cycle generator has been installed by Neal Townsend at Wabuska. The

geothermal well produces 740 gpm with a wellhead temperature of 228°F; the well depth is only 350 feet. A nearby pond is used for cooling water, and the generator produces approximately 600 kW when the pond temperature is at 55 to 60°F. Output dropped during the late summer months when the pond temperature increased to 90°F. Power is sold to Sierra Pacific Power Co. at less than 6 cents per kWh. Future plans are to install an additional pair of 750-kW ORMAT generators, bringing the total capacity at the site to 2.25 MW. Cooling towers may be added to the system when the additional power goes on line (EG & G Idaho Regional Geothermal Progress Monitor, Oct 84).

Trans-Pacific Geothermal (Oakland, California) and TGS Associates have entered into a partnership to construct a 225-mile geothermal electrical transmission line from Nevada to California. TGS is the operator of two geothermal wells in Dixie Valley, Nevada, where the line will begin. The line would extend to a Southern California Edison substation in Bishop, California. Construction is scheduled for completion in early 1987. TGS Associates is a partnership owned by Trans-Pacific Geothermal and Swiss Re Holding of New York. The Dixie Valley geothermal area is approximately 40 miles northeast of Fallon (National Geothermal Service, 16 Nov 84).

The Division of Earth Sciences, Environmental Research Center and University of Nevada-Las Vegas announced the publication of a new, full-color map entitled Geothermal Resources of Nevada. The map was prepared under contract to the U.S. Department of Energy in cooperation with the National Oceanic and Atmospheric Administration. The 1:500,000-scale map shows 900 geothermal springs and wells throughout the state, and an accompanying table lists temperatures, well depths, flow rates, and total dissolved solids contents of the geothermal waters.

Residents of Gerlach and others interested in the local hot springs waters raised more than \$10,000 toward building a new spa after the natural hot

FEDERAL GEOTHERMAL LEASES IN EFFECT BY COUNTY¹

COUNTY	NUMBER OF LEASES				ACREAGE			
	Noncompetitive		Competitive		Noncompetitive		Competitive	
	FY83	FY84	FY83	FY84	FY83	FY84	FY83	FY84
Carson City	0	0	0	0	0	0	0	0
Churchill	137	107	33	33	214,126	184,113	57,116	61,000
Clark	0	0	0	0	0	0	0	0
Douglas	0	0	0	0	0	0	0	0
Elko	22	18	0	0	26,314	22,508	0	0
Esmeralda	40	48	0	0	73,259	91,368	0	0
Eureka	2	2	3	3	1,840	2,476	6,689	6,767
Humboldt	56	30	7	7	105,872	56,145	13,512	13,512
Lander	57	37	3	2	73,195	64,289	3,859	3,781
Lincoln	0	0	0	0	0	0	0	0
Lyon	2	3	3	0	2,720	4,080	3,168	0
Mineral	5	4	0	0	8,239	7,559	0	0
Nye	52	54	3	3	85,742	79,268	6,083	6,083
Pershing	117	64	9	6	203,852	106,527	15,480	10,753
Storey	0	0	0	0	0	0	0	0
Washoe	9	7	7	7	10,023	8,644	11,527	10,247
White Pine	14	1	0	0	32,117	1,941	0	0
Total	513	375	68	61	837,299	628,918	117,434	112,143
	26.9% decrease		10.3% decrease		24.9% decrease		4.5% decrease	

¹Data from the U.S. Bureau of Land Management (FY = fiscal year, 1 Oct to 30 Sep).

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springs were closed more than a year ago by a private landowner. The donations were matched by a \$10,000 grant from the Hawkins Foundation of Reno and another \$2,000 came from U.S. Gypsum Co., which operates a mine and processing plant at nearby Empire. A well has been drilled and a pool area excavated (Reno Gazette-Journal, 20 Aug 84).

Washoe County commissioners approved a \$6 million geothermal power plant in the Steamboat area south of Reno that could produce enough electricity to serve 5,000 people. The plant will be on land owned by **Sierra Pacific Power Co.**, and a limited partnership would lease the land and sell electricity to the power company. The limited partnership, **Geothermal Development Associates**, must still obtain financing for well drilling and plant construction (Reno Gazette-Journal, 18 Apr 84).

ORMAT Systems, Inc., a leader in the field of modular organic Rankine cycle power plants, has established a new marketing and service engineering center in Sparks. The modular units are used as stand-alone electric power generating equipment utilizing moderate-temperature geothermal waters.

A private corporation is seeking enough community support to establish a geothermal heating service in **Hawthorne**. Principals are Howard Hamar and Tom Jernigan, both contractors from Greenville, California, and Loyd Donovan, an engineering consultant from Idaho Falls, Idaho. They say their plan could reduce heating costs in Hawthorne by 25 to 30%. For the project to materialize, they have told county commissioners they need sufficient commit-

ment from businesses, public agencies, and homeowners to justify an \$8 million investment in a geothermal power plant approximately a mile south of Hawthorne (Nevada Business Outlook, Jul 84).

Phillips Petroleum Co. has bought a 10-MW Biphase rotary separator turbine for use at the Desert Peak geothermal field, which is about 50 miles northeast of Reno. Output from the plant will be sold to Sierra Pacific Power Co. The Phillips-designed plant is scheduled for operation in the third quarter of 1985. Some site excavation already has begun in anticipation of the first equipment shipment from Biphase Energy Systems Division of Transamerica Delaval. The Biphase rotary separator turbine uses the liquid portion of the geothermal fluids, as well as the steam, and is calculated to deliver up to 30% more power than conventional systems from the same well flows. No costs for plant or equipment have been given by Phillips or Biphase (EG & G Idaho Regional Geothermal Progress Monitor, Jul 84).

General Intertech of San Diego has signed a contract with the **Fallon Naval Air Station** to deliver 25 MW in 3 years and 75 MW by the end of the fifth year at Fallon. The Navy's power requirement at Fallon is 2.5 to 3.0 MW, and the agreement allows the excess to be wheeled to substations in the north or south. The Navy will buy the power at 3.9 cents per kWh. Several 500-foot temperature gradient holes and one 2000-foot exploratory well were drilled at the site. A temperature of 200°F is reported (EG & G Idaho Regional Geothermal Progress Monitor, Nov 84).



Phillips Petroleum Co. Desert Peak No. 67-21 drilling in February 1985. Larry Garside photo.



Monterey Energy Co. Dixie Federal No. 76-28 drilling in Dixie Valley, Churchill County. Larry Garside photo.

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Flow test of Chevron Resources Co. Federal No. 58-34 in February 1985 at Soda Lake, Churchill County. Larry Garside photo.

**DIRECTORY OF
NEVADA MINE OPERATIONS
ACTIVE DURING 1984**

Compiled from information supplied by the staff of the Division of Mine Inspection, Nevada Department of Industrial Relations. Data for 1984 was not available as of July 1, 1985. For information please contact the office of the State Mine Inspector in Carson City.

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