UNIVERSITY OF NEVADA-RENO
MACKAY SCHOOL OF MINES

NEVADA BUREAU OF MINES & GEOLOGY
SPECIAL PUBLICATION
MI-1987

THE NEVADA MINERAL INDUSTRY 1987

Metals
Industrial Minerals
Oil and Gas
Geothermal

Exploration
Development
Mining
Processing

GOLD
OIL
SILVER
SAND & GRAVEL
BARITE
DIATOMITE
MERCURY
CRUSHED ROCK
CEMENT
LITHIUM
LIME
MAGNESITE
GEOTHERMAL
SILICA
CLAY
FLUORSPAR
TURQUOISE
IRON ORE
PERLITE
PUMICE
TUNGSTEN
OPAL
COPPER

1988

For more information contact:
Nevada Bureau of Mines and Geology
Email: nbmg@unr.edu
Web: http://www.nbmg.unr.edu/

UNIVERSITY OF NEVADA SYSTEM

Board of Regents

June Whitley, *Chairman*

Mr. James Eardley
Mr. Joseph M. Foley
Mrs. Dorothy Gallagher
Chris Karamanos
Mrs. Joan Kenney
Daniel J. Klaich
Mrs. JoAnn Sheerin
Mrs. Carolyn M. Sparks

Mark H. Dawson, *Chancellor*

UNIVERSITY OF NEVADA-RENO

Joseph N. Crowley, *President*

MACKAY SCHOOL OF MINES

James L. Hendrix, *Interim Dean*

NEVADA BUREAU OF MINES AND GEOLOGY

Jonathan G. Price, *Director/State Geologist*

INFORMATION SERVICES
Keryl Fleming, *Geologic Computer Specialist*[1]
Ron Hess, *Geologic Information Specialist*
Arlene Kramer, *Sales Manager*
Becky S. Weimer, *Geologic Information Specialist*
Patrick Goldstrand, *graduate assistant*[1]

LABORATORY SERVICES
Paul J. Lechler, *Chief Chemist/Geochemist*
Mario Desilets, *Assistant Chemist*
David Davis, *Mineral Preparator/Shop Mechanic*

CLERICAL SUPPORT
Dorene E. Camp, *Receptionist*
Ann E. Dalbec, *Management Assistant*
Brenda Craig, *Account Clerk*[1]

PUBLICATION SUPPORT
Susan L. Tingley, *Publication Manager/Cartographer*
Rayetta Buckley, *Composition/Paste-up Artist*
Larry Jacox, *Geologic Cartographer*
Mati A. Stephens, *Publication Technician*[1]
Linda P. Hobbs, *Geologic Cartographer*[1]
Richard Meeuwig, *Geologic Editor*

[1]part time
[2]non-state funded

GEOLOGY, GEOCHEMISTRY, & MINERAL RESOURCES
Harold F. Bonham, Jr., *Research Geologist*
Stephen B. Castor, *Industrial-Minerals Geologist*
Larry J. Garside, *Research Geologist*
Liang-Chi Hsu, *Geochemist*[1]
Richard B. Jones, *Metal-Resources Geologist*
Joseph V. Tingley, *Economic Geologist*
Daphne D. LaPointe, *Geologist*[1,2]

ENGINEERING & URBAN GEOLOGY
John W. Bell, *Engineering Geologist*
Craig M. dePolo, *Assistant Geologist*[2]
Alan R. Ramelli, *Assistant Geologist*[2]
James G. Rigby, *Engineering Geologist*

COOPERATIVE PROGRAMS
U.S. Bureau of Mines mineral statistics & activities
Fred V. Carrillo, *State Liaison Officer*[2]
U.S. Geological Survey
Geologic Division
National Cartographic Information Center
National Mapping Division
State Resident Cartographer (vacant)
Nevada Department of Minerals
oil & geothermal drilling samples, logs, and other data
New Mexico Bureau of Mines and Mineral Resources
Isochron/West—Journal of Isotopic Geochronology

Editing: Dick Meeuwig
Graphics: Larry Jacox, Susan Tingley
Typesetting:
By: Rayetta Buckley
At: Nevada Bureau of Mines and Geology
On: Compugraphic EditWriter 7770
Text: Univers II, 10 pt.
Heads: Souvenir Gothic Bold, 24 pt.
Paste-up: Rayetta Buckley

Printing:
First edition, first printing, 1988
Copies: 1000
By: Printing Services
University of Nevada-Reno, Reno, NV 89557
Stock, cover: Wausau Astrobright, Galaxy Gold, 65# Cover
Stock, text: Cascade White Offset, 60 lb.
Ink, cover: Pantone 469
Binding: saddlestitch

For sale by the Nevada Bureau of Mines & Geology, University of Nevada-Reno, Reno, NV 89557-0088. Price $5.00

Digitized by Google

THE NEVADA MINERAL INDUSTRY—1987

CONTENTS

3 **INTRODUCTION** *by Larry J. Garside*

9 **METALS** *by Richard B. Jones*
- 9 Major Exploration and Development
- 11 Other Exploration Activities
- 14 Operating Mines and Plants
- 17 New Mines and Plants
- 18 Closures

19 **BULK-MINEABLE PRECIOUS-METAL DEPOSITS** *by H. F. Bonham, Jr.*

25 **INDUSTRIAL MINERALS** *by Stephen B. Castor*

29 **OIL AND GAS** *by Becky S. Weimer*
- 29 Exploration
- 29 Legislation
- 31 Plans for 1988
- 33 Production
- 34 New Producers
- 36 Other News

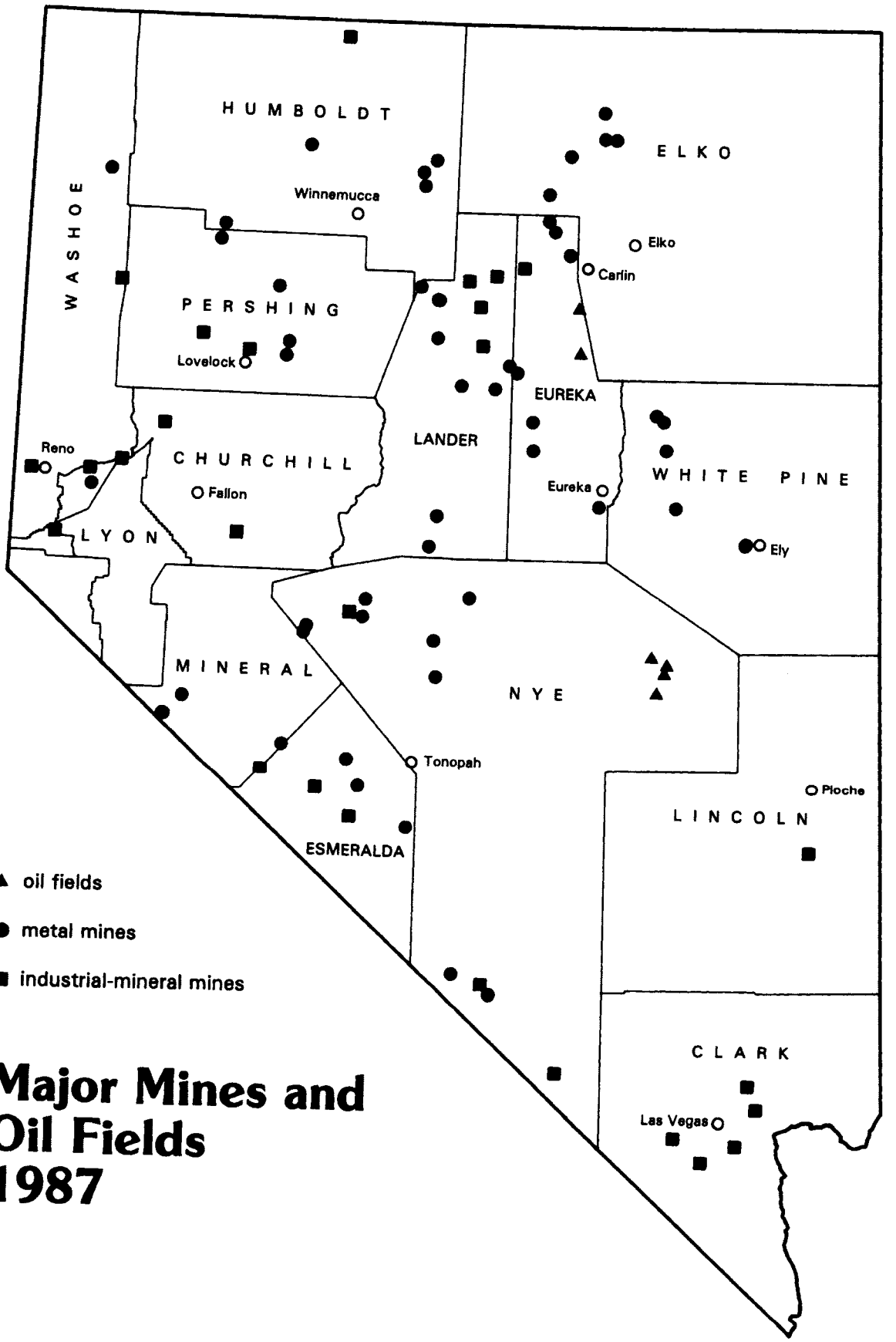
37 **GEOTHERMAL ENERGY** *by Keryl L. Fleming and Larry J. Garside*

41 **DIRECTORY OF MINING OPERATIONS** *by Keryl L. Fleming and Richard B. Jones*

This report is the ninth of an annual series. It describes 1987 activities: mineral exploration and development programs; discovery of orebodies; new mines opened; production statistics; expansion, cutbacks, closings, and other activities of existing mines; oil and gas drilling and production; and geothermal drilling and utilization.

For more information contact:
Nevada Bureau of Mines and Geology
Email: nbmg@unr.edu
Web: http://www.nbmg.unr.edu/

This One
POYS-G5H-6XTY



Major Mines and Oil Fields 1987

Introduction

by Larry J. Garside

The mining industry occupies an important place in the history and economy of Nevada. Most of our residents are aware that the State's early production of mineral wealth was of considerable importance in achieving statehood, and that the development of many Nevada towns and cities resulted from mining activity. However, few people outside the mining community are aware that mining continues to be a major contributor to the economy.

Nevada's mineral production has gone through several cycles related to world economic changes, mineral prices, and international conflicts. Its rise to prominence as a gold producer occurred during the late 1970's and early 1980's. Nevada has been the leading state in gold production every year since 1980, and led the Nation three times in the 1970's.

