

NEVADA BUREAU OF  
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SPECIAL PUBLICATION  
MI-1985

THE NEVADA  
MINERAL INDUSTRY  
1985

Metals  
Industrial Minerals  
Geothermal  
Oil and Gas

Exploration  
Development  
Mining  
Processing

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NEVADA BUREAU OF MINES & GEOLOGY  
SPECIAL PUBLICATION MI-1985

# THE NEVADA MINERAL INDUSTRY— 1985

John Schilling  
Director/State Geologist

1986



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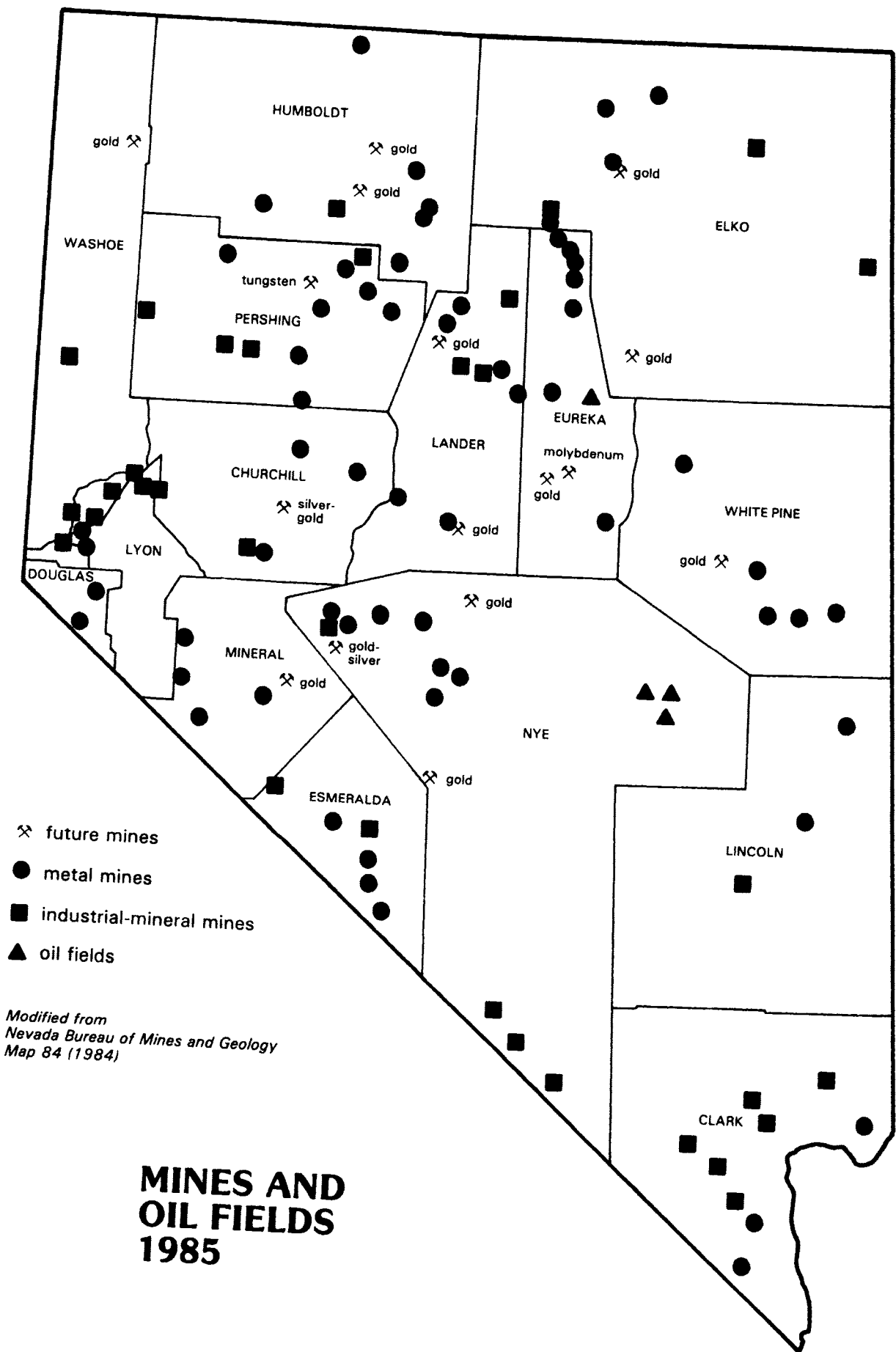
### INTRODUCTION

This report is the seventh of an annual series. It describes 1985 activities: mineral exploration and development programs, discovery of orebodies, new mines opened, production statistics, and expansion, cutbacks, closing and other activities of existing mines; oil and gas drilling, and production; and geothermal drilling and utilization.

The preliminary estimated value of Nevada's mineral production for 1985 was \$658 million—final figures are expected to exceed \$665 million, or about the same value as 1984. Lower prices for gold, silver, and oil kept 1985 from being a record year even though the amount of gold and oil produced set new, significantly higher, records. Nevada ranked 12th in Nation in the value of its 1985 non-fuel production.

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Modified from  
Nevada Bureau of Mines and Geology  
Map 84 (1984)

## MINES AND OIL FIELDS 1985



## METALS

by John Schilling

### EXPLORATION

The year 1985 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, exploration for gold continued at a much higher level in Nevada than elsewhere in the United States, although exploration for other metals remained at depressed levels. More claims were recorded in Nevada in 1985 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 ore deposits to satisfy demand more exploration is needed now. Nevada should continue to encourage exploration, if mining is to be economically important in the State in the years ahead.

Exploration by its nature is a rather secretive undertaking; for this reason much of what goes on is confidential and either not mentioned in this report, or mentioned only in brief, tabular form:

**Amselco Exploration** closed its Ely office: 14 employees were laid off including 5 geologists; the remaining 5 geologists will be transferred to the company's western regional office in Reno (Ely Daily Times, 9 Aug 85).

**Athena Mines** reported discovery of 9 million tons of mineralization averaging 0.04 oz of gold and 0.067 oz of silver per ton in the Talapoosa mining district, Lyon County (Northern Miner, 8 Jan 86).

#### CLAIMS RECORDED BY BLM\* NEVADA

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
1985	26,883	287,748

\*U.S. Bureau of Land Management.

#### TOTAL CLAIMS FILED WITH BLM\*

1976-1985	
Nevada	357,120
Utah	287,769
Arizona	247,175
Wyoming	229,459
Colorado	213,323
California	173,746
New Mexico	136,209
Montana	124,524
Idaho	106,680
Oregon	85,750

\*U.S. Bureau of Land Management.



**Chevron Minerals** plans to open a Reno exploration office early in 1986; six geologists were to be transferred from its Denver office.

**Franco Nevada Mining Corp. Ltd.** announced that Bechtel Civil and Minerals has done over 10,000 feet of drilling at Franco-Nevada's Hasbrouck Mountain property in the Divide mining district south of Tonopah. The drilling found reserves of 12.9 million tons containing 0.029 oz gold and 0.59 oz of silver per ton. (Reno Gazette-Journal, 20 Nov 85)

**Freeport Exploration Co.**, a subsidiary of Freeport-McMoran Inc., opened a new international exploration headquarters in Reno in October; 50 persons will be employed (Reno Gazette-Journal, 23 Oct 85).

**Freeport-McMoRan Gold Co.** announced additional reserves of 1.5 million tons averaging 0.21 oz of gold per ton in the Burns Basin and Mill Creek areas near the Jerritt Canyon open-pit gold mine, Elko County. FMG owns 70% of the Jerritt Canyon operation in a joint venture with FMC Gold Corp. FMG also outlined reserves at Big Springs 10 miles north of the Jerritt Canyon Mine (after drilling 756 holes totalling 231,000 feet) in a joint venture with Bull Run Gold Mines Ltd. (40% interest). The drilling defined 3 orebodies: (1) North Sammy Creek with reserves of 2.1 million tons; and South Sammy Creek and (3) MacRidge both of which have been only partially outlined and appear smaller than North Sammy Creek. (FMG Quarterly Report, 30 Sep 85)

**Gold Fields Mining Corp.**, the U.S. subsidiary of Consolidated Gold Fields, reported a new major gold discovery at its Chimney Creek deposit 5 miles northeast of the Getchell Mine in eastern Humboldt County. Preliminary testing, including 180 relatively shallow drill holes, indicates reserves of 20-million tons of open-pittable ore having an average grade of 0.09 oz of gold per ton (including 6 million tons

averaging 0.18 oz per ton). Feasibility studies will be completed in 1986. Fourteen persons are presently employed on the project; approximately 200 would be employed if the mine is brought into production. (Rocky Mountain PAY DIRT, Nov 1985)

**Great Pacific Inc.** is drilling five 300-ft holes on the Wonder and Wonder Extension patented mining claims in the Wonder mining district, eastern Churchill County.

**Lacana Gold Inc.** in October drastically reduced its exploration staff based in Reno.

**Lacana Gold Inc.** is drilling for gold and silver at Virginia City, and at the "Gabbs" gold-silver property 3 miles northwest of the Santa Fe gold-silver property near Luning. (North American Gold Mining Industry News, 15 Nov 85)

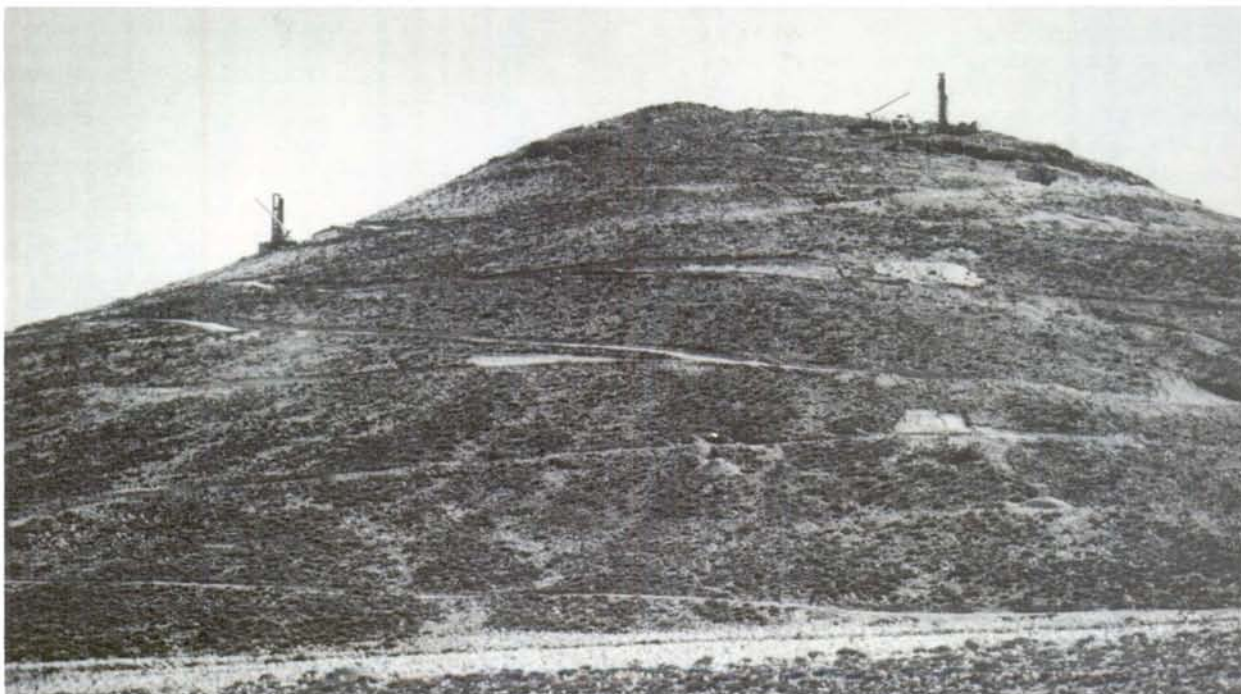
**Frank W. Lewis** announced that 30,000 feet of drilling done north of and adjacent to the Fortitude open-pit gold mine south of Battle Mountain in northern Lander County has found 2 million tons of ore averaging 0.045 oz of gold and 3.63 oz of silver per ton.

**Newmont Mining Corp.** discovered a new gold deposit 3 miles from its Carlin Mine in northern Eureka County. The 12 holes drilled to date on the Genesis prospect have delineated 50 million tons averaging 0.1 oz of gold per ton. Newmont plans to continue to explore the property over the next few years; the ore zone is open on four sides and in depth. (Reno Gazette-Journal, 10 Sep 85)

**Tenneco Minerals** has drilled nearly 400 holes near Illipah, 35 miles southwest of Ely, White Pine County, since 1980, looking for disseminated gold ore (Ely Daily Times, 31 Dec 85).

**Westly Mines Ltd.** continued drilling at its "Gabbs" gold-silver prospect in northwestern Mineral County as part of a 4500-foot program (North American Gold Mining Industry News, 24 Jan 86).

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

# OTHER 1985 EXPLORATION ACTIVITY IN NEVADA

by Richard B. Jones

Name	Location	Metal	Remarks
<b>CHURCHILL COUNTY</b>			
Summit King Mine	S11,12,T15N,R32E	Au, Ag	<b>Capri Resources</b> sampling and drilling old Summit King gold mine.
<b>CLARK COUNTY</b>			
Capitol Camp	S20,T26S,R65E	Au	<b>British American Mining</b> to do exploratory drilling.
<b>ELKO COUNTY</b>			
Charleston	~S25,T44N,R57E	Au	<b>Remington Gold</b> continued exploration with "favorable results".
Rex Mine	~S21,T39N,R46E	Au, Ag	Owned by National Treasure Mines. Leased by Exxon Minerals. <b>Exxon Exploration</b> indicates excellent anomalies north of mine.
Spruce Mountain	~S22,T31N,R63E	Au, Ag	<b>Santa Fe Mining</b> exploring for gold halos around molybdenum mineralization.
<b>ESMERALDA COUNTY</b>			
Goldfield district		Au, Ag	<b>Westley Mines/Agassiz Resources</b> exploring Westley's 130 claims at Goldfield.
<b>EUREKA COUNTY</b>			
Hamburg-Eureka Tunnel	~S34,T19N,R53E	Au, Ag	<b>Norse Petroleum</b> drilled a total of 15,000 ft, discovered gold-silver mineralization ranging from 0.07-0.25 oz Au/ton.
Geddes Bertrand	S11,T18N,R53E	Au, Ag	<b>Amselco</b> continued exploration. Approximately 11,000 oz Ag recoverable via open-pit/heap leach operation.
<b>HUMBOLDT COUNTY</b>			
Happy Creek	~S33,T41N,R32E	Au, Ag	<b>Gerle U.S.</b> exploration has defined area with open-pit potential; assays up to 0.959 oz Au and 5.4 oz Ag per ton.
Dutch Flat	~S16,T38N,R40E	Au, Ag	<b>Brican Resources</b> exploration has delineated two zones with Au values up to 0.23 oz, Ag values up to 1.6 oz/ton.
Crofoot Gold project	~S25,T35N,R29E	Au	<b>Granges Exploration/Hycroft Resources</b> drilling and blocking out ore reserves, doing metallurgical testing. 15 million tons at 0.037 oz Au/ton.
West (Pansy Lee) Coast Mine	S6,T36N,R37E	Au, Ag	<b>Great West Gold &amp; Silver/Thrust Resources</b> sampling and drilling potential open-pit operation.
<b>LANDER COUNTY</b>			
Marigold Mine area	S35,T32N,R42E	Au	<b>Welcome North Mines/New Ridge Resources</b> joint venture new-drilling defined two zones: East Hill Zone, 3 million tons at 0.04 oz Au/ton. Red Rock Zone, 750,000 tons at 0.10 oz Au/ton.
<b>MINERAL COUNTY</b>			
unknown	S17,T7N,R30E	Ag, base metals	<b>Gulf International Minerals</b> drilling around old workings.
Rawhide	S4,T13N,R32E	Au, Ag	<b>Bear Creek Mining</b> still exploring and developing ore reserves.
<b>NYE COUNTY</b>			
Golden King	~S36,T4S,R55E	Au, Ag	<b>Exxon</b> continuing exploration; mapping, geo-chem sampling, trenching, minor drilling.
Pioneer Mine	~S7,T12S,R46E	Au, Ag	<b>Kanco Energy/U.S. Precious Metals/Galli Exploration Assoc.</b> exploring. Hoping to develop open-pit heap leach operation.
Longstreet property	~S22,T6N,R47E	Au, Ag	<b>Naneco Resources</b> outlined 850,000 tons grading 0.079 oz Au and 1.1 oz Ag/ton by drilling in 1984. Exploration continued along with a feasibility study.
Grantsville	~S3,T11N,R39E	Ag, Au	<b>Fury Explorations</b> continued drilling; indicated reserves 800,000 tons at 4.2 oz Ag/ton. A second area has assays up to 14.9 oz Ag/ton.
<b>PERSHING COUNTY</b>			
Fortune Cookie Mine	S17,T33N,R36E	Au	<b>Homestake</b> continued exploration.
Willow Creek district	~S2,T31N,R36E	Au	<b>Coast Range Resources</b> exploring old lode gold mine in district. Magnetometer and geo-chemical surveys.
<b>STOREY COUNTY</b>			
unknown	~S9,T17N,R21E	Ag, Au	<b>Westley Mines</b> deep drilling in Comstock area to check fault off-set ore bodies. Partners are Baroque Resources and Franco Nevada Mining Corp.
Lily Langtree	~S21,T16N,R21E	Au, Ag	<b>Western Bell Communications, Inc.</b> signed letter of intent with Sentinel Mining Corp. to do exploration.
<b>WHITE PINE COUNTY</b>			
Hidden Treasure Mine	S22,T16N,R57E	Ag	<b>F. W. Lewis Co.</b> drilling outlined small ore body of 600 tons grading 80 oz Ag/ton. Drilling continues.



## DEVELOPMENT/FUTURE MINES

**Alhambra Mines, Inc.** will continue development at its Bell Mountain gold-silver property, eastern Churchill County, under an agreement with Nevada Silver, Inc., a wholly-owned subsidiary of American Pyramid Resources Inc. Alhambra will "construct a heap-leaching operation". Proven reserves contain 54-thousand ounces of gold and 1.1 million ounces of silver. (E&MJ Mining Activity Digest, 21 Jun 85)

**AMAX** began mining at the Sleeper gold mine early in January 1986; milling is expected to begin in March 1986 (Winnemucca Humboldt Sun, 19 Feb 86).

**Coeur Rochester, Inc.** a unit of Coeur d'Alene Mines Corp., plans to begin construction at its silver-gold project in the Rochester mining district north of Lovelock, Pershing County, early in 1985. Over \$21 million will be spent to develop a large open-pit mine. Reserves total 63 million tons containing 1.55 oz silver and 0.011 oz gold per ton. Production is

district, White Pine County, using a 100-ton-per-day, portable mill which has been setup on the property. Material for testing will come from two veins in the Exchequer-New Century Mine. Ore from the Blue vein reportedly contains 15-25 oz of silver per ton; the Exchequer vein has reserves of 150- to 250-thousand tons averaging 25-35 oz per ton. (Wallace [ID] Miner, 3 Jan 85)

**Inspiration Mines, Inc.** submitted plans to the U.S. Forest Service for the Development of the Quito gold deposit located in the headwaters of Birch Creek Canyon 10 miles south of Austin in Lander County. Development will be by the Austin Gold Venture, a joint venture between IMI and FMC Corp. Some 350,000 tons of ore would be mined and 55,000 oz of gold produced per year. Reserves are 1,750,000 tons, giving the mine a life of 5 years. Mining would be by open-pit, processing by cyanidization; mining would start in July 1986 and employ 114 workers. (Inspiration Mines, Inc., Plan of Operations, 26 Jul 85)



FMC Corporation's Paradise Peak mine and mill, Gabbs, Nevada. FMC photo.

planned at 3.7 million oz silver and 43,000 oz of gold per year over a mine-life of 13 years. (North Idaho Sunday newspaper, 29 Dec 85) Between 130 and 150 persons will be employed once mining and leaching begins (Reno Gazette-Journal, 17 Jan 86). Morrison Knudsen Co. has received a 12-year contract totaling \$138 million for services that will include removal of overburden, mining of ore, and crushing and delivery to processing facilities. (American Mining Congress Journal, 26 Feb 86).

**FMC Corp.** continued development drilling and began construction of a processing plant at its gold-silver property 10 miles south of Gabbs in north-western Nye County; production is planned in 1986. As much as 200,000 pounds of mercury will be produced as a byproduct (Wallace [ID] Miner, 14 March 85).

**Goldera Resources Inc.** began metallurgical testing at its silver properties in the Cherry Creek mining

**Kinetic Minerals Inc.** signed a letter of intent for the joint development with **Gulf Investments Overseas Inc.** of the Blue Bird gold-silver property at Battle Mountain. Golconda Management Ltd. was named project manager and will do surface sampling and drilling to establish reserves. Gulf's continued participation will depend on whether the property contains a minimum of 750,000 tons of open-pit mineable ore. (Mining Engineering, Jul 85)

**Lacana Gold Inc.** continued feasibility studies at the Santa Fe gold-silver deposit 30 miles east of Hawthorne in Mineral County. Lacana is operator of the Santa Fe joint venture with **Westley** (40%) and **Brican Resources Ltd.** (9%). Proven and probable reserves total 7.1 million tons averaging 0.036 oz of gold per ton. More than 300 holes have been drilled, and a 918-ft spiral decline sunk from which 40,000 tons of ore was recovered for heap-leach testing. Westley has expended \$2 million and Lacana \$2.1



million on the property. (North American Gold Mining News, 15 Nov 85)

**Nevada Gold Mining Inc.**, a wholly owned subsidiary of **AMAX**, began construction of processing facilities at its Sleeper gold property 30 miles northwest of Winnemucca in Humboldt County. Production is planned for mid-1986; annual production based on reserves, would be 55,000 oz of gold and 60,000 oz of silver per year for 8–12 years. Reserves total over 4 million tons averaging 0.15 oz gold and 0.73 oz of silver per ton; additional ore may be found both laterally and at depth. The deposit will be mined by open-pit methods; five million yards of overburden had been stripped from the orebody by year's end; drilling and blasting of the exposed ore is to begin in mid January. Milling will utilize a 500-ton per day cyanide mill; \$24 million will be spent to build and equip the mill; it is expected to be in operation by April 1986. The mine and mill employ 74 persons; it is expected to be "an extremely low-cost producer". (Mining Record, 17 Jul 85; Humboldt Sun, 8 Jan 8)

**Pacific Silver Corp.** constructed a mill at the Buckskin gold-silver mine 25 miles west of Yerington in Douglas County at a reported cost of over \$2 million; the mill was dedicated June 8th (Mason Valley News [Yerington], 31 May 85).

**Pegasus Gold Inc.** is development drilling at its Florida Canyon gold property in S11,T31N,R33E as an open-pit, heap-leach operation. Reserves are 12 million tons averaging 0.032 oz gold per ton; production is planned at 2 million tons per year.

**Placer U.S. Inc.**, a wholly owned subsidiary of Placer Development Ltd. of Vancouver, Canada, is developing the Bald Mountain Top claim, in which it holds a 84% interest, as an open-pit gold mine. Over \$12 million will be spent to develop the mine, build roads, and expand heap-leaching operations. Mining is expected to last at least 5 years; exploration will continue in surrounding areas. (Reno Evening Gazette, 10 Aug 85). The \$12 million expansion will be completed by March 1986. Employment will be increased from the present 20 to 90 persons. Reserves are 2,654,000 tons averaging 0.087 oz gold per ton; exploration began in 1976. (Nevada Mining Association Bulletin, Oct–Nov 85)

**Silver King Mines** and **Pacific Silver** began construction of a 1000-ton per day leaching plant 5 miles west of Ely, White Pine County, in October. The plant will treat gold-silver ore from the Star Pointer Mine on the south edge of the Ruth pit; 40,000 tons of ore have been mined at the surface and stockpiled awaiting completion of the leach plant in October 1986. Thirteen persons are presently employed. Reserves are 1.5 million containing 0.14 oz of gold and 0.3 oz of silver per ton; drilling continues. (Ely Daily Times, 8 Oct 85)

**Silver King Mines, Inc.** continued development at the Ward Mountain Mine in White Pine County; more than \$11 million have been spent through 1984. Work continued on twin 4500-foot inclines being driven into the mountain. Production is planned for late 1985.

**Tenneco Minerals** plans to develop an open-pit gold mine at the McCoy property in the Fish Creek Mountains 22 miles south of Battle Mountain in Lander County. Production is planned by early 1986 at a rate of 12,000 tons mined per year, and a life of 4 years. (Elko Daily Free Press, 22 Aug 85). Reserves reportedly are 2.5 million tons averaging 0.08 oz gold and 1 oz silver per ton.

**Western Goldfields Co.** is developing its Hog Ranch gold deposit 50 miles north of Gerlach in Washoe County; 75 to 100 people will be employed during the development-construction phase. Mining is planned for the fall of 1986, and is expected to last 5 to 7 years and employ 60 to 70 persons; reserves are 5 million tons containing "up to 400,000 oz of gold". (Reno Gazette-Journal, 24 Mar 86)



Gold and silver dore buttons produced at FMC Corporation's Paradise Peak mill, Gabbs, Nevada. The dore is 96% by-weight silver and 3.5% by-weight gold. FMC photo.





Battle Mountain Gold's new Fortitude gold mine (at left), Lander County. (The older Copper Canyon and Copper Basin copper mines are in the center foreground and distance.)

## MINING/PROCESSING

### New Mines

**FMC Corp.** began mining and stockpiling ore at its "Gabbs" open-pit mine in northwestern Nye County in December; processing is expected to start in May 1986 at a rate of 4000 tons per day. About \$100 million have been spent on startup costs. More than 190 workers will be employed by May. (Reno Gazette-Journal, 22 Sep 86)

**Nevex Gold Co.** produced the first gold-silver bullion from the Haywood-Santiago property on the southern end of the Comstock Lode near Virginia City in March; nine persons are employed at the operation (Reno Gazette-Journal, 7 Aug 85).

**Northern Dynasty Exploration** poured the first dore bullion bar from the Little Bald Mountain Mine in northeastern White Pine County in August; the bar contained 850 oz of gold. The mine is an open-pit/heap leaching operation. The grade is 0.15 oz of gold per ton. Drilling is underway to establish additional reserves. (Northern Miner, 15 Aug 85). Some 5000 oz of gold were produced in 1985. The mine

employed 30 persons during the summer, with operations cut to 5 persons in the winter when mining stops. Mining is expected to last at least two years (Ely Daily Times, 19 Dec 85)

**Rayrock Resources** began mining the Mag gold orebody one half mile from its Pinson mill where the ore is treated; reserves are 1.4 million tons averaging 0.090 oz of gold per ton (Northern Miner, 17 Jan 85).

**RKCO, Inc.** is using a new process to recover gold at its plant at the mouth of Fondaway Canyon in eastern Churchill County. The material is mined at the Fisk Mine several miles to the east in Fondaway Canyon, is tank-leached with cyanide, is passed through containers filled with resin beads, and the containers shipped to Oceanside, California, where they are processed by Akwaklame Inc.; the beads, stripped of any values, are repacked in the containers, and shipped back to RKCO for reuse. The amount of gold produced is not recorded.

**Standard Slag** opened its open-pit gold mine 40 miles west of Winnemucca in Humboldt County. The mine was the first in Nevada to use State industrial revenue bonds to help finance development.



**Tonkin Springs Gold Mining Corp.**, a joint venture of **Silver State Mining Corp.** and **Precambrian Exploration** of Denver, began production at its Tonkin Springs open-pit, heap-leaching gold mine in central Eureka County in October. The mine is expected to produce 30,000 oz of gold per year at a cost of less than \$200 per oz. (Elko Daily Free Press, 3 Sep 85). The first gold-pour was October 31st; reserves are 2.5 million tons of ore averaging 0.08 oz of gold per ton (Ely Daily Times, 13 Nov 85).

#### Operating Mines

**Amselco Minerals** reduced its workforce at the Alligator Ridge gold mine in northwestern White Pine County from 147 to 128, reflecting a decrease in the amount of stripping needed as mining progresses (Ely Daily Times, 9 Aug 85).

**Battle Mountain Gold Co.** was formed in August as a spin-off of **Pennzoil Co.**. Common-stock shareholders of Pennzoil will receive one share of BMG class B stock for each share of Pennzoil stock they hold. BMG will become an independent, publicly-held corporation; Pennzoil will have no continuing

ownership. (American Mining Congress Journal, 17 Jul 85). BMG will own and operate the Fortitude open-pit gold mine south of Battle Mountain in Lander County; the mine will produce 225,000 oz of gold and 630,000 oz of silver in 1985 making it the 3rd largest gold producer in the U.S. (Pay Dirt, Dec 85). At the beginning of 1985 "mining costs" were \$225 per oz mined, were expected to drop to \$204 per ounce in the last half of 1985, and to \$190 in 1986. Mining tonnages will decrease 480,000 tons to 1,380,000 tons per month by the end of 1985; milling rates will drop 400 tons to 3000 tons per day; the ratio of waste to ore will decrease from 16 to 1 to 3.6 to 1; and the ore-grade will increase from 0.19 oz to 0.22 oz per ton. (American Metal Market, 23 Oct 85)

**Carlin Gold Co.**, wholly owned subsidiary of Newmont Mining Co., late in July poured its first gold bar at its Number 2 mill at the company's Gold Quarry open-pit mine 8 miles north of Carlin. The mill has been treating ore since June 22nd. The new cyanide mill is designed to treat 2.5 million tons of ore and produce 170,000 oz of gold per year from the Gold Quarry, and adjacent Maggie Creek, deposits. In



Smoky Valley Mining's Round Mountain gold mine, Nye County.





Mina Mercury Co. mine, Pilot Mountains, Mineral County, in 1928. NBMG photo.

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addition to the 7000 tons of ore that will be treated by the mill daily, some 8000 tons of lower-grade material will be treated by heap-leaching. Carlin Gold operates 8 open-pit mines and four treatment facilities in northern Eureka County, and presently employs 530 persons. (Elko Daily Free Press, 25 Jul 85). The opening of the mill and mine will increase Carlin's staff from 260 in 1984 to 540, with a current payroll of \$17.5 million per year. Carlin expects to produce 345,000 oz of gold in 1986. Reserves are 236 million tons containing 17 million oz of gold. (Nevada Mining Assoc. Bulletin, Oct-Nov 1985) In 1985, 218,613 oz of gold were produced from 3 million tons of ore. An article describing mining methods, "Selective mining and grade control are key to Carlin Gold's success" by Gerald C. Smith, general superintendent of mining, is in the November 1985 issue of Mining Engineering.