Several factors are responsible for the emergence of Nevada as the leading U.S. gold producer. The State is well endowed with mineral wealth; gold and silver have been mined in nearly 300 mining districts. Additionally, a large amount of the state is public domain land—that is, land that is available for prospecting and exploration, and the location of mineral claims. The long history of the mining industry has also contributed toward a receptive climate for mining.

Nevada's 1987 mineral production has an estimated value of $1,455 million, based on preliminary data. This represents an increase of $463 million, 47 percent over 1986 mineral production and is mainly the result of a 28 percent increase in gold production (to approximately 2.7 million troy ounces) and a 97 percent increase in silver production (to 12.6 million ounces). In addition, the average price paid for the gold produced was approximately 20 percent higher in 1987 than in 1986. Petroleum prices also staged a comeback this year, adding about $13 million over the 1986 amount.

Nevada ranked fourth of the states in total nonfuel mineral production this year (U.S. Bureau of Mines data). It was first in gold production, having nearly 4 times the production of California, its nearest competitor. The State led the Nation in the production of silver and barite as well, and was the sole producer of mined magnesite and mercury. Nevada barite production, however, was less than one-third of its high point four years ago, due to declining requirements in the petroleum drilling industry and foreign-product competition.

After declining nearly 75 percent between 1981 and 1986, annual expenditures for mineral exploration in the U.S. increased about 10 percent in 1987 (Mining Engineering annual review, May 1988). The U.S. Bureau of Mines estimates that 80 percent of U.S. exploration activity in 1986 was for gold; this is believed to be true in 1987 as well. Nevada continues to be the hub of gold exploration in the U.S.; it is impossible to estimate the amount spent for 1987 Nevada exploration but it certainly must be over $100 million. New exploration offices continued to open in Reno and elsewhere in Nevada, and the number of new mining claims filed with the U.S. Bureau of Land Management increased 91 percent over last year. These 64,859 new Nevada claims represent over 40 percent of all the claims filed in the 10 western states. Nevada also continued to lead the Nation in total number of active claims, having twice as many as any other western state.

New Nevada gold and silver reserves continued to be announced; it is estimated that gold reserves at today's prices in the Carlin Trend alone are 25 to 30 million troy ounces, possibly one-half of the in-ground reserves of the State. Many of the lower-grade gold deposits could not be profitably exploited without the open-pit mass mining methods and heap-leach extraction technology. Innovations continue to be made, and gold ores of less than 0.025 ounces per ton are routinely treated. Gold production in 1988 is expected to rise again to about 3 million ounces. At this mining rate, Nevada's known reserves could require 20 years to exhaust.

At least a dozen new gold mines opened this year; the total direct employment in the mining industry was 10,314 in 326 mines (Nevada State Mine Inspectors report for 1987). This is an increase of about 2,000 employees above last year. About 80 percent of these employees were in the 40 largest mines. The increase in number of workers in the mining industry has been almost entirely in the category of larger mines. The numbers of persons employed in mines having less than 50 workers has remained relatively constant for the last 10 years. This year 84 percent of those employed in mining were in the precious metals portion of the industry, while 15 percent were employed in industrial minerals and sand and gravel.

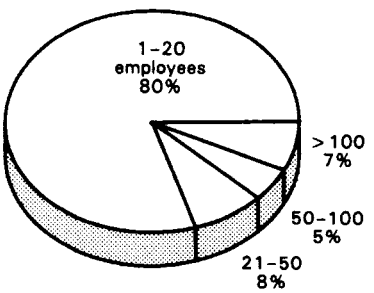
The taxes paid by Nevada mining operations are taxes on net proceeds, property taxes on patented claims, and on mine and mill equipment and improvements and sales tax paid when equipment and supplies are purchased. The net-proceeds-of-mines tax is imposed on net earnings resulting from the sale of the product of the mining operation. The mining industry is estimated to have paid more than $40 million in taxes and fees to the State during the year (Nevada Department of Minerals). Many of these taxes and fees are an important consideration in the budgets of counties in which the mines and mills are located.

NUMBER OF MINES AND EMPLOYEES IN NEVADA'S MINERAL INDUSTRY

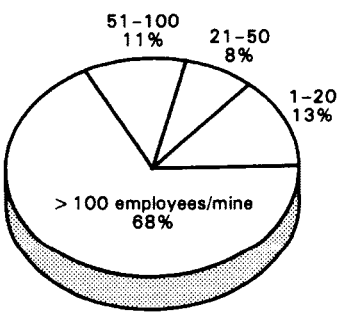
(from Mine Inspector's Report)

NUMBER OF MINES BY SIZE

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



1987



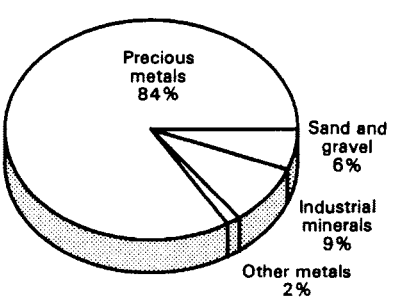
1987

NUMBER OF EMPLOYEES BY MINE SIZE

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

NUMBER OF EMPLOYEES BY COMMODITY

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



1987

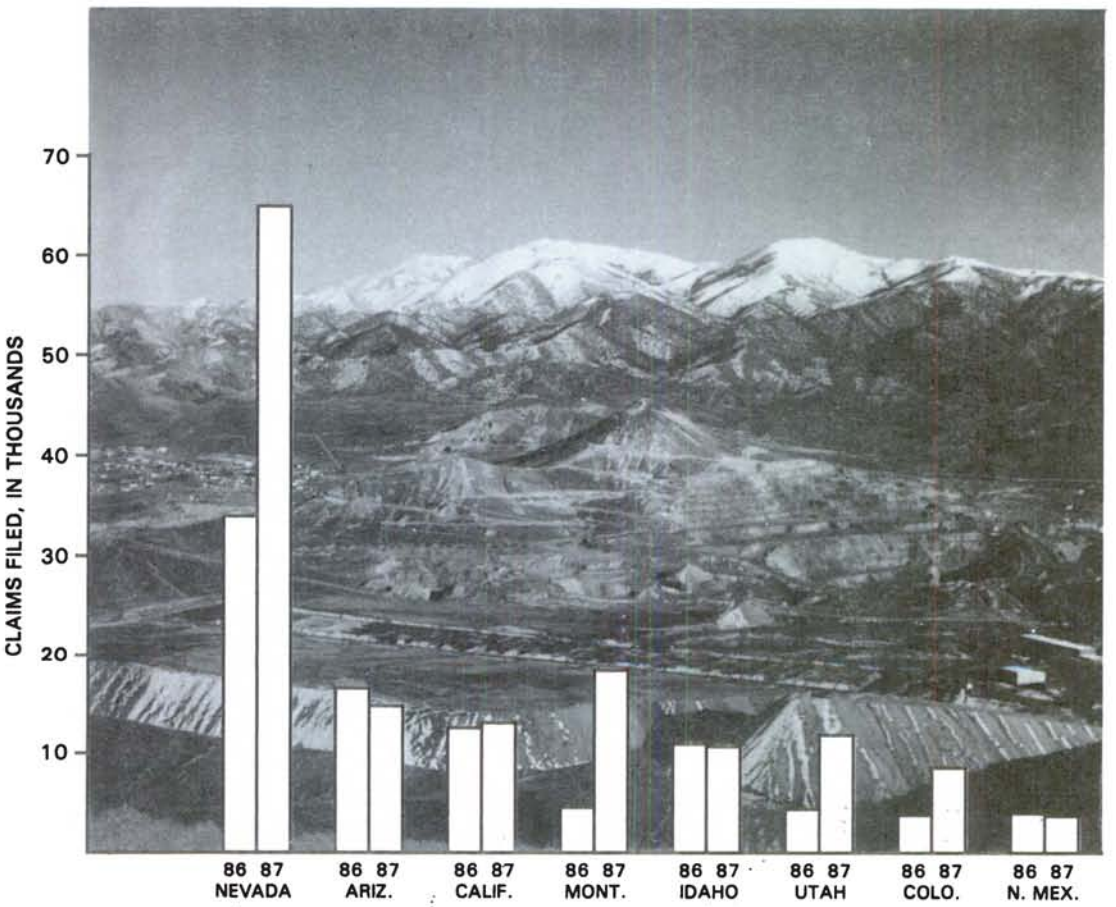
CLAIMS RECORDED BY BLM*
NEVADA

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
1986	34,002	296,022
1987	64,859	319,237

*U.S. Bureau of Land Management.