**Cominco American** has reserves of 7 million tons of ore averaging 0.04 oz of gold and 0.585 oz of silver per ton at the Buckhorn gold mine, 12 miles east of Cortez in Eureka County. Mining and processing is by open-pit, agglomeration, and heap-leaching. (Geological Society of Nevada Special Publication 3, 1985)

**Cyprus Minerals Co.** was spun off from **Amoco Corp.** which is ridding itself of non-petroleum interests. On July 1st, Amoco shareholders received 1 share of Cyprus Mineral common stock for every 10 shares of Amoco stock held. Cyprus Minerals operates the Northumberland open-pit gold mine in northern Nye County. (Wallace [ID] Miner, 3 Jul 85)

**Freeport-McMoRan's** Jerritt Canyon Mine in Elko County led the Nation in gold production during 1983 and 1984 when 260,000 and 240,000 oz were produced. The mine employs 300 workers; 3700 tons of ore are processed daily. (Reno Gazette-Journal, 22 Sep 86)

**Lombardo Turquoise Co. Inc.** was issued a patent for the Sotang Lode claim covering the Shoshone turquoise mine in the New Pass mining district, Lander County. The mine supplies turquoise for the company's jewelry manufacturing operation in Austin. The company began open-pit mining in 1972; underground mining began in 1979. (Reno Gazette-Journal, 27 Oct 85)

**Placer Development Ltd.** produced 49,000 oz of gold in 1984 from its Horse Canyon Mine near Cortez in Eureka County. Reserves are about 2 million tons averaging 0.103 oz of gold per ton; exploration for additional reserves continued. (Nevada Mining Association Bulletin, Jun-Jul 85)

**Placer U.S. Inc.** cut production by 25% at its McDermott mercury mine in Humboldt County due to weak market demand caused by stockpile sales, increased imports, and bigger consumer inventories (U.S. Bureau of Mines 1985 Nevada Mineral Industry Survey). The mine is the only major producer of mercury in the western hemisphere, producing over 99% of U.S. production—the remaining U.S. production is recovered as a byproduct of gold smelting, mostly at Nevada mines. When the mine opened 11 years ago, it had reserves of 400,000 flasks of mercury; unless new reserves are found the mine will have to close in "about four or five years". (Wallace Miner, 27 Feb 86)

**Silver State Mining Corp.** (55%) and **Precambrian Exploration Inc.** (45%) began heap-leaching operations at their Tonkin Springs gold-silver mine in the Roberts Mountains northwest of Eureka in Eureka County. Production is planned at a rate of 30,000 oz of gold per year. Reserves are 1.84 million tons averaging 0.089 oz of gold and 0.204 oz of silver per ton, only a portion of which is amenable to heap-leaching.



**Smoky Valley Mining Co.** plans to expand operations at its Round Mountain open-pit gold mine, Nye County, over the next three or four years. The company has been resampling and running leach tests on ore from a large, deep orebody. Production is expected to be about 135,000 oz of gold in 1985; mining was at a rate of 18,000 tons per day with recovery of gold in the ore at 70%. Production in 1984 was 160,000 oz, up from 60,000 oz four years ago. Smoky Valley "can make gold for \$200 an ounce or less". Some 330 persons were employed at years end. (Reno Evening Gazette, 22 Sep 85)

**Sunshine Mining Co.** produced over 1.3 million oz of silver during 1985 at its Sixteen-to-One Mine, west of Silverpeak in Esmeralda County. This new yearly record was a result of a higher average ore grade, increased tonnage mined, and improved recovery in the mill. The record month was September when the mill processed 21,169 ton of ore. (Wallace [ID] Miner, 9 Jan 86). Sunshine began accepting gold-silver ores for custom-milling at the 16-1 Mill in August; the ore must be amenable to cyanide treatment, and will be accepted only in lots of at least 200 tons containing over \$80 per ton of gold-silver value (Pay Dirt, Aug 85).

## Closings

**Amselco** will close the Alligator Ridge gold mine in northwest White Pine County in 1986 when ore reserves are depleted.

**Anaconda Minerals Co.** closed its molybdenum mine near Tonopah in January laying off 260 people due to low prices and demand (U.S. Bureau of Mines 1985 Nevada Mineral Industries Survey).

**Asamera Minerals (U.S.) Inc.** closed its Gooseberry underground gold-silver mine in Storey County in November. The mine had drastically reduced its staff at midyear, but continued mining small blocks of ore, while discontinuing underground exploration and development. Asamera mined 97,000 tons of ore in 1984; 620,000 oz of silver and 15,000 oz of gold were produced (American Metal Market, 26 Feb 85).





**Lacana Gold Inc.** closed its Relief Canyon open-pit gold mine 20 miles east of Lovelock, Pershing County, in October. **Silver King Mines** closed the Taylor open-pit silver mine 15 miles south of Ely in White Pine County on January 1st, laying off 70 workers (Reno Gazette-Journal, 1 Jan 86)

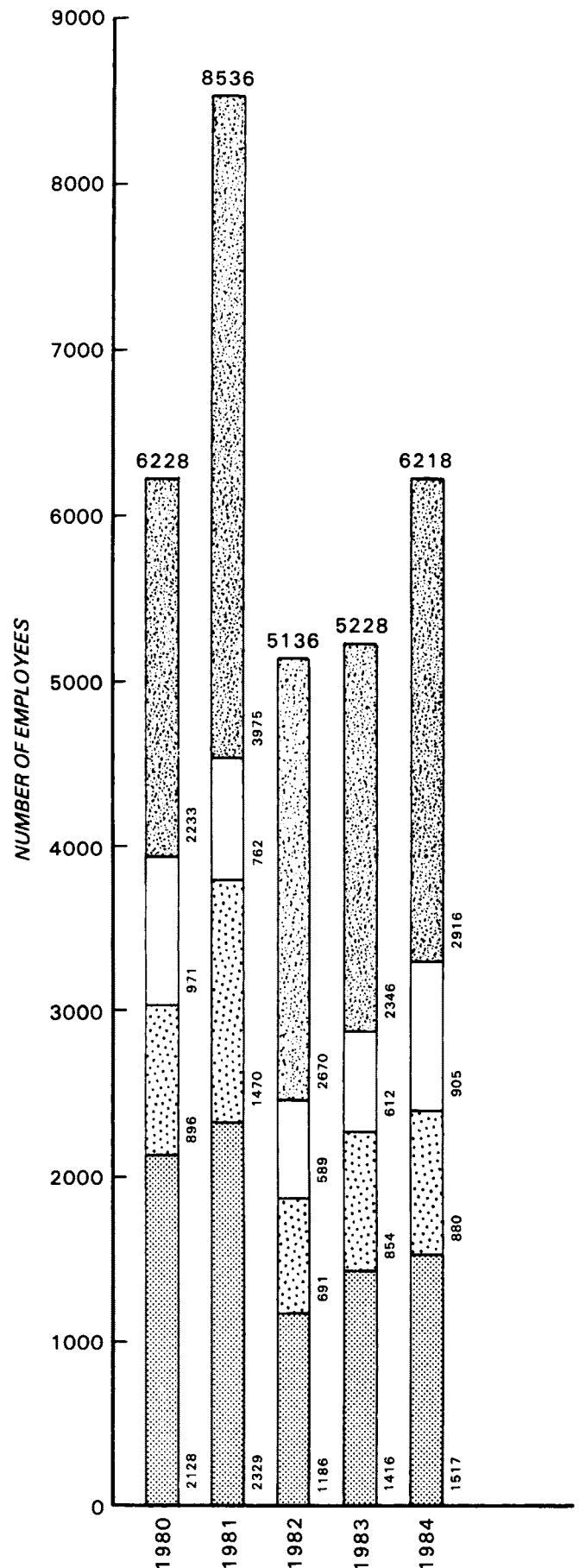
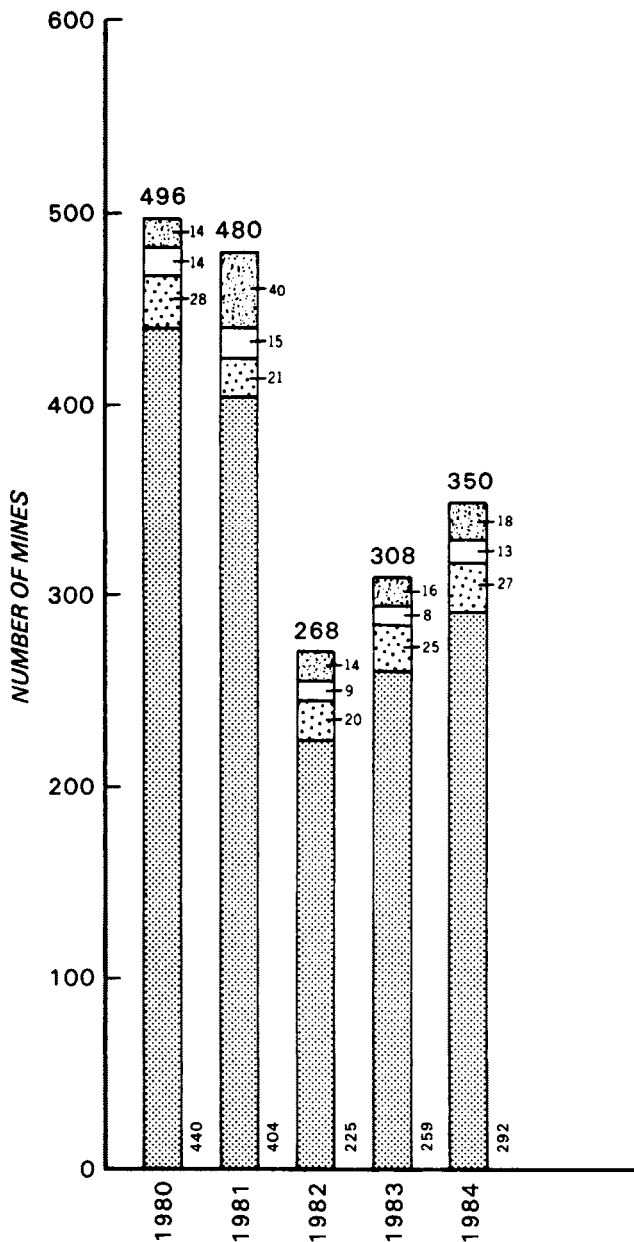
**United Mining Corp.** closed its mill and open-pit and underground mines in the Virginia City area early in the year, laying off about 60 workers. Over 318,000 tons of ore were mined in 1984; 11,000 oz of gold and 245,000 oz of silver were produced. (Reno Gazette-Journal, 3 Apr 85)



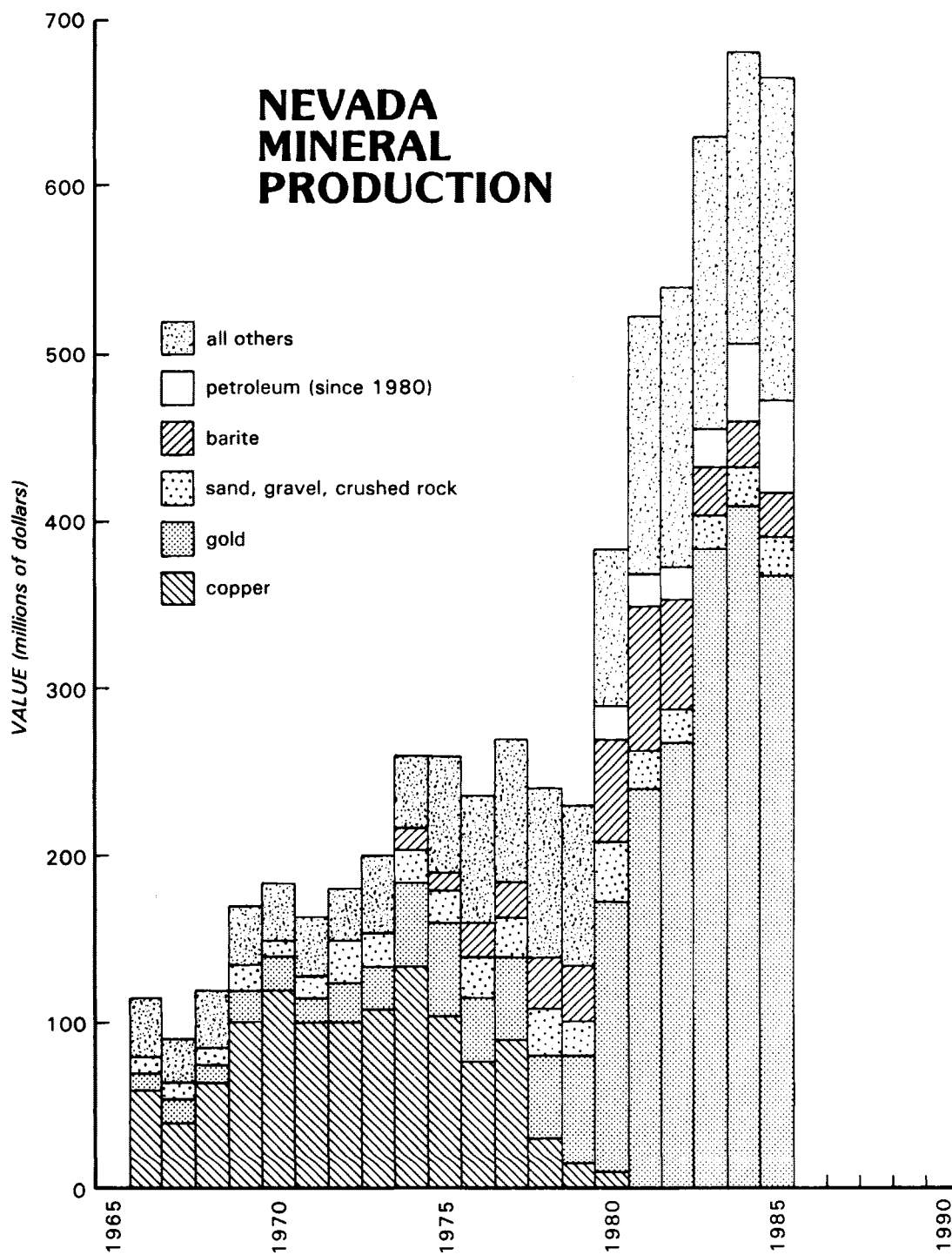
*The Nevada Bureau of Mines and Geology does research, and collects and disseminates information about Nevada's geology and mineral resources.*

# **NUMBER OF MINES AND EMPLOYEES IN NEVADA'S MINERAL INDUSTRY** (from Mine Inspector's Report)

-  100+ employees per mine
-  51-100 employees per mine
-  21-50 employees per mine
-  1-20 employees per mine

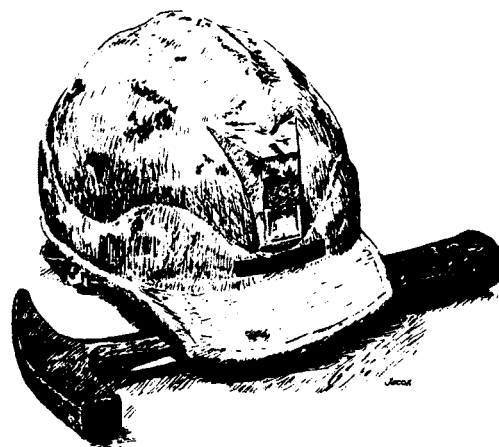






# NEVADA'S ROLE IN U.S. MINERAL SUPPLY IN 1985

Commodity	Share of U.S. output (percent)	Rank in Nation
Barite . . . . .	85 . . . . .	1
Diatomite . . . . .	35 . . . . .	2
Fluorspar . . . . .	1 . . . . .	3
Gemstones . . . . .	20 . . . . .	2
Gold . . . . .	46 . . . . .	1
Lithium . . . . .	55 . . . . .	1
Magnesite . . . . .	100 . . . . .	1
Mercury . . . . .	100 . . . . .	1
Silver . . . . .	15 . . . . .	2



## STATE OF NEVADA'S REVENUE FROM MINERAL INDUSTRY

Source	1979	1980	1981	1982	1983	1984	1985
Federal <sup>1</sup> . . . . .	\$6,548,509	\$7,718,102	\$10,262,216	\$12,595,501	\$12,184,106	\$14,412,423	—
Net proceeds tax <sup>2</sup> . .	1,976,912	3,243,145	1,912,754	1,799,735	4,156,623	3,223,986	\$3,534,176
Geothermal <sup>3</sup> . . . . .	829,892	753,000	29,937	944,305	642,256	491,302	—
<b>Total</b>	<b>\$9,358,250</b>	<b>\$11,714,247</b>	<b>\$12,204,907</b>	<b>\$15,339,541</b>	<b>\$16,982,985</b>	<b>\$18,127,711</b>	<b>\$3,534,176</b>

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

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

<sup>3</sup>Bonus bid payments and royalties from geothermal leases sales.