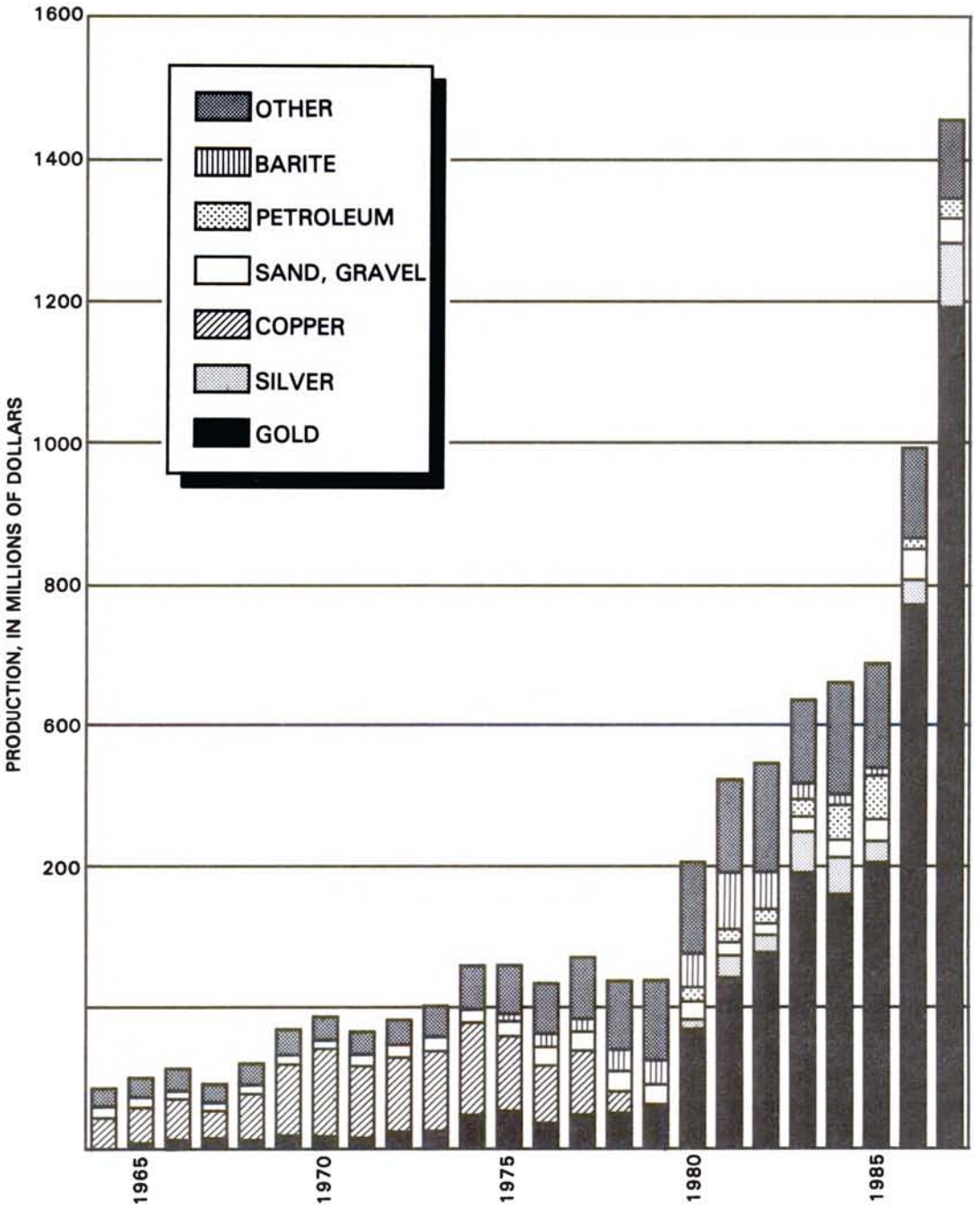
TOTAL CLAIMS FILED WITH BLM*

	1976–1986	1987	Total active claims
Nevada	391,112	64,859	319,237
Utah	292,122	11,789	161,375
Arizona	263,667	14,726	147,575
Wyoming	231,389	4,749	72,838
Colorado	217,078	8,557	77,147
California	186,228	12,978	143,265
Montana	129,152	18,304	79,876
New Mexico	140,176	3,732	39,604
Idaho	117,576	10,714	78,469
Oregon/Washington	89,926	7,378	49,429



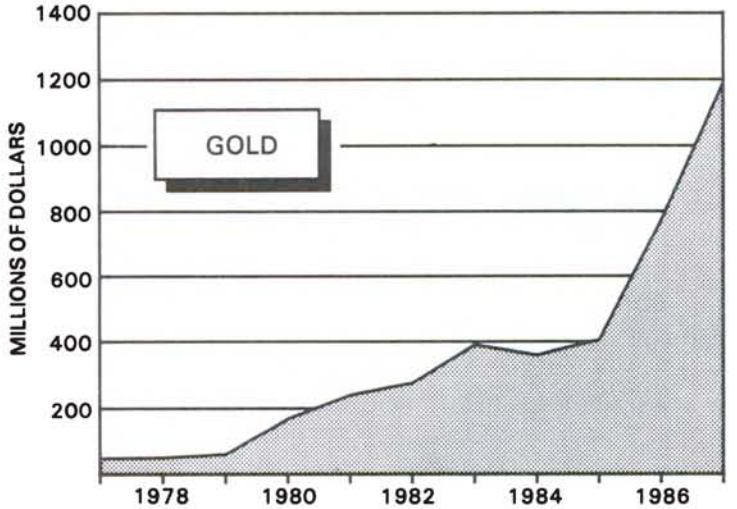
New claims filed with the U.S. Bureau of Land Management in 1986 and 1987.

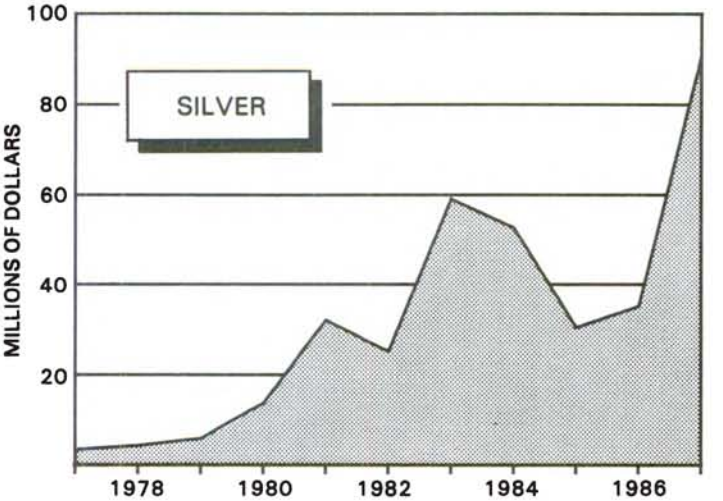
Digitized by Google

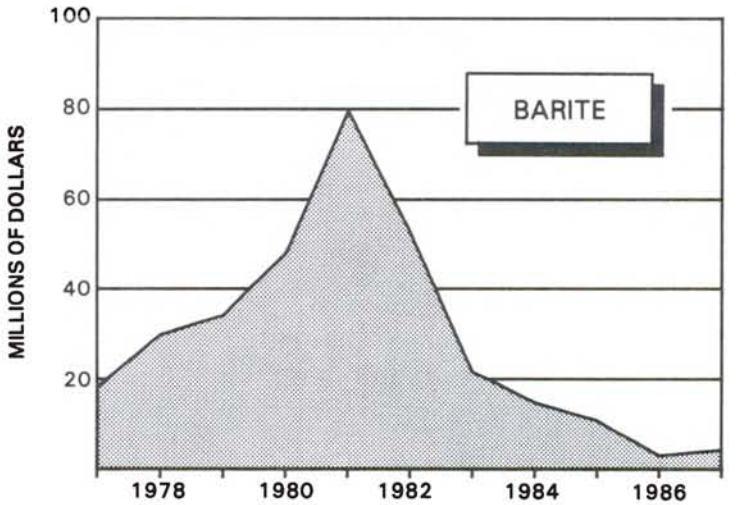


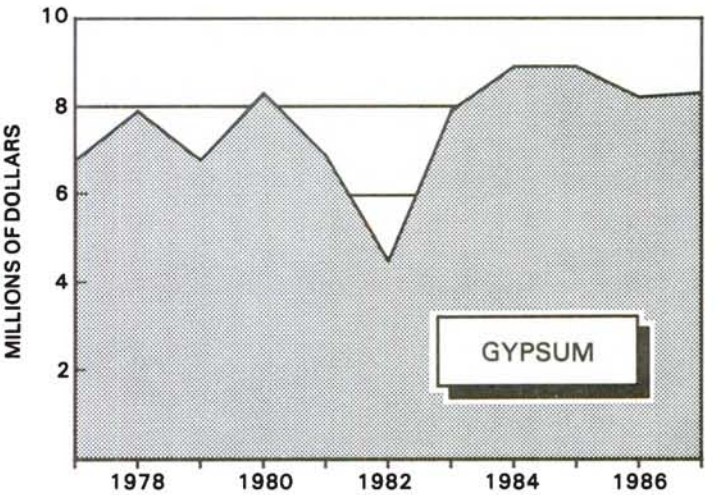
Nevada mineral production (U.S. Bureau of Mines compilation except for petroleum).

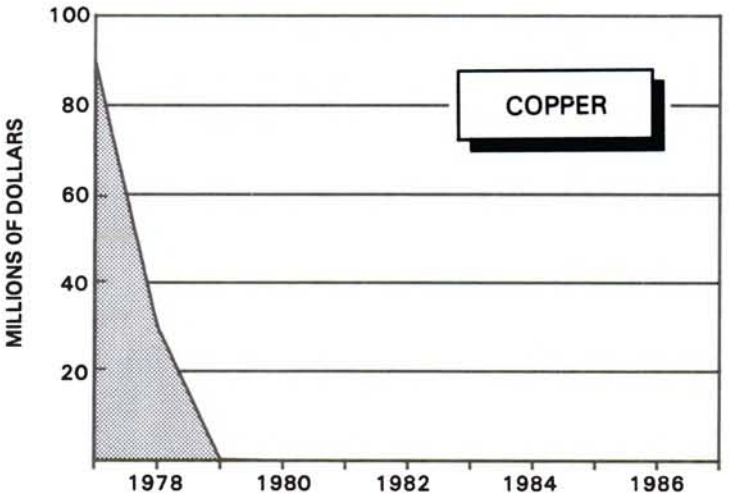
Digitized by Google

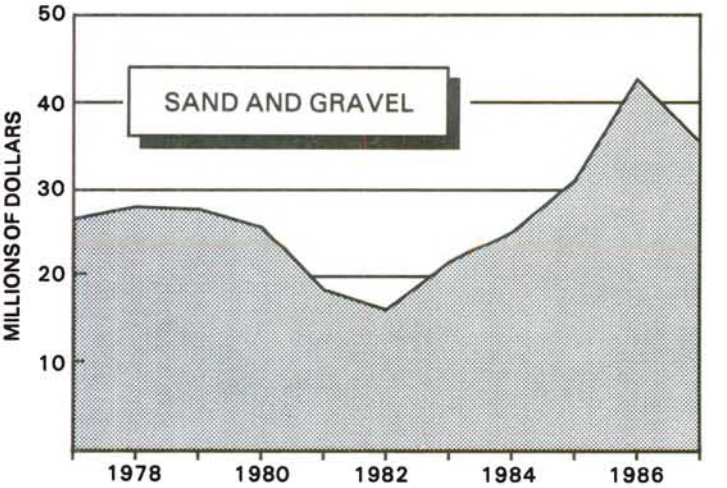












Annual production of selected minerals in Nevada (U.S. Bureau of Mines).

Digitized by Google

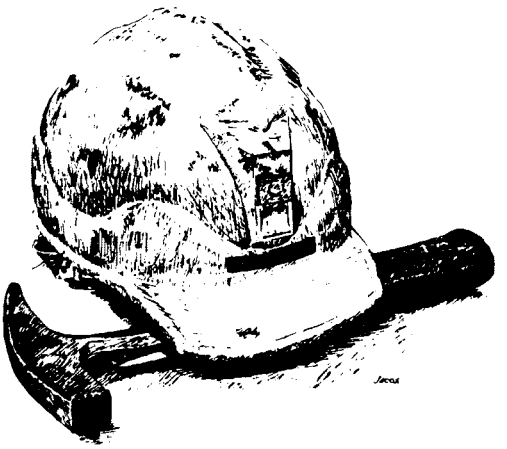
MINERAL LEASING REVENUES PAID TO THE STATE OF NEVADA BY THE U.S. GOVERNMENT

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

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

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

[1]October 1 through September 30.



ANNUAL TAX ON NET PROCEEDS OF MINES

Year	Annual net proceeds[1] (thousands)	Annual tax (thousands)
1982	$159,999	$1,800
1983	245,688	4,152
1984	184,987	3,222
1985	198,263	3,527
1986	374,664	6,091
1987	631,767	12,179

Source: Nevada Department of Taxation "Net proceeds of mines, 1987–1988."

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

OTHER REVENUE TO THE STATE OF NEVADA FROM THE MINERAL INDUSTRY

Fiscal year[1]	Mining claim fee[2] (thousands)	Oil production tax[3] (thousands)
1983	$158	NA
1984	158	$ 52
1985	160	129
1986	160	155
1987	175	146

Source: Nevada Department of Minerals.

[1]July 1 through June 30.

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

[3]Does not include drilling permit fee.

MINERAL PRODUCTION IN NEVADA[1]

Minerals	1985		1986		1987 preliminary	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite (thousand short tons)	590	$10,904	184	$3,005	216	$4,305
Clays (thousand short tons)	80	3,776	10	584	17	1,440
Gemstones	NA	1,300 (est.)	NA	213	NA	278
Gold (thousand troy ounces)	1,276	405,369	2,099	772,909	2,684	1,191,512
Gypsum (thousand short tons)	1,207	8,942	1,236	8,221	1,244	8,275
Petroleum (thousand 42-gallon barrels)[2]	3,040	60,800	2,906	14,530	3,109	27,981
Sand and gravel (thousand short tons)	9,500 (est.)	24,880 (est.)	12,197	35,692	10,600 (est.)	30,100 (est.)
Silver (thousand troy ounces)	4,947	30,383	6,409	35,056	12,625	90,903
Stone, crushed (thousand short tons)	1,334	6,218	1,500 (est.)	7,000 (est.)	1,600	5,400
Other minerals[3]	—	139,201	—	114,652	—	94,750
Total	—	691,773	—	991,862	—	1,454,944

[1]Production as measured by mine shipments, sales, or marketable production (including consumption by producers); compiled by U.S. Bureau of Mines except for petroleum.

[2]Values are based on average well-head prices of $20/barrel in 1985, $5/barrel in 1986, and $9/barrel in 1987 (Nevada Department of Minerals estimates).

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

Metals

by Richard B. Jones

MAJOR EXPLORATION AND DEVELOPMENT

Elko County

Cornucopia Resources and **USX Corp.** (formerly U.S. Steel) completed an option agreement on USX's **Ivanhoe property**. The property covers approximately 13,000 acres. Terms of the agreement required $750,000 be paid on the day the option took effect, $1 million paid by year-end, and a final payment of $1.5 million by the end of November 1988. There is a 5 percent underlying royalty. Mineral inventory at option commencement was reported at 8 million tons, grading 0.045 oz gold per ton. Cornucopia then announced in April that it had made an agreement with **Galactic Resources, Ltd.** to share 50-50 on any ore found below 400 feet in depth on the property. Cornucopia retains 100 percent interest in all deposits above 400 feet. Galactic immediately started a deep drilling project with very encouraging results. Mineralized intercepts of up to 0.50 oz gold per ton have been encountered. Exploration drilling penetrated the overlying volcanic rocks and upper plate Valmy/Vinini rocks. Cornucopia continued to expand ore reserves on the initial find made by USX. This deposit, now known as the **Hollister**, will probably be put in production during 1988.

Newmont Gold Mining Co. concluded a land swap agreement with the BLM in order to have room to construct a mill for the **Rain deposit**. Newmont acquired approximately two sections of land around

The information in this section was compiled primarily from news releases in Rocky Mountain Pay Dirt and in the Mining Record, Northern Miner, and Reno Gazette-Journal newspapers. Some information was extracted from company annual reports.

Digitized by Google

Dorsey Creek north of Elko and exchanged it for land south of Carlin Canyon. The Rain deposit is to be placed in production in 1988 or 1989. Work for the year consisted almost entirely of development and construction of leach pads, roads, etc. Ore reserves are reported to be a minimum of 10 million tons, grading 0.08 oz gold per ton.

Eureka County

American Barrick Resources Corp. made a rich new discovery on their **Goldstrike property**. Mineralization begins at approximately 1,000 feet below the surface and continues downward several hundred feet. It will be some time before the extent of this mineralized zone is known. Assays range from 0.1 to 1.0 oz gold per ton and average around 0.35 oz gold per ton. It will be mined by underground methods. There are actually two deposits: the **Betze** and the **Deep Post**. Part of the Deep Post deposit extends into Newmont Gold property.

Humboldt County

The **Crofoot Mine** started gearing up the last of the year with full production coming on-stream during the first quarter of 1988. The operator is **Hycroft Resources and Development Corp.** (owned 56.6 percent by Granges Exploration Ltd.). The property is adjacent to the Lewis Mine in the Sulphur district. The two mines share the same orebody but they are separate operations, each having its own recovery plant. Eventually there will be one large open pit measuring approximately 5,800 by 3,000 feet. Crofoot reserves listed at the end of 1987 were 23.45 million tons, grading 0.027 oz gold per ton. Expected annual production is 55,000 oz of gold and operating costs are projected to be $220/oz. The two operations are also expected to produce around 160,000 to 200,000 oz of silver annually. Capital costs to develop and bring the property into production are listed at $21.5 million.

The **Cordex IV Syndicate**—composed of **Rayrock Yellowknife Resources** (approximately 33.3 percent), **Dome Explorations** (23.3 percent), **Lacana Mining** (23.3 percent), and approximately 20 percent unknown—conducted accelerated exploration/feasibility work on the **Marigold Gold project** west of Battle Mountain this year. The property comprises 35 square miles of mineral rights owned 70 percent by Cordex and 30 percent by **Santa Fe Minerals**. Three gold zones are known to exist: the 8 south zone, the 8 north zone, and 5 north zone. The 8 south zone is the most significant, containing 4.35 million tons, grading 0.0935 oz gold per ton, plus additional lower grade material. It is expected that the property will be in production during 1988–89.

Lander County

A major new discovery by **Echo Bay Mines, Ltd.** is the **Cove deposit**, located approximately 1 mile northeast of Echo Bay's McCoy Mine. The deposit has yet to be fully delineated but by year-end announced reserves, in all categories, were 16.4 million tons, grading 0.076 oz gold and 3.2 oz silver per ton. When in full production, sometime in 1989, Cove should produce about 225,000 oz of gold and 2.5 million oz of silver per year. During early stages of production estimated cash production costs are expected to be $150/oz gold equivalent.

Mineral County

Kennecott Exploration Australia Ltd. applied for air quality registration certificates for the construction of a primary and secondary crushing system and a smelting furnace at its **Rawhide project** in the Rawhide mining district. **Kiewit Mining Group** and **Plexus Resources** are partners in this venture. Announced reserves are 24 million tons grading 0.045 oz gold and 0.47 oz silver per ton. Production is scheduled to begin in 1988.

Production from **Lacana Mining's** wholly-owned **Santa Fe gold property** is expected to begin the last quarter of 1988. The open-pit heap-leach operation is expected to produce 50,000 oz of gold per year for the first 5 years. Capital costs are estimated at $12.1 million. Lacana first became involved in the property in 1983 and eventually earned a 51 percent interest by completing a feasibility study. They purchased the other 49 percent for $200,000 and 150,000 Lacana shares. Production royalties and holding fees are still in effect. Mineable ore reserves are 8.5 million tons grading 0.037 oz gold and 0.316 oz silver per ton. About 6.5 million tons is oxide ore and 2 million tons is sulfide ore. Both types are amenable to heap leaching but the ore will have to be crushed and agglomerated. Recovery is expected to be 70 percent for gold and 22 percent for silver.

Nye County

Glamis Gold signed a lease-royalty agreement with **Omega Resources** to acquire Omega's **Sullivan property** located adjacent to FMC Gold's Paradise Peak Mine. Terms include a $250,000 payment upon signing, a second-year payment of $500,000, and a third-year advance minimum royalty payment of $750,000. A 5 percent net production royalty is also payable from the start of commercial production. Previous exploration on this property has outlined a zone of oxide gold-copper mineralization with reserves of 10.2 million tons containing 0.039 oz gold and 0.086 oz silver per ton and 0.37 percent copper. Although the property had been considered uneconomic because of high cyanide consumption, Glamis Gold constructed and leached a 27,000-ton test pad; results indicate that the copper-bearing ore can be handled with low cyanide consumption. Glamis will rename the property the **Cuervo Mine** and plans to place it in production at a yearly rate of 36,000 oz of gold. Several interesting geologic

targets remain to be tested within the property, one of which extends into the adjoining Paradise Peak property.

Pershing County

A joint venture between **Santa Fe Pacific Mining Inc.** and **Pacific Coast Mines**, a U.S. Borax subsidiary, is developing a new silver mine in the Trinity district. U.S. Borax is the operator. The deposit contains approximately 1 million tons of oxide ore grading 5.25 oz silver per ton. The mine will be open pit and mining will be done by a contractor. Treatment of ore will be by heap-leach methods at an initial rate of 1,500 tons/day. This will be expanded to 3,000 tons/day. The mine has an expected life of 2 years and will yield around 4.6 million oz of silver. Estimated capital costs are $3 million and the mine was expected to be in operation the first part of 1988.

White Pine County

U.S. Minerals Exploration Co. made the decision to go ahead and bring into production its **Green Springs property**, south of Mt. Hamilton. Production startup is scheduled for mid-1988. The mine will be an open-pit, heap-leach operation. Recovery is expected to be greater than 70 percent with an annual production rate of 16,000 oz of gold. Total gold production for the 3½-year-life of the mine is projected to be 55,000 oz. Announced reserves are 1.25 million tons, grading 0.06 oz gold per ton. Construction costs are estimated to be $3 million. The property consists of 5,000 acres and it is expected that other gold targets will be found.

OTHER EXPLORATION ACTIVITIES

Churchill County

Fireball Ridge property (S18,T23N,R26E?; *Au*). **Cominco American Inc.** signed an agreement with **Interaction Resources Ltd.** to take over property which consists of 68 unpatented claims plus deeded land. Cominco will pay a 6 percent NSR royalty on any production from the property.