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## NEVADA'S MINERAL PRODUCTION<sup>1</sup>

Mineral	Unit	1984		1984 <sup>P</sup>		1985 <sup>P</sup>	
		Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite . . . . .	thousand short tons	615	\$14,924	768	\$18,211	731	\$14,431
Cement . . . . .		W	W	W	W	W	W
Clays . . . . .	thousand short tons	20	1,191	61	2,288	20	1,201
Copper . . . . .		W	W	W	W	W	W
Diatomite . . . . .		W	W	W	W	W	W
Fluorspar . . . . .		W	W	W	W	W	W
Gemstones . . . . .		—	1,300	—	1,200	—	1,300
Gold . . . . .	troy ounces	997,508	359,759	1,093,647	410,118	1,121,113	364,362
Gypsum . . . . .	thousand short tons	1,192	8,860	1,108	9,086	1,200	9,960
Iron ore . . . . .	thousand long tons	W	W	W	W	W	W
Lead . . . . .		W	W	W	W	0	0
Lime . . . . .		W	W	W	W	W	W
Lithium . . . . .	thousand pounds lithium carbonate	13,996	W	13,996	W	11,959	W
Magnesite . . . . .		W	W	W	W	W	W
Mercury . . . . .	76-pound flasks	19,048	W	20,000	W	15,100	W
Petroleum . . . . .	thousand 42-gallon barrels	1,954	48,850	1,954	48,850	3,060	56,600
Perlite . . . . .		W	W	W	W	W	W
Salt . . . . .		W	W	W	W	W	W
Sand and gravel . . . . .	thousand short tons	8,202	20,505	6,400	11,700	10,800	24,800
Silica sand . . . . .	thousand short tons	489	W	W	W	470	W
Silver . . . . .	thousand troy ounces	6,477	52,727	3,055	25,202	6,250	38,750
Stone, crushed . . . . .	thousand short tons	1,600	6,500	1,600	6,500	1,100	4,100
Zinc . . . . .		W	W	W	W	0	0
Combined values indicated by symbol W			151,787		138,118		142,406
<b>TOTAL</b>			<b>\$664,603</b>		<b>\$671,273</b>		<b>\$657,910</b>

<sup>1</sup>Production as measured by mine shipments, sales, or marketable production (including consumption by producers), as compiled by U.S. Bureau of Mines except for lithium (1984) and petroleum.

<sup>P</sup>Preliminary.

W Withheld.



## INDUSTRIAL MINERALS

by Keith G. Papke



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### Exploration

The year 1985 was one of somewhat increased exploration for industrial minerals as this segment of the mineral industry tended to recover faster from the 1983 lows than most of the rest of the industry. In terms of dollar value of production, almost all industrial minerals produced in Nevada—with the exception of barite and magnesite—showed increases in 1985 over 1984 and 1983.

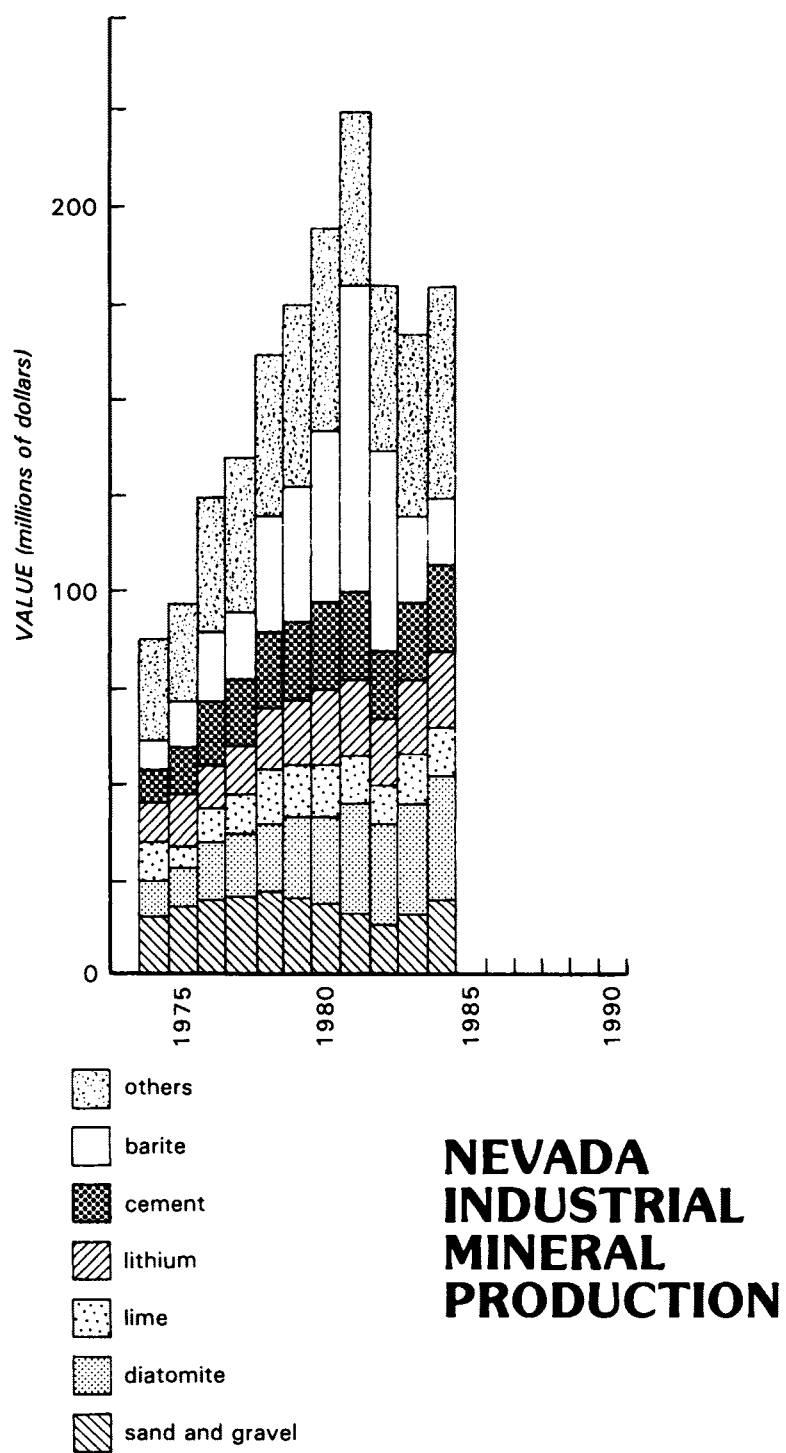
Exploration for barite continued at about the same level as 1984 and was mainly conducted by the staffs of several of the major Nevada producers. The short-term outlook for Nevada barite continued to be poor owing to decreased drilling for oil and gas, large imports of barite, and high railroad-freight rates from Nevada to the Gulf Coast area - the principal region of domestic drilling. About 90% of the barite consumed in the U. S. is used in drilling mud, and Nevada produces about 85% of all domestic barite. Assuming that the amount of imports remains fairly constant, the number of drill rigs active in the U.S. is a good index of the Nevada barite industry. At the end of 1985 the rig count was 1898 compared to 2650 at the end of 1984.

Exploration for many of the other industrial minerals that occur in Nevada increased as demand for these commodities continued to grow. Good data on the extent of this exploration is difficult to obtain because of the secretiveness of exploration people

and because most company exploration, except for barite, was done by staffs based outside of Nevada. Increased or continued high interest was noted for swelling clay, diatomite, gypsum, silica, and sulfur. Data on these or other of the State's abundant industrial minerals can be obtained at the Nevada Bureau of Mines and Geology.

### Mining/Processing

The value of industrial-mineral production in Nevada in 1985 is estimated by me at 191 million dollars. This compares favorably with the final estimate of 180 million dollars for 1984. The chart on page 16 shows values of industrial-mineral production by commodity from 1974 through 1984. In these 11 years the value of industrial-mineral production increased at an overall annual rate of 7.3% compared to 11.2% for diatomite, the fastest growing and since 1983 the most valuable industrial-mineral commodity produced in Nevada. According to 1984 statistics from the Nevada State Division of Mine Inspection, 162 industrial-mineral mines or mills were in operation and employed 1645 persons. The sand and gravel industry was the biggest segment with 83 operations and 395 employees. Clark County had the largest number of operations (27) but Nye County had the largest number of employees (404). The C-E Basic magnesite operation in Nye County was the largest single employer (217).







Eagle Picher's diatomite mine, Pershing County. Keith Papke photo.

The most important industrial minerals produced, in terms of value, were barite, cement, diatomite, lithium carbonate, and sand-gravel. Nevada also produced the following: bentonite, kaolin, and sepiolite clays; decorative and crushed stone; fluorspar; gemstones; gypsum and anhydrite; lightweight aggregate; limestone, lime, dolomite, and dolomitic lime; magnesite and magnesium oxide; perlite; pyritic soil additive; salt; and silica. In 1985 Nevada continued to rank first of the States in the value of barite and magnesite production, second in diatomite, gemstones and lithium carbonate, third in fluorspar, and sixth in gypsum. Borate, hectorite (a lithium-bearing clay prized for its high-swelling property), and zeolite mined at separate localities in California were processed in three plants in southern Nye County. The borate operation of American Borate Co., a wholly owned subsidiary of Owens-Corning Fiberglass Corp., was scheduled to close in early 1986 owing in part to competition from Turkish borate producers.

**Diatomite.** Three companies produced diatomite from Miocene or Pliocene freshwater lake deposits. The Eagle-Picher Industries filter-grade plant in Pershing County was the largest producer followed by their non-filter grade plant in Storey County. Grefco, Inc., with mine and plant in Esmeralda County, and Cyprus Minerals Co., with mine in Churchill County and plant in Lyon County, also produced diatomite. An out-of-State company was investigating the possibility of producing adsorbent-grade diatomite products from a western Nevada deposit.

**Construction Materials.** Production of sand, gravel, crushed rock, and lightweight aggregate for the construction industry continued to increase in 1985 and several new but relatively small operations were started. The Nevada Cement Co. plant near Fernley in Lyon County—Nevada's only cement plant—continued to produce at a high rate utilizing freshwater limestone mined nearby and clay mined in central Washoe County.

**Lithium Carbonate.** Foote Mineral Co. at Silverpeak in Esmeralda County recovered lithium carbonate by solar evaporation and chemical processing of lithium-rich brine pumped from beneath the Clayton Valley dry lake. Foote is 87.5% owned by Newmont Mining Corp.

**Barite.** A preliminary report by the U.S. Bureau of Mines shows that barite production in 1985 was 731,000 short tons, a 19% increase over 1984. Most of this production was by Dresser Industries, Inc., FMC Corp., Milchem, Inc., and NL Industries, Inc. In the latter part of the year, Milchem and the drilling-mud division of Newpark Resources merged with the new company named Milpark, Inc. In Nevada Newpark had operated as Eisenman Chemical Co. and Barite Mining, Inc.

**Gypsum.** The gypsum industry had an excellent year as demand for wallboard remained high and considerable calcined and uncalcined gypsum was shipped to plants in California. 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. In addition, Pacific Coast Building Products continued to supply calcined gypsum to its wallboard plant at Newark, CA. and U.S. Gypsum continued to supply its plant at Fremont, CA. The Art Wilson Co. shipped fairly large tonnages of uncalcined gypsum and anhydrite from a mine in Lyon County to the Nevada Cement plant and two cement plants in northern California. Near year's end it was reported that Pacific Coast Building Products intends to double the size of its Clark County wallboard plant and that Georgia Pacific Co. is planning a wallboard plant in southern Nevada. Presumably the gypsum for the new operation would come from patented claims owned by Georgia Pacific in southern Lincoln County about 70 airline miles northeast of Las Vegas. The Nevada Bureau of Mines and Geology issued an open-file report



"Gypsum in Nevada" by this author at the end of the year.

**Carbonate Rocks.** Genstar Cement and Lime Co. produces carbonate rock or lime at three localities in Clark County: dolomite at Sloan, limestone at Apex, and lime at Henderson. Marblehead Lime Co. continued to produce limestone from their mine near Pilot Siding in eastern Elko County. The crushed rock is hauled 60 miles by truck to a lime plant in Utah. Dolomite is mined and ground at two small operations in Humboldt County; the products are used mainly as feed additive for dairy cattle.

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

**Silica.** Simplot Silica Products at Overton in northeastern Clark County had a good year. They produce high grade silica sand from the Cretaceous Baseline Sandstone for glass plants in southern California and for the foundry industry.

**Clays.** The largest producer of Nevada clays, Industrial Minerals Ventures, Inc., mined and proc-

essed sepiolite and bentonite at Ash Meadows in southern Nye County. Hectorite mined nearby in California and bentonite from Wyoming are also processed at the plant to make high value organo-clad clays. Such clays are consumed in drilling operations when diesel oil is used as the drill fluid rather than water. Vanderbilt Minerals Co. continued to produce bentonite, mostly from their underground mine near Beatty in Nye County. Nevada Cement Co. produced a kaolin clay from its open-pit mine northwest of Pyramid Lake in Washoe County for use in the manufacture of cement. Use in cubing alfalfa provided a growing market for Nevada bentonite. The prepared alfalfa is mixed with about 2% bentonite before it is extruded to form cubes.