Metz property (east of Holy Cross district?; *Au*). Mineralization occurs along a range-front fault in sheared, altered metamorphic rocks. One drill intersection assayed 0.196 oz gold per ton over 40 feet. It is staked over large zone of faulting and alteration in Tertiary volcanic rocks. Low-grade gold mineralization is present along with cinnabar and sulfur. The property is controlled by **Interaction Resources, Ltd.**

Westgate property (S29,32,T17N,R35E?; *Au, Ag*). **Inland Gold Corp.** is continuing exploration on two target areas: one measures about 1,000 by 260 feet and has an outcrop grade of 0.045 oz gold and 3.11 oz silver per ton; the second area is about 800 feet west of previous area, is about 360 by 100 feet, and has an outcrop grade of 0.23 oz gold and 3.66 oz silver per ton. Mineralization is reported to occur in structurally prepared Tertiary volcanic rocks.

Clark County

Midas Ax claims (3 miles west of Goodsprings; *Au, Ag, Pt, Pd*). A joint venture between **Pundata Gold Corp.** (60 percent) and **Trio Gold Corp.** (40 percent) with about 289 claims in group. Surface sampling has indicated 0.02 to 2.38 oz gold, 3.5 to 191.4 oz silver, 0.128 oz platinum, and 0.228 oz palladium per ton.

Elko County

Rossi gold project (S15,T37N,R49E; *Au*). **FMC Gold** made an agreement with **NL Industries** giving FMC the right to earn a 50 percent interest in the property by spending a significant amount of money by December 1989, but no other details are available. NL Industries began work on this property in 1983 and has found some gold mineralization.

Morgan Pass prospect (T30–32N,R68E?; *Au*). **Battle Mountain Gold Co.** continued exploration drilling in 1987 on their 257 claim block. BMG began work here in 1985 and had completed a total of 8,785 feet of drilling in 24 holes by the end of 1986. Mineralization has been found over intervals ranging from 20 to 330 feet. Gold values range from 0.03 to 0.236 oz/ton. Drilling is located along a 2-mile-long zone that trends northeast. The claim block lies within the Bluebell and Goshute Peak Wilderness Study Areas.

Rock Creek Ranch (S24,T37N,R46E; *Au*). **Getty Resources** acquired an option from **Getchell Resources** to earn a 50 percent interest in this property. Property consists of 17,900 acres and is considered a good prospect for sediment-hosted epithermal precious-metal deposits. Before December 31, 1989, Getty must spend $685,000 on land acquisition costs, $350,000 in advance royalty payments, and $2.7 million on exploration and development. Initial work has identified several jasperoid zones.

Kinsley Mountain (T26N,R69E?; *Au*). A joint venture between **Cominco American** (60 percent) and **USMX** (40 percent) consisting of 5,000 acres. A 24,000-foot drilling program was planned for 1987 and a 4,000-foot zone has been identified in which results from drilling indicate mineralization up to 65 feet thick grading 0.03 to 0.08 oz gold per ton.

Pine Mountain (S25,36,T31N,R52E?; *Au*). **Interaction Resources Ltd.** holds a 25 percent interest in this Carlin-type gold prospect. A drilling program was planned for midyear.

Spruce Mountain property (~S22,T31N,R63E; *Au, Ag, Cu, Pb, Zn*). **Mt. Wheeler Mines, Inc.** signed an agreement on its 20,000-acre mineral holdings at Spruce Mountain with **Placer Dome U.S. Inc.** Terms of the agreement include cash advance royalty

payments to be made by Placer Dome which consists of monthly payments, a bonus payment upon notification of intent to produce, and increased monthly payments upon commencement of production; after completion of payback of advance royalties, a 20 percent net-profits royalty will be in effect. Placer Dome has the option of purchasing Mt. Wheeler Mines' interest for $10 million. There is a known 75-foot-thick gold-bearing zone in Pilot Shale in the western portion of the property and it is thought that exploration will be concentrated there.

Independence property (T40N,R58E?; *Au*). A joint venture between **Westley Mines** (20 percent) and **Radcliffe Resources** (40 percent). First-phase drilling indicated a possibility of substantial tonnages of economic gold mineralization and a second-phase drilling program was started. Mineralization occurs in the Roberts Mountains and Hanson Creek Formations. Drill intercepts indicate a zone 40 to more than 100 feet thick, assaying 0.04 to 0.137 oz gold per ton.

Esmeralda County

Divide property (~S27,T2N,R42E; *Au, Ag*). **Crown Resources Corp.** reached a joint venture agreement with **East West Resources, Inc.** on its Divide property. East West (with Australian roots) can earn up to 50 percent interest by spending approximately $430,000 on the property by the end of 1989. The property has potential as an open-pit heap-leach operation. Current drilling by East West and previous drilling indicated a geologic resource of 306,000 tons, grading 0.057 oz gold and 0.45 oz silver per ton.

Eureka County

Goldstone/Gold Ridge (~T22N,R49E; *Au*). **Atlas Corp.** is exploring 50,000 acres surrounding its Gold Bar property and discovered these two deposits that have added approximately 280,000 oz of gold to their reserves.

Gabel Canyon property (~NW¼,T26N,R49E; *Au*). **Etruscan Enterprises** planned a $275,000 program consisting of geophysical (I.P.) and geochemical surveys and drilling which will earn them a 50 percent interest in the property. Results from five shallow drill holes indicate a near-surface, sulfide-rich zone about 1,200 by 200 feet. Samples from this zone assayed 0.01 to 0.02 oz gold per ton. Drilling to depths of 1,200 feet is planned.

Zeke prospect (T27N,R49E?; *Au, Ag*). A 5,000-foot drilling program was planned for the year to define and confirm an estimated 2 million tons grading 0.056 oz gold and 0.224 oz silver per ton. One hole intercepted 290 feet grading 0.49 oz gold per ton while another hole intercepted 50 feet grading 0.35 oz gold per ton. This property shares a common boundary and structural continuity with the Buckhorn Mine. **Northern Dynasty Explorations** owns 41 percent of the property.

Bullion-Monarch Venture (~NE¼,T35N,R50E; *Au*). **United Mining Corp.** acquired a 100 percent interest in **Eldorado Gold Mines Ltd.** which has a piece of the action in the joint venture. Operator is **Westmont Mining Inc.** (formerly Nicor Mineral Ventures, Inc.). Other participants in the joint venture are **Petrol Oil and Gas, Camsell River Investments Ltd., Lambert Management Ltd.,** and **Eltel Holdings Ltd.** Approximately 100 holes have been drilled on the 2,000-acre property and gold mineralization was encountered in several holes. Intercepts and grades of some of the gold mineralization are 170 feet of 0.023 oz gold per ton and 70 feet of 0.05 oz gold per ton. One deep hole, drilled to check mineralization at depth, encountered mineralization from 1,280 feet to 1,370 feet below the surface. Grade is not known.

Maggie Creek prospect T33N,R51E?; *Au*). Joint venture between **Noranda Exploration, Skeena Resources,** and **Tenore Oil and Gas.** If all goes well, Noranda will end up with 50 percent, and Skeena and Tenore will have 25 percent each. Property consists of 62,000 acres. Approximately $500,000 was to be spent in 1987 on mapping, geochemical sampling, geophysical surveys, trenching, and drilling.

Hot Springs Point (~NE¼,T29N,R48E; *Au*). **Telis Gold Mining Co.** optioned the property from **BRU Hotsprings Partnership.** A gas-vapor-phase geochemical survey over the property outlined a large anomaly believed to be a highly altered zone with gold mineralization. The area has not been previously drilled and a drilling program was planned for the summer. Results are not known.

Humboldt County

Electrum property (~N½,T39N,R35E; *Au*). **Genco Industries** sampled and mapped the property which lies adjacent to the Jumbo Mine. The best target appears to be the **Alma zone** which is traceable on the surface for over 1,000 feet. The zone trends north-northeast. Bulk sampling from underground workings have assayed from 0.05 to 1.0 oz gold per ton.

Adelaide Crown property (~NW¼,T34N,R40E; *Au*). **Grand Teton Industries** can earn a 50 percent interest in this property by bringing it into production by October 1988. Indicated reserves are 1 million tons grading 0.06 oz gold per ton. Estimated cost to bring the property into production is $4.24 million. Grand Teton has been doing column testing, delineation drilling, and heap-leach pad preparation. **Getchell Resources** of Kamloops, British Columbia, owns the property.

Willow Creek property (~T43N,R38E; *Au, Ag*). **Dawson Eldorado Mines** acquired an option to purchase a gold-silver property in the Willow Creek (Rebel Creek) district. A check sampling program was carried out in preparation for a drilling program later in the year. Forty-one rock outcrop samples assayed from 0.02 to 2.7 oz gold per ton with silver

values. No results from the drilling program are known.

Sawtooth property (~T35N,R30E; *Au*). **Nova Gold Resources Nevada** acquired 48 unpatented mining claims in the Sawtooth district which lies along the Humboldt–Pershing county line. Nova Gold can acquire a 100 percent undivided interest in the property by paying $90,000 within the three-month option period. The property is still subject to a net smelter return royalty. Nova Gold has an option to purchase this royalty for $1.89 million. American Hunter Resources of Reno is doing the evaluation work for Nova Gold.

Ashdown property (~SW¼,T45N,R29E; *Au, Mo*). **Win-Eldrich Mines** acquired a 73 percent interest in this property by spending $300,000 (Canadian) on a feasibility study and further exploration. The remaining 28 percent is retained by **American Copper & Nickel Co**. The property consists of approximately 4,000 acres and drilling to date has indicated 1.16 million tons within 200 feet of the surface, mineable by open-pit methods, with a diluted gold grade of 0.125 oz/ton. The property also contains a high-grade molybdenum reserve of 140,000 tons grading 2.9 percent MoS_2 and another 600,000 tons grading 1 percent MoS_2. Mineralization occurs in thick quartz veins which follow shear zones in diorite. Mineralization that is known to occur below the 200-foot level will be the target for future exploration work.

West Coast Mine (S1,T36N,R36E; *Au, Ag*). **Great West Gold and Silver Inc.** and **Newmont Exploration Ltd.** signed an agreement whereby Great West assigned its interest in the property to Newmont for an overriding royalty, annual cash payments, and a minimum $390,000 exploration program over 3 years.

Lander County

Canyon Placer (~SW¼,T31N,R43E; *Au*). **Battle Mountain Gold Co.** is evaluating the old Natomas placer ground around the mouth of Willow Creek. The pilot program employs gravity separation at a rate of 1,200 tons per day. If it proves feasible, the property will be placed into production during 1988 at a rate of about 15,000 oz gold per year. Estimated cash production costs are $194/oz.

Big Three property (north end of Battle Mountain Gold's property?; *Au*). **Cosmos Resources** signed a joint venture agreement, subject to a 30-day inspection period to further develop this property. To acquire a 50 percent interest, Cosmos is committed to spend $500,000 in drilling and exploring the property within the next year.

Frank Lewis property (~S9,T31N,R43E; *Au, Ag*). **American Barrick Resources Corp.** has leased this property and drilled 39 holes in 1986. Results have been encouraging with considerable amounts of erratic good-grade gold ore being encountered, but no orebodies have yet been found. The 1987 budget was $1 million.

Hilltop property (~S4,T29N,R46E; *Au*). **Noranda Exploration** entered into an agreement with **U.S. Precious Metals** on this property. Noranda can earn a 50 percent interest and budgeted $1.3 million to drill promising targets with the hope of expanding known ore reserves. Known reserves are listed as 10.35 million tons grading 0.073 oz gold per ton. It is hoped that the property will produce in the neighborhood of 100,000 oz of gold per year. Part of Noranda's commitment is a detailed metallurgical testing program and a detailed engineering feasibility study. Also, Noranda must put the property into production within three years. Prior to the Noranda agreement the property was held 25 percent by U.S. Precious Metals and 75 percent by **Ruskin Developments**.

Mill property (~SE¼,T29N,R44E; *Au*). **Interaction Resources** can earn a 51 percent interest in this property. They planned a 2,000-foot percussion drilling program to check gold mineralization in veined, pyritized, fractured rocks that are thought to be both upper and lower plate rocks associated with a window in the Roberts Mountains thrust. The property is owned by **Brican Resources** and **Bowvalley Industries**.

Lyon County

Talapoosa (~S3,T18N,R24E; *Au, Ag*). **Athena Gold Corp.** continued exploration on this property during 1987 and plan to bring it into production in 1988.

Nye County

Gold Bar project (S36,T11S,R46E; *Au*). **Angst Inc.** applied for two air quality permits for construction on the property. Production date: 1988?. Announced reserves are 1.23 million tons, no grade announced.

Bullfrog project (~S10,T12S,R46E; *Au*). **St. Joe Gold Corp.** (currently owned by a subsidiary of **Dallhold Investments Pty. Ltd.**) announced a gold discovery near Rhyolite. Preliminary estimates are more than 8 million tons of mill-grade ore at 0.09 oz gold per ton and another 12 million tons of heap-leach ore grading 0.02 oz gold per ton.

Bonanza Exploration Venture II (~S13,T9N,R39E; *Au*). **Mountain West Resources** (50 percent) made an agreement with **Noranda Exploration, Inc.** on several claims in the East Golden district. Noranda must spend $160,000 by the end of 1988 to earn a 51 percent interest in the venture. Noranda was committed to spend $60,000 during 1987, part of which included 2,500 feet of drilling. Noranda has an option to acquire an additional 24 percent interest by spending an additional $100,000 within 1 year after it earns the 51 percent interest. Noranda is the operator of the project.

Monitor property (~T6N,R47E; *Au*). **Precious Metals Exploration** has acquired this property. Numerous anomalous gold and trace elements values are

known to exist in jasperoid bodies. Mapping and sampling were to be done in 1987 and drilling is planned for 1988.

Longstreet Mine (~S16,T6N,R47E; *Au, Ag*). As a result of 1986 exploration, this property, controlled by **Naneco Resources**, is being planned for production. The **Main zone**, which is open in several directions, has drill-indicated reserves of 6.35 million tons grading 0.034 oz gold and 0.51 oz silver per ton. A mine life of six years is projected at a production rate of 28,900 oz gold and 255,000 oz silver per year.

Manhattan property (~S20,T8N,R44E; *Au*). Work was continued by **Sunshine Mining Co.** on the Manhattan property, a joint venture with **Freeport-McMoRan Gold Co.** Sunshine can earn a 45 percent interest in the property by spending $1.5 million on surface and underground exploration. There is a good possibility that either a shaft will be sunk or an incline driven to develop the property as an underground mine. Ore will be processed at Sunshine's Silver Peak mill.

Pershing County

Kennedy property (~S19,T28N,R38E; *Au, Ag*). **Sumac Ventures, Inc.** and **Mega-Gold Resources, Ltd.** agreed to a joint venture in which Mega has the right to earn a 49 percent interest in seven claims in the Kennedy district. Mega has to pay a total of $150,000 through August 1988 and spend $50,000 in exploration on the property by November 1989. The property encompasses a 1½-by 1-mile area containing extensive vein-type gold-silver mineralization.

Poker Brown property (T31N,R32E; *Au*). **New Gold, Inc.** and joint-venture partner, **Planet Resources Group, N. L.** of Australia announced an exploration/mining lease agreement with **MBA Inc.** on their placer ground covering 4 square miles in the Poker Brown district. New Gold discovered gold nuggets on this property with ore grade ranging from 0.05 to 0.30 oz gold per cubic yard. MBA planned to process 50 cubic yards/hour using new technology and, if successful, to increase production to 150 cubic yards/hour.

White Pine County

Taylor district (~C,T14N,R65E; *Au, Ag*). **Silver King Mines/Pacific Silver Corp.** (50 percent) and **Nerco, Inc.** started a gold exploration program on their Taylor district holdings (4,700 acres). Silver King is the operator and plans to spend in excess of $100,000, mainly on drilling. Two of the first five holes encountered ore-grade gold intercepts. The property also has 3.9 million tons of silver reserves grading 3.2 oz/ton but is not currently being mined due to low silver prices.

White Pine property (~S9,T16N,R57E; *Au*). **Silver State Mining Corp.** has made a gold discovery in a drill hole on the west edge of the White Pine district. Gold values average 0.07 oz/ton over 125 feet (beginning at the surface). A second hole averaged 0.06 oz gold per ton over a 100-foot interval. Previous drilling hit intercepts of 0.13 oz gold per ton. Most of the summer's drilling program was done to establish the size of gold reserves and to test similar targets throughout the 10,000-acre property.

OPERATING MINES AND PLANTS

Elko County

At the **Dee gold mine**, a third grinding mill was started up during the first part of the year. This increased milling capacity to an average of 1,175 tons/day, up from 969 tons/day during 1986. The grade of ore was expected to be lower than previous years; the grade was 0.133 oz gold per ton in 1986 and recovery was 86 percent. Production costs for the first five months of 1987 averaged $175/oz and were probably about the same during the rest of the year. The Dee Mine, located within the heavily mineralized "Carlin Trend", was put into production in late 1984 at a capital cost of $21 million. It has a carbon-in-pulp mill, capable of handling 1,200 tons per day, and a heap-leach facility. During its first full year of production, 1985, the mine produced 49,632 oz of gold at an average direct operating cost of $162/oz. In 1986 production was 51,033 oz of gold at an operating cost of $164/oz. In March 1987, the mine paid off its pre-production debts. Projected production for 1987 is 45,000 oz of gold.

Freeport McMoRan Gold Co. stated that the company achieved record production sales and mill output at **Jerritt Canyon** during 1987. Estimated mine production was over 300,000 oz of gold. Mill output averaged 4,144 tons/day and gold recovery averaged 91.8 percent, compared to 87.4 percent in 1986. Unit cash production costs were $157/oz before depreciation, almost 10 percent lower than 1986 costs. Proven reserves were 2.285 million oz of gold at the end of 1987.

Eureka County

The **Tonkin Springs gold mine**, owned by **Silver State Mining Corp.**, produced 9,700 oz of gold in 1987, down from the 13,740 oz produced in 1986. This was due to a decrease in oxide ore production so that development could be done on the sulfide ores. Production is expected to be back up in 1988 and to exceed 1986 figures. Operating costs were $124/oz in 1986. No costs are known for 1987 but they are probably somewhat higher than 1986 costs. Potential exists to boost annual gold production to 35,000 to 40,000 oz, with a mine life of approximately 10 years. A $16 million expansion planned for the mine will include construction of a 1,500-ton/day carbon-in-leach mill, with a pre-oxidation step that will allow processing of sulfide ore, and enlargement of the heap-leach facilities to

allow processing of additional oxide ore. These expenditures will increase the estimated operating cost into the $230/oz range.

The Gold Bar Mine, owned and operating by **Atlas Corp.**, ended its first year of full production. The property came on-stream during the last three months of 1986. Capital costs, including exploration, mine development, plant and equipment construction, and acquisition were $17.5 million. The mine produces approximately 45,000 oz of gold per year. At the beginning of the year, ore reserve grade was 0.109 oz gold per ton, with a total contained gold reserve on the property of 300,000 oz. Mine life is expected to be 5 to 10 years. Ore is processed using an agitated carbon-in-leach process which is said to extract 90 percent of the gold. Estimated production cost is less than $250/oz of gold. Active exploration is ongoing and by year-end gold reserves were approximately 600,000 oz.

Production from the **Buckhorn Mine** for 1987 is estimated at 38,000 oz of gold and 210,000 oz of silver. Defined reserves are due to be mined out by the end of 1988. However, deep exploration drilling has encountered some interesting results. One drill intercept cut 30 feet grading 0.7 oz gold per ton and another drill intercept of 55 feet assayed 1.1 oz gold per ton. **Cominco Resources International** has a 76.4 percent interest in the property and is the operator, **Equinox Resources** owns the remaining 23.6 percent, and **Bar Resources** receives a 20 percent net proceeds payment.

American Barrick Resources Corp. acquired the **Goldstrike property** from **Western States Minerals** and **Pancana Minerals** in December 1986. During 1985 and 1986 the property produced about 40,000 oz of gold annually by heap leaching low-grade oxide surface ore. In 1987 it produced around 52,000 oz of gold. Production during the next 2 to 3 years, starting in 1988, is expected to double or triple. Surface reserves on Barrick's side of the **Post deposit** stand at 20 million tons grading 0.053 oz gold per ton. Construction began the latter part of the year on a 3,500-ton/day mill which will increase 1988 production to a projected 120,000 oz of gold.

As a result of an unsuccessful takeover attempt during the year by T. Boone Pickens Jr., **Consolidated Gold Fields PLC**, as the knight in shining armor, ended up owning approximately 49.9 percent of **Newmont Mining Corp.** Newmont reported an accumulated debt of $2 billion as a result of the attempted takeover. Production from Newmont Gold's **Carlin properties** in 1987 was 589,000 oz of gold. Production is expected to increase over the next few years and is projected to end up being around 1.6 million oz of gold per year. Besides increasing gold production, Newmont also plans to decrease production costs by at least 15 percent over the next few years. Projected cash production costs are expected to drop from around $200/oz of gold in 1987 to $155/oz of gold in 1992.