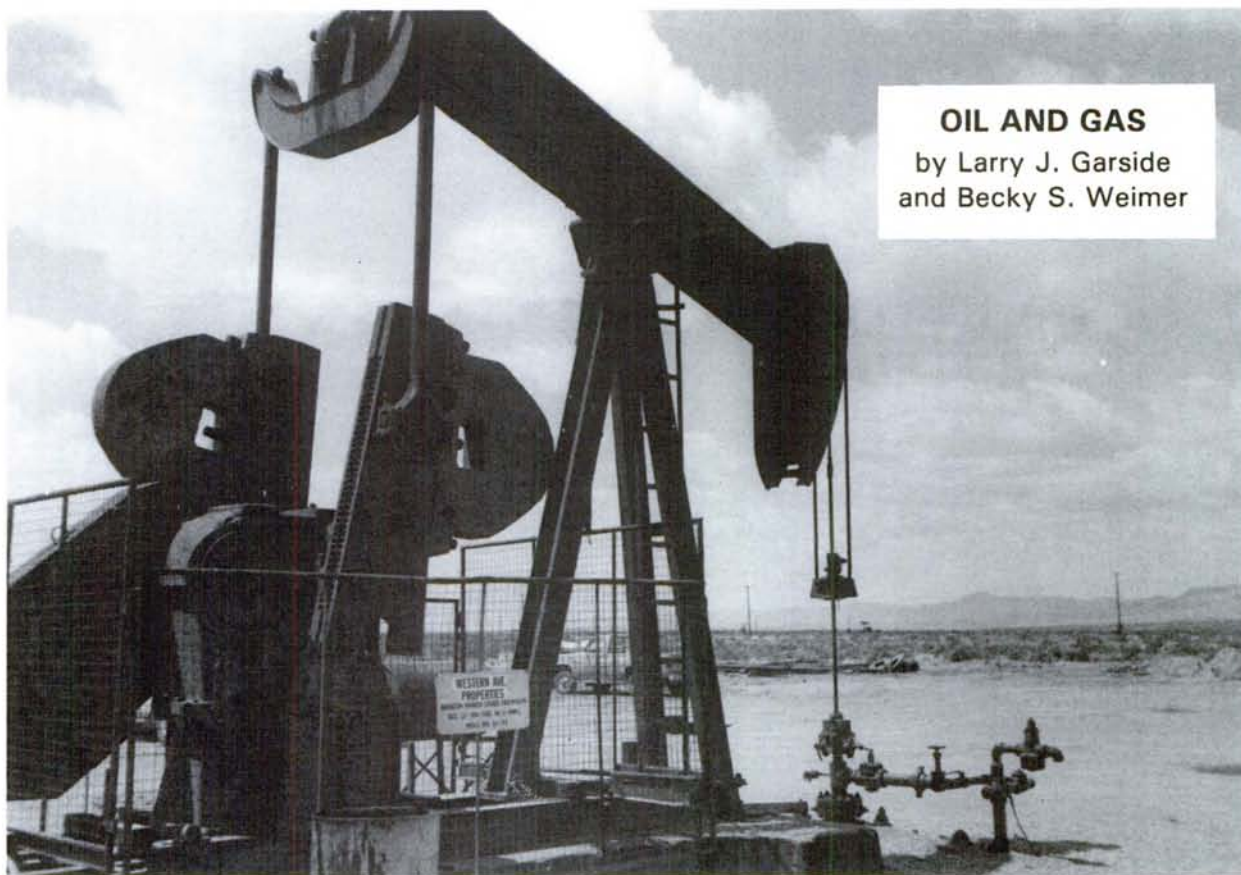
**Zeolites.** Zeolite International, Inc. screened and bagged clinoptilolite at Ash Meadows in southern Nye County. The mine, several miles south in California, was leased from Anaconda Minerals Co. Near the end of the year, the Ash Meadows deposit and several Anaconda zeolite deposits in Nevada were purchased by an outside company.

**Fluorspar.** J. Irving Crowell, Jr. and Son mined metallurgical-grade fluorspar at the Daisy Mine, an underground operation near Beatty in Nye County.



Simplot's silica mine, Clark County.  
Keith Papke photo.





## OIL AND GAS

by Larry J. Garside  
and Becky S. Weimer

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### EXPLORATION

During 1985, 34 wells totaling 214,204 feet were drilled in the search for oil and gas in Nevada. This footage is only slightly less (a 3% decrease) than the 1984 total, when a record 221,655 ft were drilled (see bar graph). The average depth of wells drilled was 6300, an increase from 6157 ft in 1984. An average of six drill rigs were active in Nevada in 1985. Although interest in the State will certainly remain high in 1986, the depressed world crude-oil price will no doubt affect the amount of drilling.

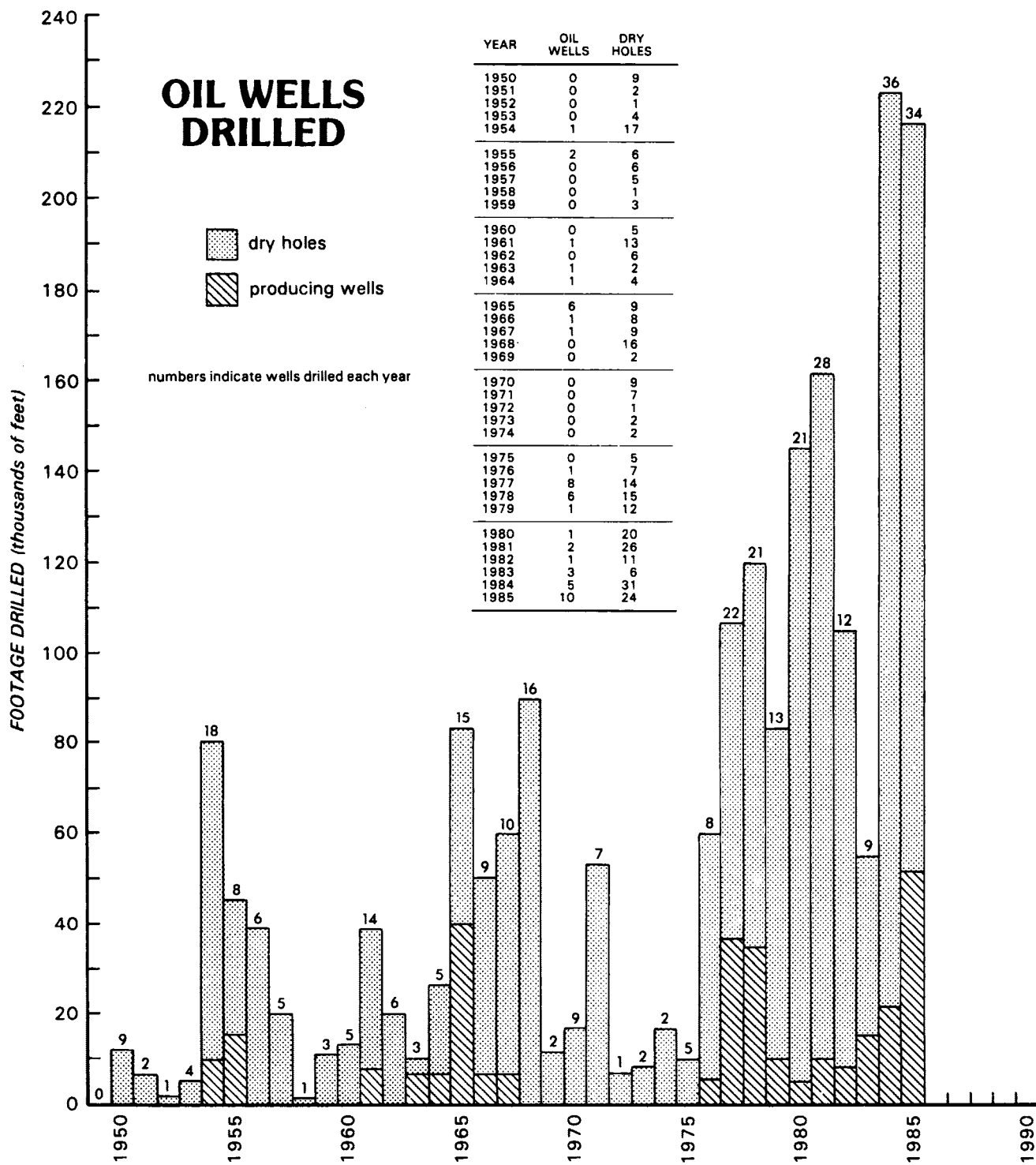
Oil and gas parcels in Railroad Valley, Nye County, brought in a total of \$125,165 in bonus bids from a U.S. Bureau of Land Management sale in September. The sealed bids on parcels within Known Geologic Structures ranged from \$56 to \$1,238 per acre. The parcels were in the Trap Spring, Grant Canyon, Eagle Springs, and Currant Known Geologic Structures.

Exxon Corp. drilled the third deepest well ever drilled in the State, a 14,450 ft dry hole located 65 miles northwest of Elko. The Fourmile Butte Federal No. 1 was rumored to have quite high bottom-hole temperatures.

### NEVADA'S OIL PRODUCTION<sup>1</sup>

Field (discovery date)	1984		1985	
	year	cumulative	year	cumulative
Eagle Springs (1954)	69,673	3,721,833	58,807	3,780,640
Trap Spring (1976)	522,833	5,710,219	582,822	6,293,041
Currant (1979)	0	641	0	641
Bacon Flat (1981)	10,855	89,064	47,942	137,006
Blackburn (1982)	135,541	238,074	284,246	522,320
Grant Canyon (1983)	1,168,709	1,331,899	2,065,747	3,397,646
	1,907,609	11,091,730	3,039,564	14,131,294
			59% increase	

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

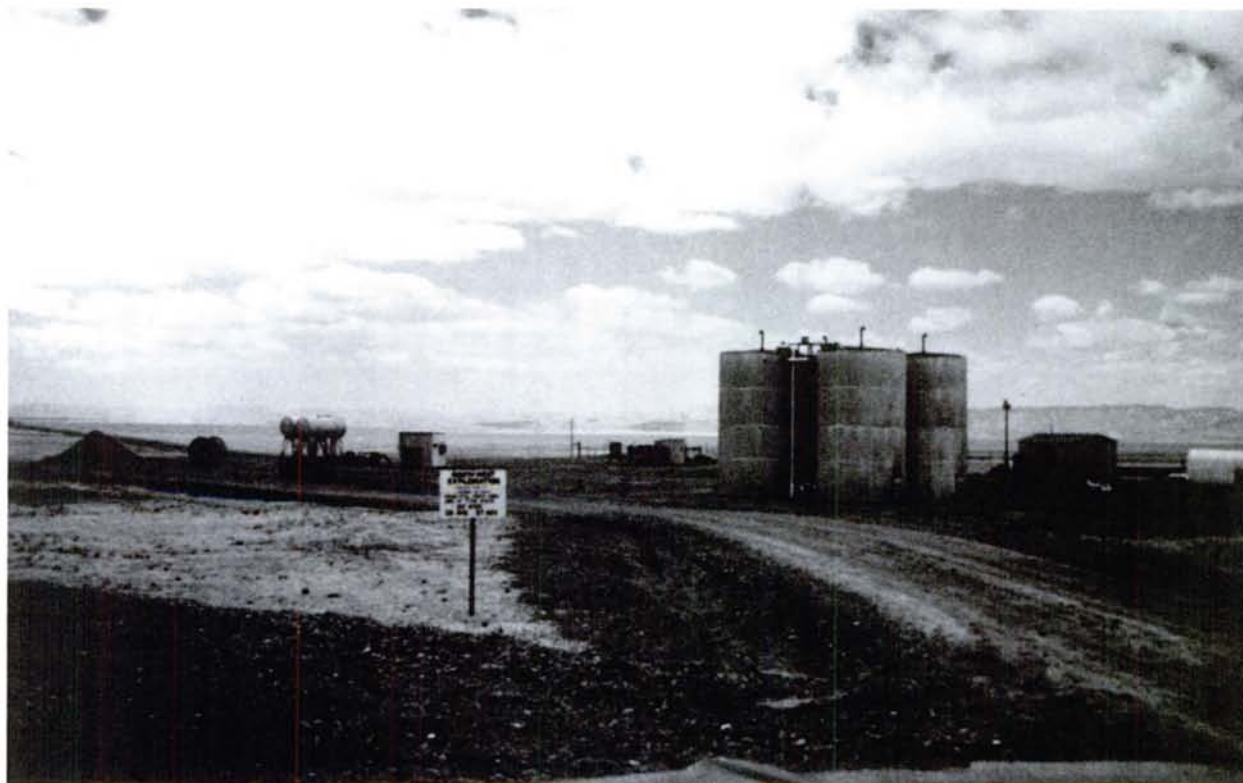




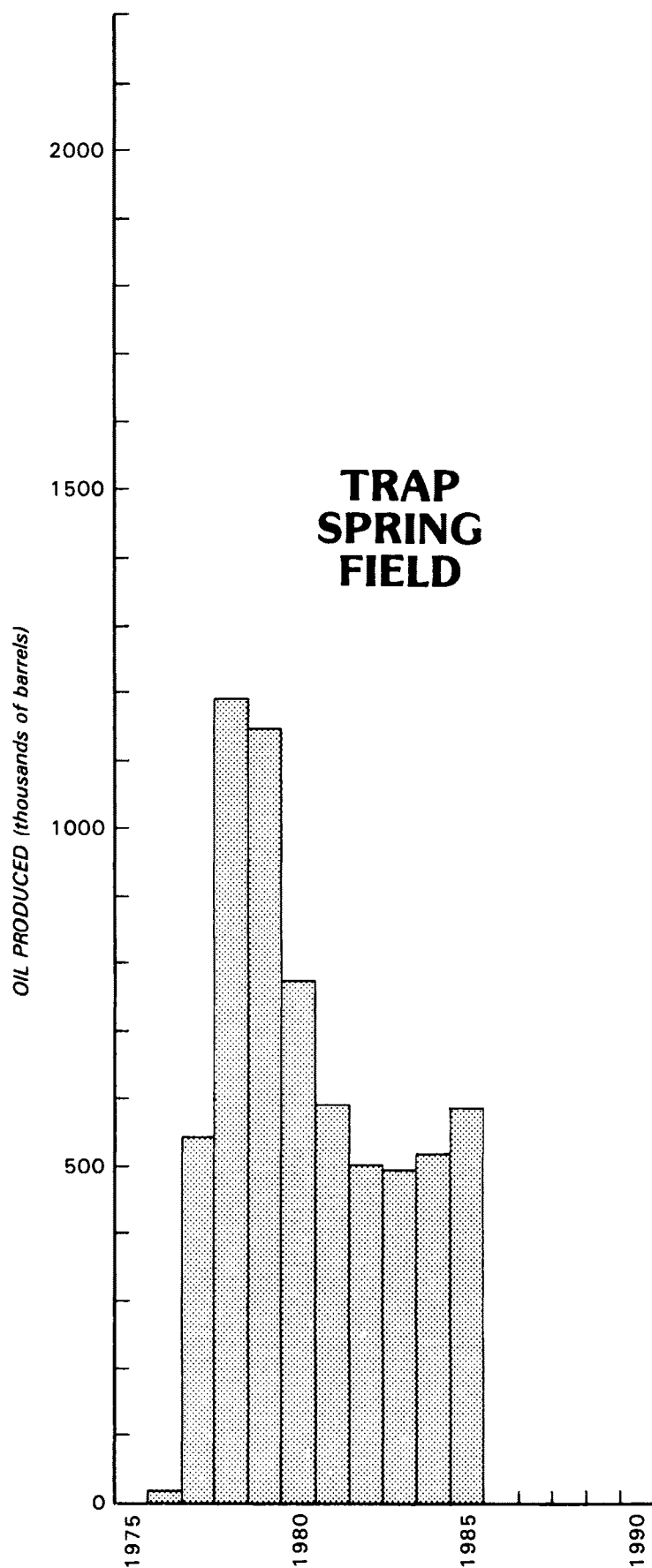
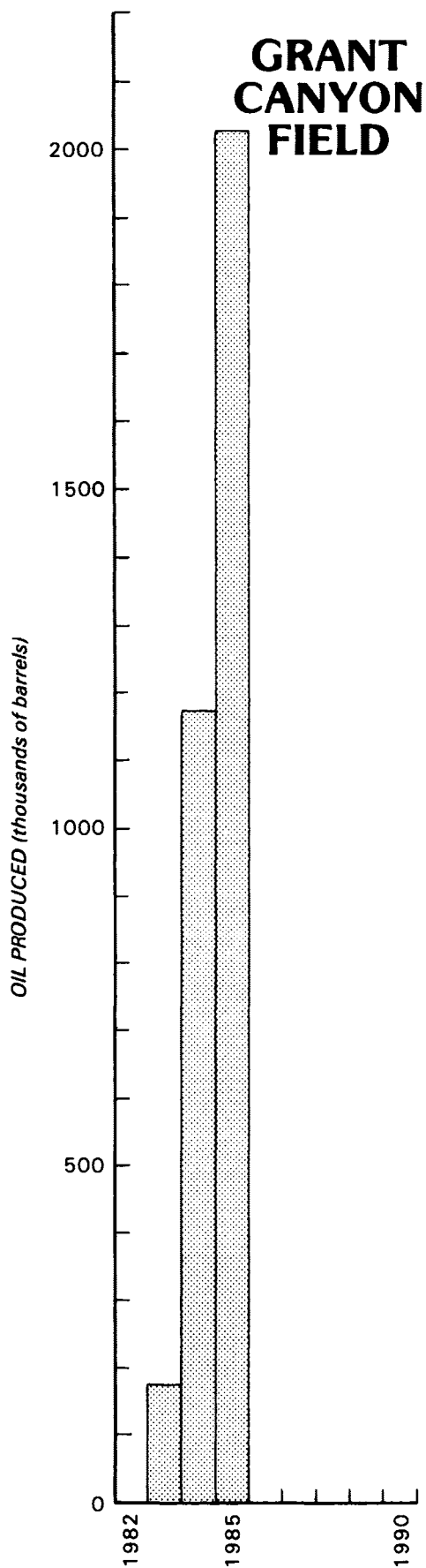
# OIL AND GAS WELLS DRILLED AND COMPLETED DURING 1985

Company	Well	Permit No.	Depth (ft)	County
Harper Oil Co.	Grant Canyon No. 6	401	6,250	Nye
Marlin Oil Co.	Federal No. 1-5	403	10,530	White Pine
Arco Oil & Gas Co.	Antelope Valley No. 1	407	4,600	Lander
Harper Oil Co.	Conoco Federal No. 19-1	409	4,912	White Pine
Phillips Petroleum Co.	Stoneberger Creek Federal No. 1-35	410	5,050	Lander
Phillips Petroleum Co.	Dobbin Creek Federal No. 1-6	411	4,679	Nye
Boswell Energy Corp.	Big Pole Creek No. 1-11	415	8,217	Eureka
Amoco Production Co.	Dutch John Unit No. 1	421	12,750	Lincoln
Harper Oil Co.	*Trap Spring No. 17-R	422	4,379	Nye
Western Avenue Properties	*Munson Ranch Unit No. 12-33	423	4,470	Nye
Amoco Production Co.	East Henderson Creek No. 1	425	10,977	Eureka
Amoco Production Co.	Stage Line Unit No. 1	427	8,500	White Pine
Diamond Shamrock Exploration Co.	Magnuson Fee No. 22-21	428	8,865	Elko
Sun Exploration & Production Co.	Adobe Federal No. 1	429	8,525	Elko
Western Avenue Properties	*Munson Ranch Unit No. 12-24	432	4,477	Nye
Wil-O Exploration	Farnes No. 1	434	2,250	Elko
Marathon Oil Co.	*Munson Ranch No. 13-1	435	4,199	Nye
Marathon Oil Co.	*Kate Spring No. 1	436	7,501	Nye
Ram Resources, Inc.	Federal No. 1 Long Jevity	437	10,346	White Pine
Ram Resources, Inc.	Federal No. 1 Long Shot	438	4,577	White Pine
True Oil Co.	Panos Federal No. 44-33	439	1,442	White Pine
True Oil Co.	Pon Federal No. 44-14	440	464	White Pine
True Oil Co.	Hendrickson Federal No. 43-35	441	3,250	White Pine
Amoco Production Co.	*Blackburn No. 14	442	7,210	Eureka
Exxon Corp.	Four Mile Butte Federal No. 1	443	14,464	Elko
True Oil Co.	Langley Federal No. 14-28	444	2,830	White Pine
Western Avenue Properties	*Munson Ranch No. 12-44X	445	4,550	Nye
Meridian Oil, Inc.	Federal No. 32-29	446	14,505	Nye
Wil-O Exploration	Farnes No. 2	447	1,074	Elko
Western Avenue Properties	*Munson Ranch No. 13-14X	448	4,524	Nye
Western Avenue Properties	*J. N. Federal No. 1	449	3,842	Nye
Amoco Production Co.	Blackburn No. 15	450	7,567	Eureka
Harper Oil Co.	Big Smoke No. 14-20	453	5,210	Nye
Amoco Production Co.	*Blackburn No. 16	458	7,208	Eureka

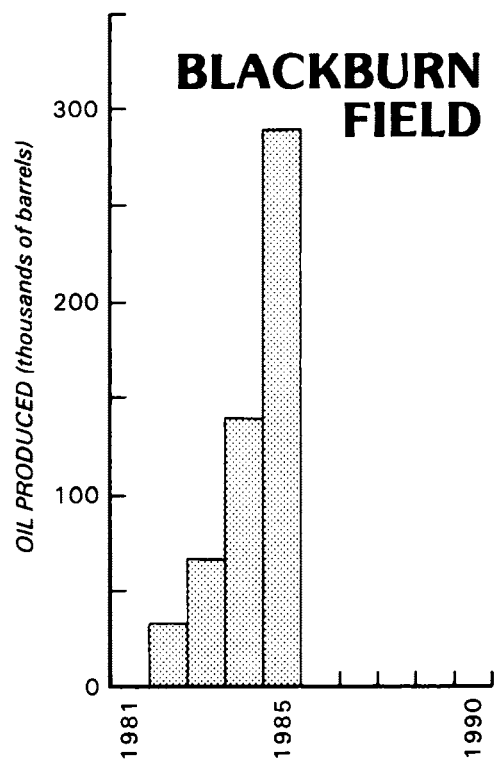
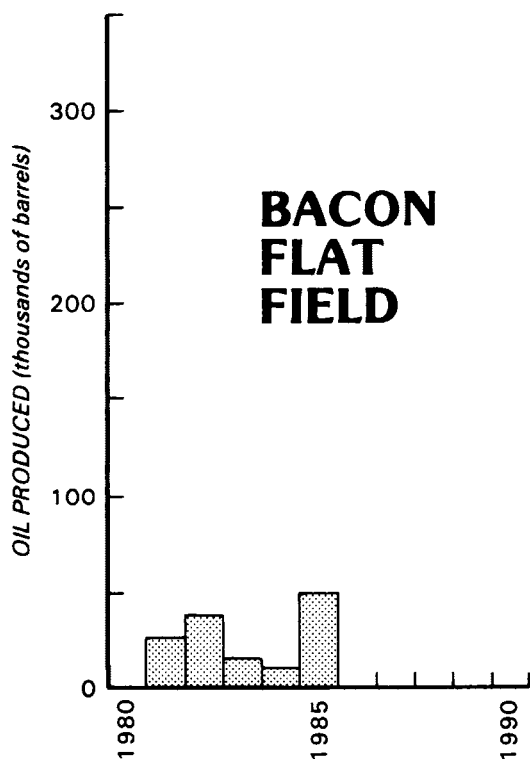
\*Producing Well



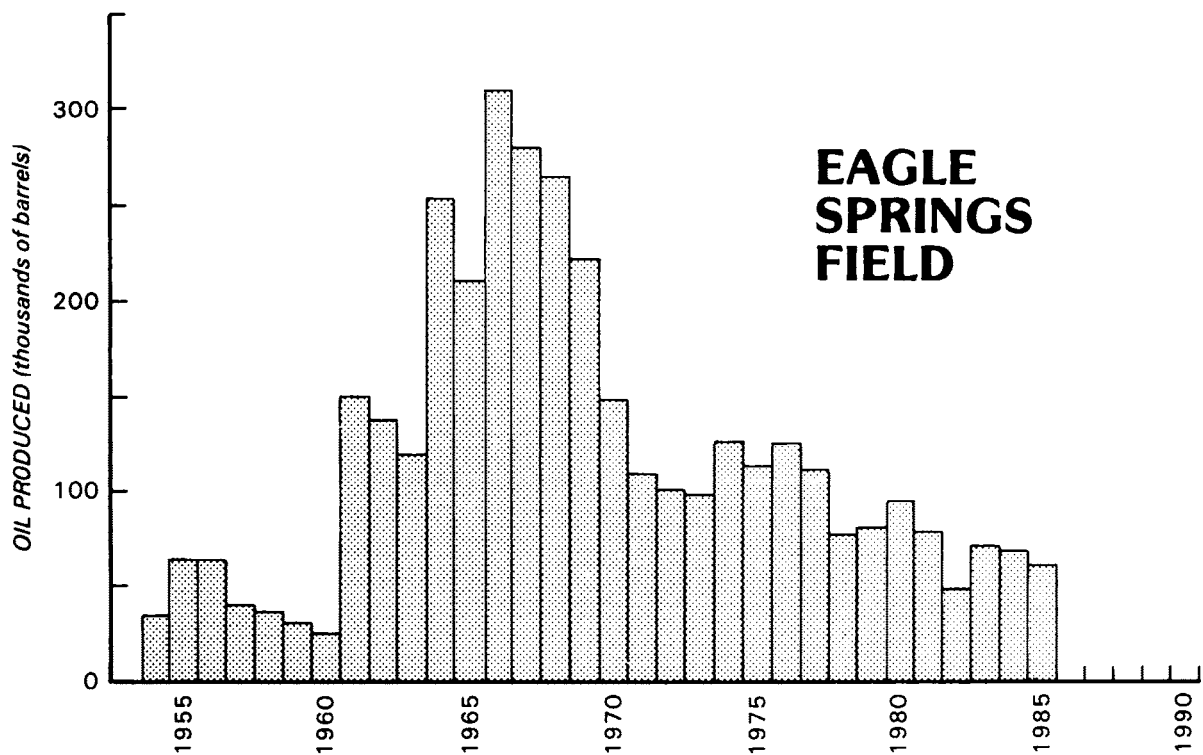
Tank battery at the Bacon Flat oil field, Nye County. Scott McDaniel photo.

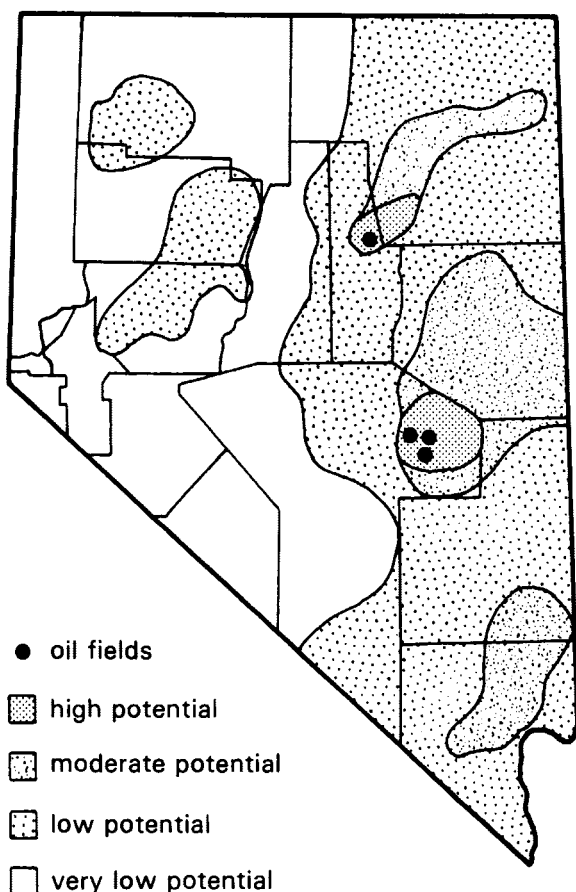






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## NEVADA PETROLEUM POTENTIAL

Good oil shows are reported from thin sandstone beds in the Mississippian Chainman Shale at the Meridian Oil, Inc. (Milestone Petroleum) Federal No. 32-29 well. Additional oil may have been encountered in the underlying Mississippian Joana Limestone. The Meridian well is located slightly over 1 mile southeast of the Trap Spring field in Nye County's Railroad Valley.

### NEW FIELDS DISCOVERED

The Marathon Oil Co. Kate Spring No. 1 well, located in Railroad Valley, approximately 1 mile south of the Eagle Springs field had rumors of oil-production capability during testing in late 1985. The oil is reported to be low gravity (less than 12 API), and it may be necessary to produce a considerable amount of water with the oil if commercial production can be established. Over 1200 barrels of oil were reportedly produced from the well in January of 1986.

### PRODUCTION

Nevada's oil production for the calendar year 1985 was 3,039,564 barrels (see table, bar graph), a 59% increase from 1984. Forty-three wells in five producing fields were operated during the year. The daily production at year-end was approximately 10,000 barrels per day. If this rate is continued through 1986, about 3.5 million barrels will be produced. Two new producing wells were drilled in the Blackburn Field in 1985, seven in the Trap Spring Field, and one well (The Kate Spring No. 1) was drilled in a new field.