Humboldt County

Amax Gold Inc. reported that the **Sleeper Mine** produced approximately 200,000 oz of gold in 1987. Latest announced ore reserves are 3.4 million tons grading 0.376 oz gold per ton. Heap-leach reserves, previously reported at 45.7 million tons grading 0.030 oz gold per ton, decreased to 44.8 million tons grading 0.021 oz gold and 0.24 oz silver per ton. Latest figures indicate that there are 2.225 million oz of contained gold on the property. Production for 1986, the first year of operation, was 128,000 oz of gold and 94,000 oz of silver. Direct operating costs are in the $55/oz range.

Pinson/Preble gold mines—operated by **Pinson Mining Co.** and owned jointly by **Rayrock Yellowknife Resources** (26.5 percent), **Lacana Mining** (26.25 percent), **American Barrick Resources Corp.** (26.25 percent) and private individuals (21 percent)—had direct operating costs of $178/oz of gold in 1987. Gold production figures were not available for 1987 but the two properties in 1986 produced a total of 86,833 oz of gold and it is expected that 1987 production was about the same. Direct operating costs were $165/oz in 1985 and $135/oz in 1986. The Pinson mill processed 542,648 tons of ore from the Pinson Mine in 1986 with an average grade of 0.107 oz gold per ton and 88 percent recovery. The Pinson mill processed 28,170 tons of Preble Mine ore in 1986 with an average grade of 0.30 oz gold per ton and a recovery of 89.6 percent. At the beginning of 1987, Pinson reserves were 4.0 million tons of mill ore grading 0.090 oz gold per ton and 1.8 million tons of heap-leach ore grading 0.028 oz gold per ton. Preble reserves were 46,000 tons of mill ore grading 0.160 oz gold per ton and 981,000 tons of heap-leach ore grading 0.056 oz gold per ton.

In August 1987, **First Mississippi Corp.** formed a wholly-owned subsidiary **First Miss Gold Inc.** to finance, develop, and operate the **Getchell gold project**. In 1986, its first full year of production, the project produced 10,100 oz of gold, all from heap-leach operations. Production for 1987 was expected to be over 15,000 oz of gold. Initial production life of the leach operation was estimated to be 5 years but due to the discovery of additional ore, production is now expected to continue considerably longer than 5 years. In May the company authorized a $77 million development project for the property. Part of this money is being spent on a 3,000-ton/day mill and expansion of the open pit. Mill construction was started during the summer and the new facilities are expected to come on-stream in early 1989. When this happens, estimated average yearly production will be 150,000 oz of gold. Estimated cash cost of gold is expected to be less than $200/oz. Estimated proven and probable reserves are listed as 8.2 million tons grading 0.16 oz gold per ton. Reserves are of two types, sulfide ore and oxide ore. Most of the current reserves are of the sulfide type. Costs for heap leaching were $250/oz of gold in 1987, with

the dore produced being 90 percent gold. Wright Engineers of Vancouver, British Columbia, is the consulting engineering firm for the expansion project.

Granges Exploration Ltd. and its joint venture partner **Hycroft Resources and Development Corp.** (owned 56.6 percent by Granges Exploration) completed the acquisition of the operating Lewis Mine in the Sulphur district. The former owner, **Standard Slag Co.**, was paid $4.15 million for the property. Several improvements were made during the year: construction of a third leach pad designed to accommodate three lifts, each lift being 20 feet and capable of handling more than 1 million tons of ore; construction of a 4-million-gallon pregnant-solution reservoir below pad 3 and installation of three automated clarification filters; development of a second water well; construction of a modular assay and metallurgical laboratory; improvements to the drilling, blasting and sampling operations; initiation of a 7-day round-the-clock operation; larger tertiary crushing facilities; and expansion of solution-processing facilities and pond capacities. All of these improvements were made to triple gold production and lower operating costs. At the beginning of the year ore reserves were 6 million tons grading 0.032 oz gold per ton. Production is expected to be around 25,000 oz of gold. At the end of 1987 announced reserves were 9.85 million tons grading 0.03 oz gold per ton. Operating costs were $250/oz of gold.

Lander County

Battle Mountain Gold Co. reported a net income of $170 per equivalent oz of gold sold at an average realized gold price of $439/oz. The **Fortitude Mine** produced 255,000 oz of gold and the **Surprise Mine** produced 2,000 oz of gold. When in full production, which will be in 1988, the Surprise is expected to produce 15,000 to 18,000 oz of gold annually at an estimated production cost of $220/oz. Indicated reserves at the Surprise Mine are 225,000 oz of gold. Cash costs at the Fortitude mine-mill complex averaged about $140 per equivalent oz of gold.

The **Austin Gold Venture** mine and mill, 72.5 percent owned by **Inspiration Gold Inc.** and 27.5 percent owned by **FMC Gold**, was expected to produce 52,000 oz of gold in 1987, its first full year of production. Ore reserves at the beginning of the year were 1.2 million tons grading 0.186 oz gold per ton. The mine uses a fairly new process for extracting the gold, a combination of conventional flotation and conventional carbon-in-leach methods. They float the sulfide gold ore and then run these tailings through a carbon-in-leach column. The operation produces both gold concentrates and dore bullion. Total recovery is around 83 percent.

Nevada Goldfields Corp. acquired the **Kingston property** in mid-1986. Production ceased at that time but was resumed in March 1987. During the interim a completely new 500-ton/day carbon-in-leach mill was built. The first dore bullion was poured in April. During the operating portion of the year the mill operated at a rate of 770 tons/day with mill-head grade averaging 0.193 oz gold per ton, or about 1,000 oz of gold per week. When in full production, the mine is expected to produce about 49,000 oz of gold per year. Ore reserves stood at 1.48 million tons grading 0.208 oz gold per ton at the end of 1987.

The **McCoy Mine**, owned by **Echo Bay Mines Ltd.**, is expected to produce around 85,000 oz of gold in 1987. At year-end reserves stood at 1.2 million oz of gold and 53.3 million oz of silver. A 5,000-ton/day milling complex is going to be constructed on the property to handle high-grade material from the McCoy Mine as well as from the newly discovered Cove deposit. It is planned to be operational by 1989.

Mineral County

NERCO Minerals Co.'s Candelaria Mine poured its 10 millionth oz of silver in June 1987. The mine came operational in 1979 and is one of the largest open-pit primary silver mines in the U.S. It was also one of the first large-scale heap-leach operations to recover silver. During 1985–86, 15.8 million oz of silver and 95,000 oz of gold were added to Candelaria's recoverable reserves. During the past four years, silver production increased 1.7 million oz/year to almost 3 million oz/year. Direct production costs have been reduced 40 percent from $8.08/oz in 1983 to $4.84/oz in 1986.

Nye County

The **Paradise Peak gold-silver mine**, wholly-owned by **FMC Gold**, had sales of 188,000 oz of gold and 3.0848 million oz of silver in 1987. The average cash cost of production was $113/oz gold equivalent. Ore grades processed for the year were 0.137 oz gold and 3.019 oz silver per ton. Recoveries were 94.4 percent for gold and 24.6 percent for silver. Total proven reserves are 1.1 million oz of gold and 37.8 million oz of silver. During the year the **Ketchup Flat** deposit was added to the mines probable reserves and, as a result, the mine ended the year with the same level of gold reserves as in December 1986. Announced reserves for Ketchup Flat are 160,000 oz of gold and 1.7 million oz of silver.

The **Round Mountain Mine** produced 167,650 oz of gold in 1986 and production was expected to be about the same in 1987. Production costs were up from $179/oz of gold in 1986 to a little over $200/oz in 1987. At the beginning of the year Round Mountain reserves were reported at more than 194 million tons containing approximately 6.8 million oz of gold (grade approximately 0.035 oz gold per ton). The mine is already the world's largest open-pit, heap-leach gold mine and plans are to make it even bigger. An announcement was made during the year that gold production would double by the end of 1988, bringing it up to 300,000 oz per year. Cost for the expansion program is expected to be around $140 million. Wright Engineers, based in Vancouver, B.C., was awarded the engineering and

procurement contract for the materials-handling portion of the expansion. The current pit is about 4,800 feet long, 3,600 feet wide, and 1,000 feet deep. After the expansion, the pit will be 6,600 feet long, 4,800 feet wide, and 1,400 feet deep.

Pershing County

Pegasus Gold Inc. acquired the **Relief Canyon Mine** in July 1986 and placed it in production (again) during the fourth quarter of that year. The mine produced 1,800 oz of gold through the end of 1986 and was expected to produce approximately 42,000 oz of gold in 1987. At the first of the year Pegasus awarded Morrison-Knudson Co. a $17 million contract for mine development, waste removal, mining operations, loading and unloading of leach pads, and short-term management services. Ore reserves are 3.3 million tons grading 0.03 oz gold per ton.

Pegasus Gold's Florida Canyon Mine produced 48,000 oz of gold in 1987. The 1988 forecast calls for 4 million tons of ore to be mined to produce 55,000 oz of gold. The ore is mined by open-pit methods and N.A. Degerstrom is the mine contractor. Ore reserves are 22 million tons grading 0.024 oz gold per ton.

Coeur d' Alene Mines' Rochester Mine produced over 4 million oz of silver and 27,000 oz of gold during 1987. As of April 1986 total proven and probable reserves were 117 million tons. Morrison-Knudsen has been performing mining and crushing operations on a contract basis but Coeur d' Alene Mines plans to take over these operations in 1988.

Washoe County

The Hog Ranch Mine in northern Washoe County was expected to produce around 50,000 oz of gold in 1987. After some minor adjustments in ownership during the year, the current (?) joint venture partners are **Western Goldfields** (operator and 65 percent owner), **Geomex Development Sixth Partnership** (25 percent) and **Royal Gold, Inc.** (10 percent). All ore that was mined in 1987 was replaced with new reserves, and a feasibility study is under way in the Bell Springs area, approximately 4 miles southwest of the current operating pit. Announced ore reserves are 3.8 million tons grading 0.049 oz gold per ton and another 5.8 million tons grading 0.016 oz gold per ton. The joint venture controls approximately 14,000 acres in the mine area.

White Pine County

The Bald Mountain Mine, 84 percent owned by **Placer Dome U.S.**, had a few start-up problems, which have been ironed out, but supposedly the mine operated up to capacity and produced approximately 4,000 oz of gold per month during the year.

The Little Bald Mountain Mine phased into underground mining by the end of October and was expected to produce about 4,000 oz of gold in 1987. The mine is operated by **Northern Dynasty Explorations** (42.6 percent owner). Announced reserves are 220,000 tons grading 0.14 oz gold per ton. A 10,000-foot drilling program carried out during the year outlined another deposit, south of the main pit, with a potential of producing an additional 5,000 oz of gold that could be mined by open-pit methods.