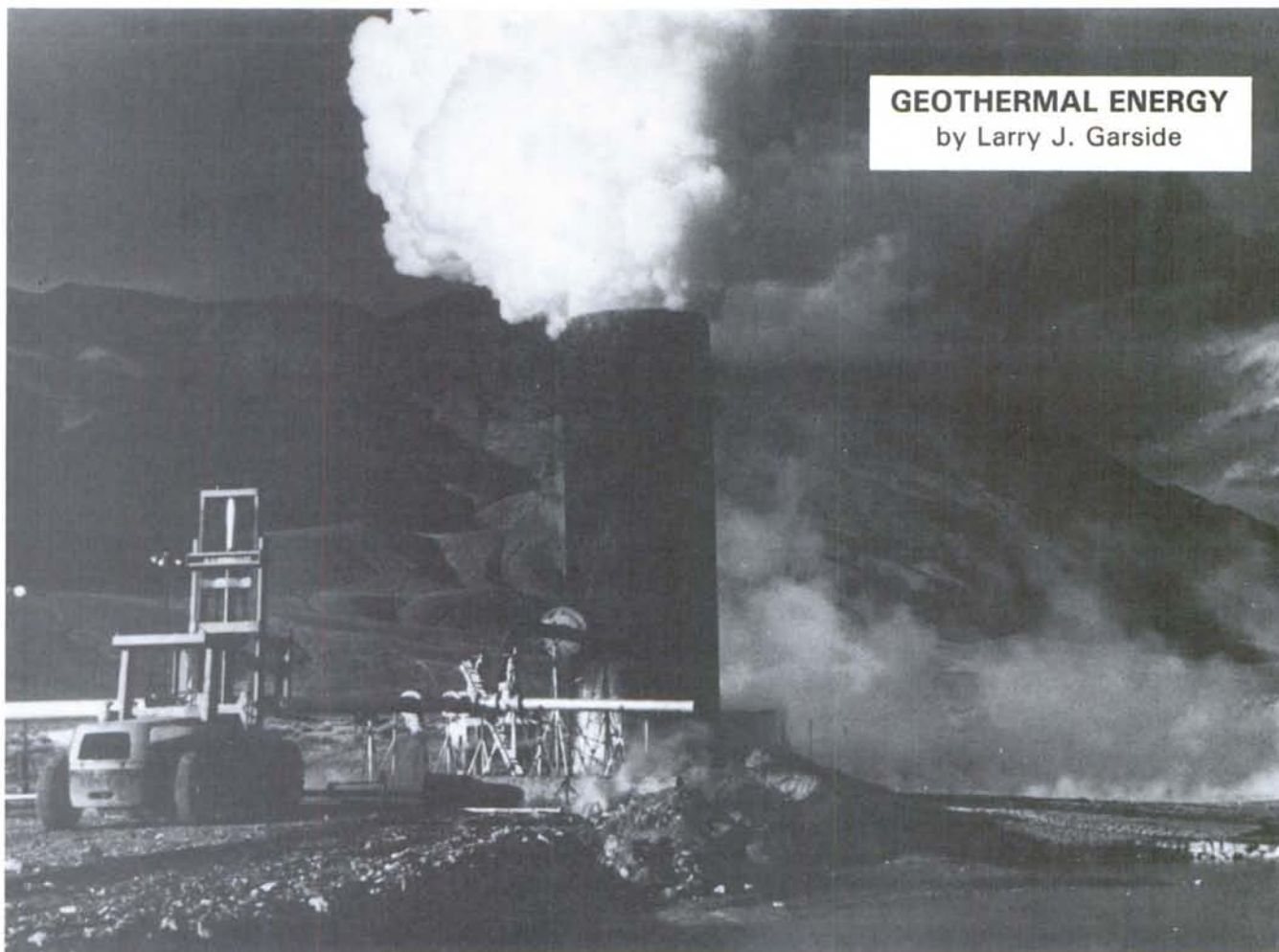
In 1985 Amoco Production Co. completed the third and fourth producers in the Blackburn Field of Eureka County's Pine Valley. The Blackburn No. 14 was perforated between 6950 and 7024 ft, and originally flowed 890 barrels of oil per day from the Devonian Nevada Formation. Amoco, Texaco, Inc., and North Central Oil Co. all hold a one-third interest in the well (Petroleum Information, 14 Aug 85). In late December, Amoco also reported the first production of oil from their fourth producing well in the Blackburn Field, the Blackburn No. 16.

The Nevada Department of Minerals reports that the Grant Canyon No. 3 well in the Grant Canyon Field of Railroad Valley may be the leading onshore producer (for an individual well) in the contiguous United States. The 4300 ft well is currently flowing an average of 3333 barrels of oil per day from Devonian dolomite.

Construction on a new crude-oil refinery in Railroad Valley, Nye County, was begun in June. The refinery is owned by Petro-Source, a Salt Lake City company. The plant will be capable of processing up to 3000 barrels of oil per day and is expected to be in full operation by spring of 1986. Diesel fuel and residential fuel oil will be made at the plant (Reno Gazette Journal, 19 Jan 86). Approximately 7600 barrels of oil per day are produced in Railroad Valley. The Nevada Refining Company at Tonopah process about 3000 barrels per day; the remainder of the Railroad Valley production has been trucked out of the State to northern Arizona or southern California (Reno Gazette Journal, 21 Jul 85). Trucking costs are reported to be nearly \$6 per barrel.

Nevada crude oil sold for \$18-\$19 per barrel in 1985. A 12.5% royalty is collected by the Federal Government from wells on public land. This royalty is split 50-50 with Nevada, yielding about \$1.15 for the State for every barrel produced. In addition, the State receives one-half of the lease payments that are made on all public domain (Federal) lands leased for petroleum in Nevada. These funds are earmarked for education and distributed to the counties based on population. The 1985 Nevada Legislature passed a bill (SB232) that will return 25% of all State oil royalties and lease payments over \$10 million to the counties that have producing wells or leases. (Reno Gazette Journal, 21 Jul 85).





## GEOTHERMAL ENERGY

by Larry J. Garside

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### EXPLORATION

Nevada geothermal resources continued to receive attention by energy companies in 1985, but the emphasis was on development rather than exploration. Falling petroleum prices have resulted in considerably reduced geothermal exploration budgets for most companies; however, millions of dollars were invested in the State in 1985 in the construction of geothermal generating facilities and the drilling of production wells in proven fields. There were seven wells drilled in the State in 1985 to exploit geothermal energy for electric power generation; these industrial-class wells (table) range in depth from 600 to nearly 8600 ft. The total footage drilled in 1985 (about 22,400 ft.) was nearly the same as that drilled in 1984 (bar graph).

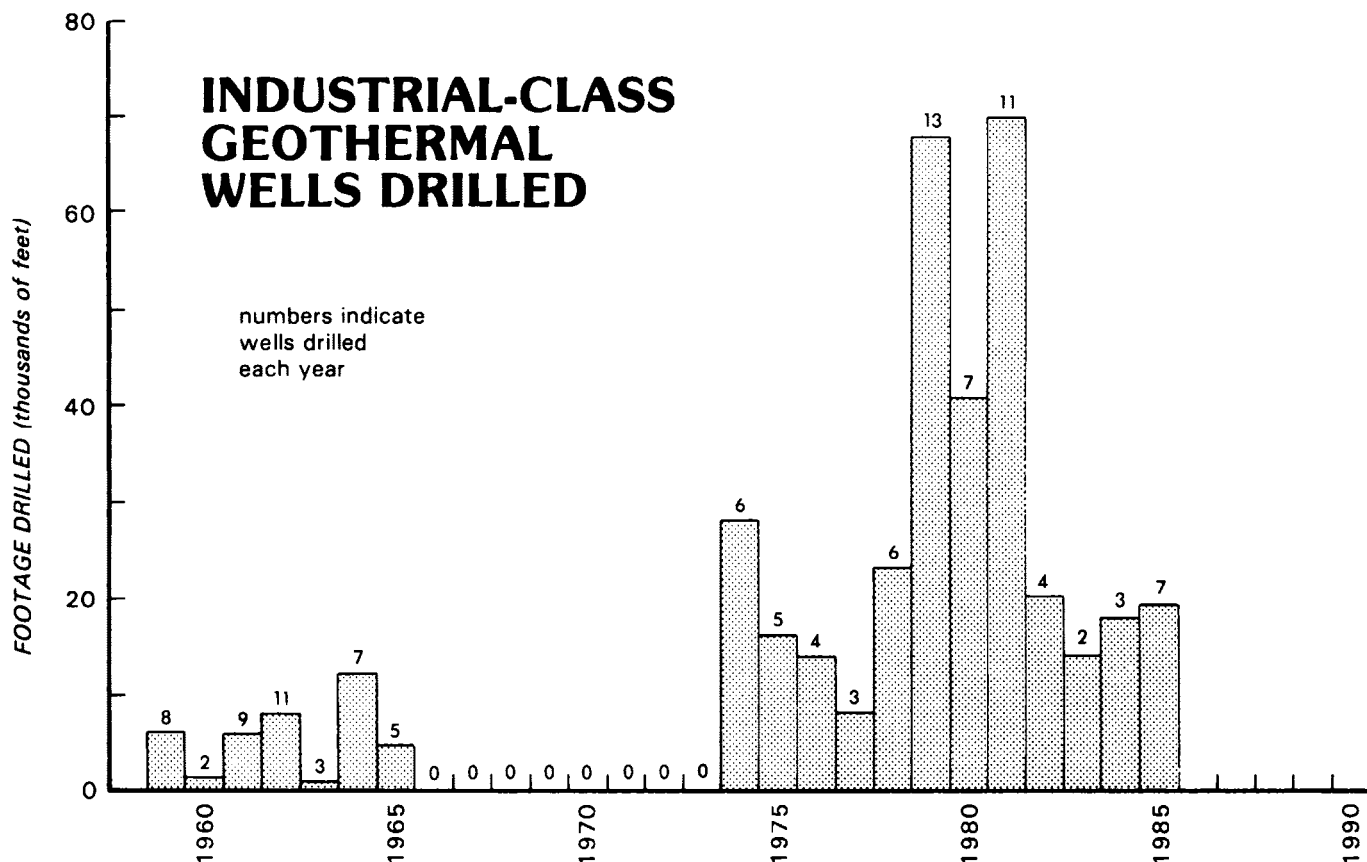
**Steam Reserve Corp.** began exploration in the Fish Lake Valley area of Western Esmeralda County in 1981. They reportedly have found geothermal fluids in commercial quantity at a temperature of 383°F. The company, a subsidiary of AMAX, Inc. reportedly has plans to install a 5-megawatt generating unit in 1986 and 10 megawatts of capacity by 1988. These developments would require construction of a power line to the nearby Valley Electric Association system, which would wheel the power to Southern

California Edison at Oasis, CA near Bishop (Reno Gazette Journal 16 Aug 85). At year-end development plans by Steam Reserve were uncertain.

In late October 1985, **Anadarko Petroleum Corp.** announced the discovery of commercial quantities of geothermal energy near Salt Wells in south-central Churchill County, approximately 60 miles east-southeast of Reno. The discovery well is 700 ft. deep and was pumped at a maximum sustained rate of 1300 gallons per day. The wellhead temperature is 265°F. Anadarko stated that the geothermal resources could be exploited with binary (heat exchanger) technology (Geothermal Resources Council Bulletin, Dec. 85).

**Oxbow Geothermal** bought controlling interest in **Nevada Geothermal Associates**, a company originally formed by California investors to develop a geothermal generating facility in Big Smoky Valley south of Austin, Nevada. Nevada Geothermal Associates has a contract with Sierra Pacific Power Co. for 10 megawatts of power (Nevada Business Journal, Mar 86). A 2500-foot thermal gradient well drilled near Darrough's Hot Springs in Big Smoky Valley in early 1986 had disappointing results, and future plans for the area are uncertain.

In mid-1985 **Oxbow Geothermal Corp.** acquired the assets of **TGS Associates** and **Sun Geothermal**,



Inc. companies with geothermal lease holdings in several western states including Nevada. Oxbow's acquisition included geothermal leases and 12 geothermal wells in Dixie Valley. Oxbow Geothermal is a subsidiary of the Oxbow Corp. of Massachusetts, a diversified company with interests in energy.

Oxbow plans to develop 50 megawatts of electric power generation capacity in Dixie Valley. Existing wells may have a capacity of 20-35 megawatts, and plans for 1986 include continued drilling to confirm up to 60-70 megawatts. (Doug Powell remarks at Geothermal Resources Council Topical meeting). The existing wells are generally 8000 to 9000 ft deep and have encountered temperatures of about 410°F (although temperatures as high as 480°F have been reported); generating capacity is probably 1-3 megawatts per well.

Oxbow has continued with plans begun by Sun and TGS for a power line from Dixie Valley to Bishop, California. This powerline will be necessary to transport electricity to Southern California Edison, as there are no available lines near the Dixie Valley field, and Oxbow does not have a contract for the Dixie Valley power with the northern Nevada utility, Sierra Pacific Power Co. Residents of Benton, California, 30 miles north of Bishop have opposed Oxbow's proposed powerline route (Reno Gazette Journal, 21 Sept 85 and 18 Jan 86).

In August 1985, Phillips Petroleum Co. completed a 3000 foot geothermal well in the Steamboat Hot

Springs geothermal area; the well is reported to be capable of commercial production. Phillips was the operator on the well, but Yankee Petroleum provided the money for drilling in order to earn a one-half interest in another nearby producible Phillips steam well which had reported temperatures of 460°F. The new well, the Phillips Petroleum Co. Steamboat No. 23-5, reportedly cost about \$1 million.

### DEVELOPMENT

Three Nevada geothermal generating plants went on line in 1985 and a fourth was under construction. These developments resulted in a completed generating capacity of about 31 megawatts, with another 10 megawatts under construction. Development drilling in several other areas could lead to more geothermal generating facilities in the next several years.

Electric power was generated at the Beowawe Hot Springs geothermal area in late December of 1985. **Chevron Geothermal Company of California** and **Crescent Valley Energy Co.** (a subsidiary of **Southern California Edison Co.**) entered into a general partnership to develop the resources and generate electricity. Chevron was responsible for the production and injection wells and pipeline, while Crescent Valley was responsible for providing the power plant and arrangements to deliver power to Southern California Edison. The two companies share ownership of the



# INDUSTRIAL-CLASS GEOTHERMAL WELLS DRILLED IN NEVADA IN 1985

Company Name	Well Name	Depth (ft)	Location	County
Anadarko Petroleum Corp.	Salt Wells No. 14-25	700	S25,T17N,R30E	Churchill
Munson Geothermal, Inc.	MGI No. 1	~600	S12,T22N,R26E	Churchill
Steam Reserve Corp. (AMAX)	Fish Lake No. 88-11A	8,589	S11,T15N,R36E	Esmeralda
Chevron Geothermal Co.	Ginn 2-13	8,300	S13,T31N,R47E	Lander
Geothermal Development Associates	Production, Well No. 1	~600	S29,T18N,R20E	Washoe
Geothermal Development Associates	Production Well No. 2	~600	S29,T18N,R20E	Washoe
Phillips Petroleum Co.	Steamboat No. 23-5	3,022	S5,T17N,R20E	Washoe

project facilities equally. Reported cost of the project is nearly \$20 million (Nevada Business Journal, Mar 86).

The Beowawe power plant is a 16.6 megawatt dual flash design based on the delivery of 1.25 million pounds per hour of fluid with a bottomhole resource temperature of approximately 410°F. Mitsubishi Heavy Industries Ltd. supplied the plant equipment. At plant delivery conditions the flow stream contains about 13% steam. The plant is supplied geothermal fluid from two wells, one 8300 ft deep and the other 9600 ft deep. The spent fluid is reinjected through a well located approximately 2 miles to the east. (L. T. Elliot in Geothermal Resources Council Topical Meeting proceedings). Electric power from the Beowawe plant will be wheeled by Sierra Pacific Power Co. to the Southern California Edison Co. In February of 1986, the plant was generating about 14 megawatts of electricity.

**Phillips Petroleum Co.**, in December of 1985, began generation of electric power from a 9-megawatt geothermal facility located near Desert Peak 65 miles northwest of Reno. The power plant, which was designed by Phillips, uses a biphasic turbine built by TransAmerica Corp. that utilizes the total flow of steam and hot water from two 9000-foot wells. The resource temperature is approximately 400°F. Each well is capable of producing about 500,000 pounds per hour of fluid, of which approximately 10% flashes to steam (Phillips Petroleum Co. announcements). Erection of the Desert Peak power plant began in May and was completed by December. The plant is currently producing 9.3 megawatts.

A geothermal electric generating facility was completed during late 1985 at Steamboat Springs 9 miles south of Reno by **Geothermal Development Associates**. The project is located on a 30 acre parcel leased from Sierra Pacific Power Co. The power plant consists of seven Ormat organic Rankine cycle ("binary") modular generating units arranged in a cascading temperature configuration. Three production wells, each less than 1000 ft deep, provide geothermal fluid at a temperature in excess of 325°F. The spent fluid is reinjected in two injection wells. The reservoir is fractured granodiorite. The facility is rated at a net output of 5 megawatts; electricity is sold to Sierra Pacific Power Co. under an agreement which provides for a leveled rate of

\$0.0717 per kilowatt-hour for 10 years. Initial start-up was in December 1985; full operation is scheduled for June 1986. The project will cost approximately \$10 million.

Geothermal Resources are now recognized by the State of Nevada as mineral commodity, subject to regulation by the **Department of Minerals**. As a mineral, geothermal resources therefore belong to the surface owner, unless otherwise conveyed, and in most cases are not subject to appropriation procedures and regulation as groundwater. If mineral ownership has been severed from surface ownership, and geothermal resources were not specifically mentioned in that severance, courts in some states have concluded that the geothermal resources stay with the mineral ownership.

Senate Bill 354 amended Nevada Revised Statutes, 533, 534, 534A and 362 easing the regulation of groundwater for geothermal purposes, switching jurisdiction of geothermal operations from the State Engineer to the Department of Minerals, and clarifying permitting procedures for geothermal wells and exploration holes. A water right is not longer required under NRS 533 for obtaining geothermal energy as the non-consumptive use of groundwater for energy is no longer under the category of a "beneficial water use."

The bill provided a number of amendments to NRS 534. One deletion was the categorizing of geothermal resources as a "domestic use" when used as a heat source in a single family dwelling. Geothermal wells are, therefore, no longer under the same restrictions as wells drilled for domestic water use. An amendment to NRS 534 provides that the use of water from a geothermal well is not subject to appropriation procedures if "the water is returned to or reinjected in the same aquifer or reservoir" or if only a reasonable amount of water is lost during well testing or due to a temporary reinjection system failure (Nevada Mining Association Bulletin, Oct-Nov 86).

Senate Bill 354 also directed that the Nevada Department of Minerals, rather than the State Engineer will direct the well permitting process, after consultation with other state agencies. The information obtained as a result of a geothermal project must be filed with the Department of Minerals within 30 days after it is accumulated. This information is kept confidential for 5 years, and may not be



Geothermal Development Associates drilling at Steamboat Hot Springs, Washoe County. *Larry Garside photo.*

disclosed without the written consent of the geothermal project operator. The Department of Minerals has developed regulations for the drilling, completion, and abandonment of geothermal wells.

Additionally, in NRS 362, the words "geothermal steam" have been changed to "geothermal resources", thereby allowing any heat commercially recovered to be taxed as proceeds of an operating mine. However, the use of geothermal water for raising plants and animals has been excluded from assessment as an operating mine (Nevada Mining Association Bulletin, Oct-Nov 85).

The Nevada Department of Minerals adopted permanent regulations concerning the drilling and utilization of geothermal wells in August of 1985. Required drilling practices are different for the three

different classes of geothermal wells: domestic, commercial, and industrial. A domestic geothermal well is one which is used for domestic purposes by one or more single family dwellings on a single parcel of land under the same ownership, and not more than an annual average of 1800 gallons of water a day is drawn from the well. A commercial geothermal well is one used to provide geothermal resources on a commercial basis for purposes other than the generation of power. An industrial geothermal well is primarily used to generate power. Additional regulations cover temperature-gradient, observation, and injection wells. Copies of the regulations are available from the Department of Minerals.

**Munson Geothermal, Inc.** began construction in 1985 of a geothermal generating plant at Brady Hot Springs in Churchill County. The development, termed the **Brady Geo Park Power Projects** consists of two separate power generation facilities. A 5.5 megawatt facility will consist of a dual-boiling cycle binary unit originally built for the U.S. Department of Energy at the Raft River Test Facility near Malta, Idaho. This unit was moved to the Brady's site and will be reconstructed to utilize the higher temperature geothermal fluids available at Brady's. A second power project will consist of eleven **Ormat Systems, Inc.** modular binary generating units in a cascade array. This project is projected to produce 4.4 megawatts; the estimated start-up time is April 1986. The geothermal fluid to be supplied to the plants is reported to have a temperature of approximately 300°F. **EG&G Hydro, Inc.** and **Hydra-Co Enterprises, Inc.** (a subsidiary of **Niagra Mohawk Power Corp.**) are limited partners in the dual-cycle plant. Electricity from the plants will be sold to Sierra Pacific Power Co. (paper by S. M. Munson, 12 Feb 86).

The **Wells High School** is heated with a heat pump which is supplied 87°F water from a 800 foot well. The heat pump uses one-third less electric energy than the electric boiler that it replaced. A similar heat pump system for heating domestic water is in place at the **Carlin High School**, utilizing 87°F water from a 640 foot well. Future plans include a space-heating system for the High School utilizing 87°F water from a 640-ft well. (EG&G Idaho Regional Geothermal Progress Monitor, Dec 85).

**Walley's Hot Springs Resort** near Minden received a national energy conservation award in November from the U.S. Department of Energy for its geothermal space heating system. The award will be given to the system designers, **Chilton Engineering** (Reno) and the **Zephyr Restaurant** (Genoa) (EG&G Idaho Regional Geothermal Progress Monitor, Feb 86).

**Delta Omni Corp.** applied to the Churchill County Planning Commission and State agencies to drill wells and construct a geothermal power plant adjacent to the Fallon Naval Air Station. The company also wants to obtain at least \$3.5 million in State industrial development bonds for the project. The company plans to generate electricity using a unique patented turbine (Reno Gazette Journal 21 Feb 85).



In February 1985 **The Elko County School District** completed a new geothermal well which produced, in a preliminary test, 190°F water under artesian conditions at a flow rate of 150 gallons per minute. The new well was intended to heat the new Junior High School, but it is now estimated that the Senior High School, as well as the Convention Center and swimming pool, could be heated (Geothermal Resources Council Bulletin, Apr 85). The School District estimates that it will soon have 12 buildings in Elko and two in Carlin using geothermal water space heating and domestic hot water. The district has received funding under The Institutional Conservation Program, which is funded by the U.S. Department of Energy and administered by the State Office of Community Services (Reno Gazette Journal, 26 Nov 85).

Plans for construction of a 75 megawatt geothermal power plant at the **Fallon Naval Air Station** have been delayed because the project may be economically unfeasible. The U.S. Navy signed a 30 year contract with **General Ener-Tech of California** and **Helioscience, Inc.** of New York in 1982. These developers were to construct a geothermal power plant, and the Navy agreed to purchase the electric power. The initial contract price was 3.9 cents per kilowatt-hour, a rate that is considered by many industry experts too low to produce a profit. No test wells were drilled by the developers, and they reportedly were having trouble securing financing.

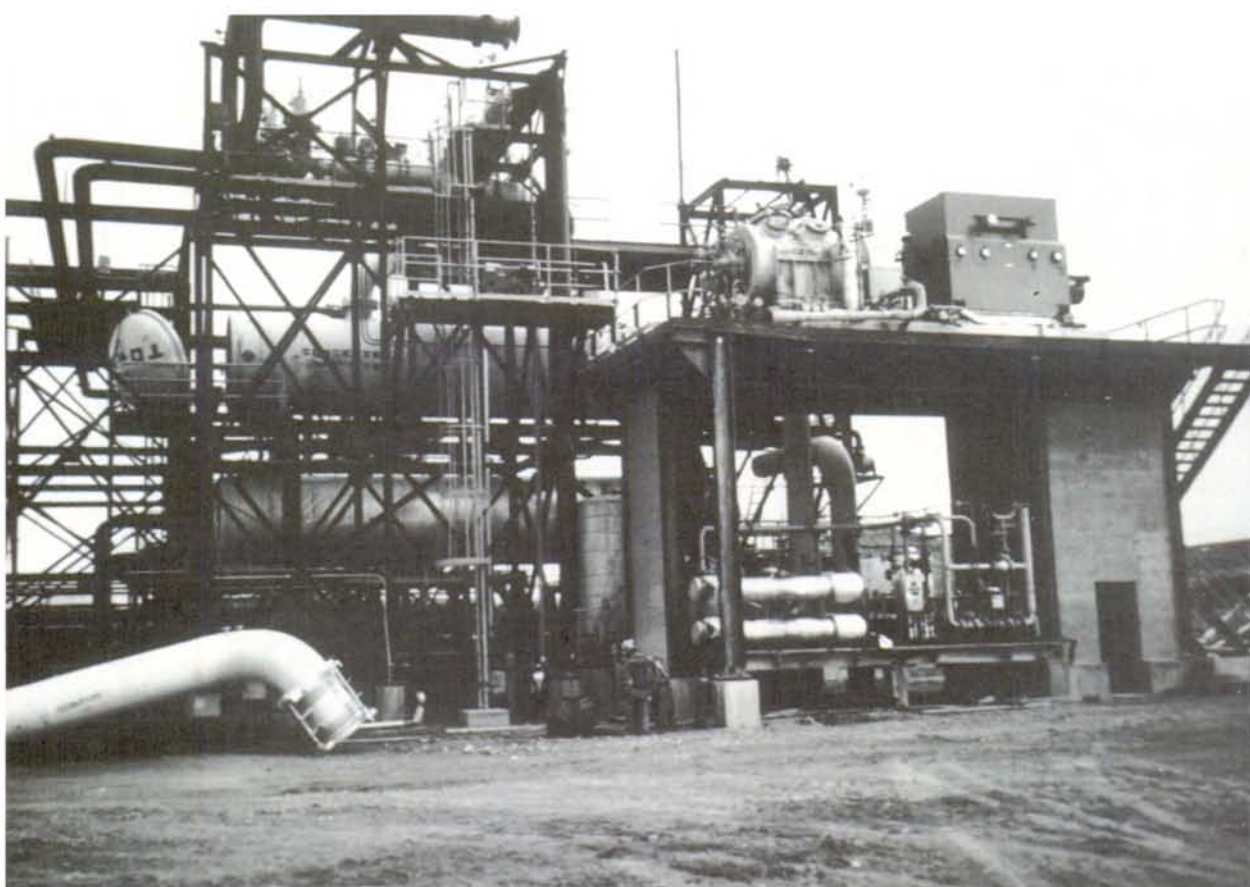
A joint U.S. Congress subcommittee on military appropriations has asked the Navy to explain why the contract was awarded to a company which had no experience in geothermal development, and which had been involved in a number of failed business ventures and investigations concerning stock manipulation. The Navy has been told to submit a report to the congressional subcommittee by January 31, 1986 (Reno Gazette Journal, 15 Aug, 3 Oct, and 2 Dec 85). A Fallon Naval Air Station spokesman says that the Navy will solicit bids for another company to build the project (Geothermal Resources Council Bulletin Mar 86).

In early April Gilroy Foods announced the purchase of a geothermal vegetable dehydration plant (The Geothermal Food Processors, Inc. plant), 12 miles east of Fernley from the McKesson Corp. for an undisclosed amount of money (Geothermal Resources Council Bulletin, Jun 85). The plant utilizes geothermal fluid from a well at Brady's Hot Springs to dry vegetables, mainly onions.

A 1,370-foot geothermal exploration well was drilled at the **Veterans Administration Medical Center** in Reno. Tests on this well indicate that a production well at the site would be capable of yielding 300 gallons per minute of 115°F water. This resource could be used directly (with fan coils) to heat an area of 38,000 square feet. With amplification by use of heat pumps, an area of 380,000 square feet could be heated (Geothermal Hot Line, Dec 85).

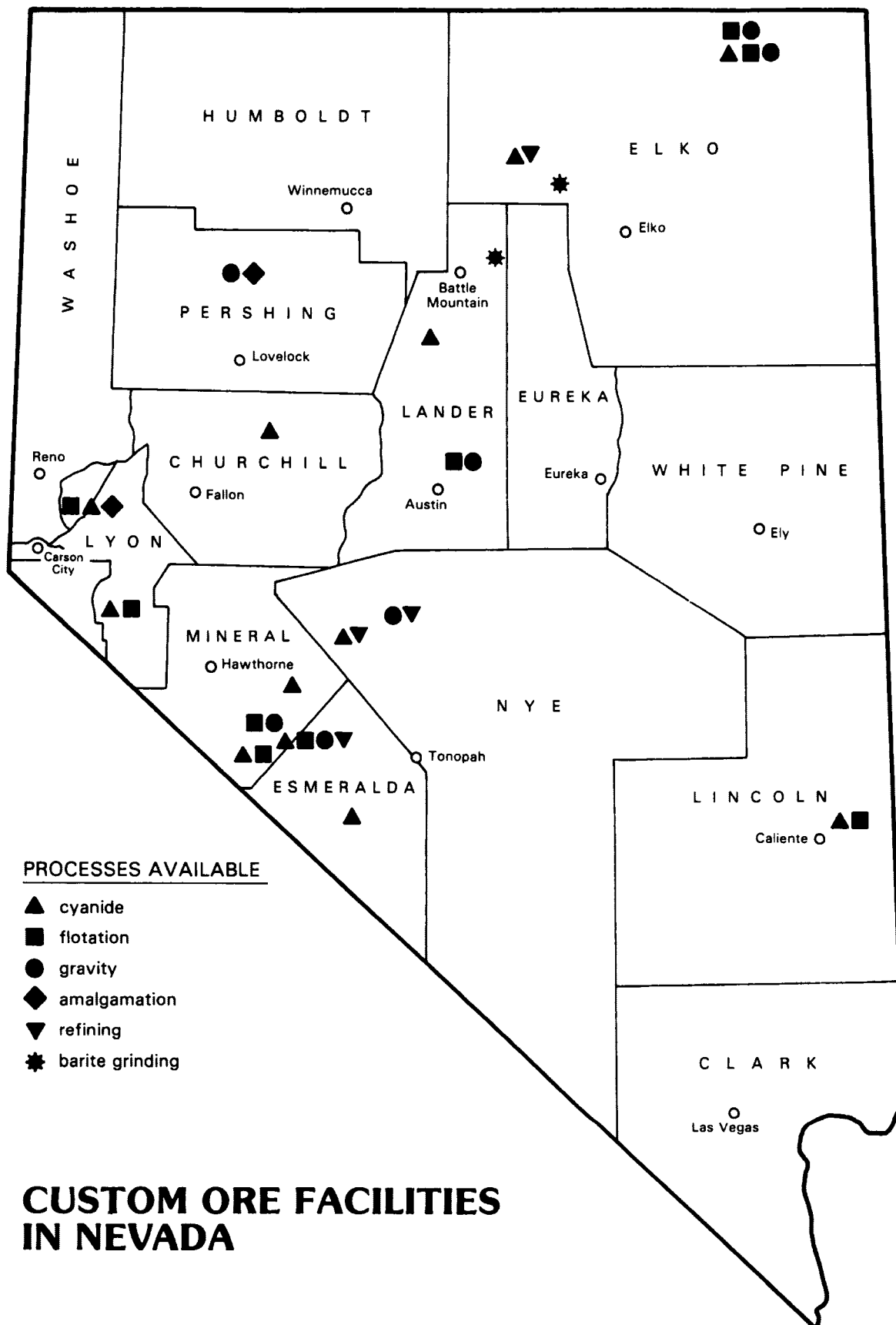


Desert Peak geothermal power plant, Churchill County. Larry Garside photo.



Geothermal power plant (relocated Raft River, ID plant) under construction by Munson Geothermal at Brady's Hot Springs, Churchill County.





**DIRECTORY OF  
NEVADA MINE OPERATIONS  
ACTIVE DURING 1985**

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