NERCO Minerals Co. (50 percent) and **Amselco Minerals, Inc.** (50 percent) announced the construction of a carbon-in-leach plant at the **Alligator Ridge Mine**. This plant will enable them to recover an additional 70,000 oz of gold over the next three years.

During its first full year of production the **Robinson gold mine (Star Pointer)** produced 50,207 oz of gold and this production rate is expected to continue for the next six years. The mine is on claims leased from **Kennecott Corp.** (currently **B.P. Minerals U.S.A.**) that are peripheral to the old open-pit copper mine. The mine is owned equally by **Silver King Mines** and **Pacific Silver Corp.** Both companies are run by the same management team. Late in the year these two companies announced a merger, with Silver King being the surviving company name. Cost of gold production is given as $170/oz, which includes royalties, appreciation, amortization, and all other costs.

NEW MINES AND PLANTS

Churchill County

Wonder Mine (S5,T18N,R35E; *Au, Ag*). **Belmont Resources** re-opened the mine in April. Production through September was 32,000 oz of silver and 400 oz of gold, all from leach pads; October production was 5,300 oz of silver and 800 oz of gold; November production was 9,300 oz of silver and 140 oz of gold. By year-end the mining rate was planned to be 5,000 tons/day, producing 15,000 oz silver and 225 oz gold per month. A new vein was discovered on the north side of Wonder Mountain. The vein ranges from 30 to 180 feet wide. Assays have averaged 7 oz silver and 0.03 oz gold per ton.

Elko County

Wood Gulch project (S25,26,35,36,T44N,R53E; *Au, Ag*). **Homestake Mining** applied for permits to develop a new mine with an expected life of 2 years and an estimated 720,000 tons of ore of undisclosed grade. The open-pit heap-leach operation is scheduled to begin in 1988. The work force will vary between 10 to 45 people, depending upon type of activity necessary during mine life. Gold mineralization occurs in a structurally prepared sequence of sedimentary rocks that have been intruded by dacitic/andesitic sills and dikes. Oxidation is present but quite variable.

Big Springs gold mine (T41N,R51E?; *Au*). Early in 1987 **Freeport McMoRan Gold Co.** (60 percent) stated that the property was commercially viable and placed it into production in September and it became fully operational in October. Reserve base at year end was 3.762 million tons, grading 0.148 oz gold per ton. Initial production is from heap leaching, but second phase construction will provide a fluid-bed roasting system and conventional ore-milling facilities. On completion, Freeport plans on mining and

processing 400,000 tons of ore to produce approximately 60,000 oz of gold annually. **Bull Run Gold Mines, Ltd.** owns 40 percent of the project. Included in the project area is the **South Sammy Creek** deposit where there is an additional 1.163 million tons, grading 0.110 oz gold per ton. A considerable amount of exploration on this property remains to be done.

Dexter project (~S3,T39N,R51E; *Au, Ag*). **Fisher-Watt Gold Co.** and **Horizon Gold Shares, Inc.** formed a 50-50 joint venture and placed the old Dexter Mine in operation the latter half of 1987. It is an open-pit heap-leach operation with no mill. Ore reserves are approximately 2 million tons or more, grading 0.04 oz gold and 1.9 oz silver per ton. Current production is coming from a higher-grade section made up of 562,000 tons, grading 0.061 oz gold and 1.97 oz silver per ton.

Esmeralda County

Silver Sun project (~S1,T3S,R38E; *Au, Ag*). Heap-leach operation started in September by **Federal Claim Staking Agency, Inc.** No tonnage, grade, or production figures are known.

Humboldt County

Chimney Creek gold mine (S7,T39N,R43E; *Au*). **Gold Fields Mining Corp.** (parent company, Consolidated Gold Fields PLC of London) put the new $91-million Chimney Creek gold mine into production in December. The mine is located approximately 5 miles northeast of the Getchell Mine. The mine has both milling and heap-leaching facilities and produced more than 14,000 oz of gold during December. Anticipated yearly production is 150,000 oz. Projected cash production costs are $119/oz. Mine life is expected to be at least 15 years, but ore reserves are being continually increased. At completion of the feasibility study proven/probable ore reserves were 22.5 million tons grading 0.058 oz gold per ton. At the end of 1987 reserves were increased to 26.9 million tons, grading 0.068 oz gold per ton, about 12 million tons of which is millable and 14.9 million tons is leachable. Average ore grade during mine life is expected to be 0.14 oz gold per ton for millable ore and 0.03 oz gold per ton for heap-leachable ore. Recovery is expected to be 92 percent for millable ore and 60 percent for heap-leach ore.

Lyon County

Haywood-Santiago Mine (S18,T16N,R21E; *Au, Ag*). **Canyon Resources Corp.** and **Nevex Gold Co.** began heap-leach production from old mine dumps in early May 1987. Production for the remainder of the year was expected to be more than 2,400 oz of gold and more than 26,000 oz of silver. In February, Canyon Resources entered into an agreement to acquire Nevex gold.

Mineral County

Aurora gold mine (~S17,T5N,R28E; *Au, Ag*). **Nevada Goldfields Corp.** Aurora Mine was officially commissioned in December. It has an estimated five-year life and is expected to produce 100,000 oz of gold and 150,000 oz of silver during this time. Yearly gold production is expected to be 20,000 oz. Cost to develop and bring to production was $5.1 million.

Aurora Mine #2 (~S17,T5N,R28E; *Au, Ag*). **Electra North West Resources** and **Minerex Resources** began gold production at their "Aurora" Mine in October. (This mine is separate from the Nevada Goldfields operation and is not related to it.) The mine was expected to produce approximately 4,000 oz of gold by year end and, when in full production, will produce over 20,000 oz of gold and over 20,000 oz of silver per year. Announced reserves are 2 million tons grading 0.12 oz gold per ton. Mineralization is open at depth and along strike. Mine life is expected to be 6 to 7 years.

Nye County

Grantsville property (~S3,T1N,R39E; *Ag*). In January **Fury Exploration Ltd.** applied for three air quality registration certificates for surface area disturbance and the construction of a crushing system and melting furnace. Greenwell, Montagu and Company, a major London brokerage firm, agreed to finance the property to production. The finance house put up $1.35 million which will be repaid from 60 percent of the profits. Drill-proven reserves are 531,757 tons grading 4.39 oz silver per ton. There are additional drill-indicated reserves of 345,095 tons grading 4.30 oz silver per ton. Capital costs for the project are estimated to be $330,000. Results from a non-agglomerated column-leach test program yielded a recovery of 71.3 percent after 109 days of leaching. Ore will be crushed to −¾ inch and agglomerated to improve recovery. The property went into production late in 1987 and a limited tonnage was mined by the end of the year. When in full production the property will produce 165,550 oz silver per month.

White Pine County

Illipah Mine (~S33,T19N,R58E; *Au, Ag?*). Owned by **Echo Bay Mines**; the first gold was poured in October 1987. Production for 1987 was expected to be 5,000 to 6,000 oz of gold and 1988 production is expected to be 25,000 to 30,000 oz of gold. Total mine life is expected to be only 1½ to 2 years with total recoverable gold content of 33,800 oz. Capital costs were $2.3 million and the production cost of gold is projected to be in the $250/oz range.

CLOSURES

The **McDermitt mercury mine**, the only operating mercury mine in the U.S., closed down in January 1987. Production was 12,000 flasks in 1986. **Placer Dome U.S.** (owner and operator) stated that it had enough mercury supplies in stock to meet its commitments for more than a year. Reasons given for the closure were: low price of mercury (generally below $230/flask), low-cost foreign imports, and continued sales from the U.S. Government stockpile. The mine may reopen in 1988.

Bulk-Mineable Precious-Metal Deposits

by H. F. Bonham, Jr.

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

RESERVES, PRODUCTION, HOST ROCKS, AND AGES

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

Deposit name	Reserves	Production	Host rock	Mineralization age
CHURCHILL COUNTY				
Bell Mountain	1982: 1 million tons, 0.055 oz Au and 1.4 oz Ag/ton (possible additional 1 million tons, 0.022 oz Au and 1.0 oz Ag/ton; *Sphinx zone:* 50,000 tons, 0.14 oz Au and 3.3 oz Ag/ton)	no production	rhyolitic tuff	Miocene
Fondaway Canyon	1986: 4.4 million tons, 0.134 oz Au/ton	1987: exploration	Triassic slate and phyllite	Cretaceous
ELKO COUNTY				
Big Springs (Sammy Creek)	1987: 3.76 million tons, 0.148 oz Au/ton	1987: 350,000 tons/year	Mississippian to Permian overlap assemblage	Cretaceous or Tertiary
Bootstrap	1987: 1 million tons, 0.12 oz Au/ton	1974–84: heap leaching, low-grade ore 1987: exploration	dacitic dikes, Paleozoic siltstone and laminated limestone/chert	~37 m.y.
Burns Basin	1986: 3.2 million tons, 0.177 oz Au/ton; 804,000 tons, 0.038 oz Au/ton	pre-production	Roberts Mountains and Hanson Creek Formations	Cretaceous or Tertiary
Dee	1982: 2.5 million tons, 0.12 oz Au/ton; 1.1 million tons, 0.028 oz Au/ton heap-leach 1985: 2.14 million tons, 0.133 oz Au/ton mill-grade; 1.5 million tons, 0.027 oz Au/ton heap-leach 1987: 2.5 million tons, 0.1 oz Au/ton	1987: ~45,000 oz Au/year	Vinini Formation Devonian carbonates, dacitic dikes	Cretaceous or Tertiary

continued

Digitized by Google

BULK-MINEABLE, PRECIOUS-METAL DEPOSITS (continued)

Deposit name	Reserves	Production	Host rock	Mineralization age
ELKO COUNTY (continued)				
Dexter	1987: 2 million tons, 0.039 oz Au and 1.9 oz Ag/ton	1896–1902: 29,940 oz Au, 28,543 oz Ag 1987: 5,000 oz Au, 70,000 oz Ag	Eocene rhyolitic ignimbrite and andesite	38 m.y.
Ivanhoe	1986–87: 8 million tons, 0.045 oz Au/ton	exploration	rhyolitic tuff, flows, volcaniclastic rocks	Miocene
Jerritt Canyon	1981: 12.5 million tons, 0.231 oz Au/ton 1985: 4.5 million tons, 0.14 oz Au/ton (additional reserves) 1986: 16 million tons, 0.174 oz Au/ton 1987: 3.124 million oz Au/Ag at an average grade of ~0.18 oz Au/ton	1981–84: 962,500 tons/year 1986: ~270,000 oz Au/year 1987: 316,000 oz Au	Hanson Creek and Roberts Mountains Formation	Cretaceous or Tertiary
Kinsley Mtn.	1987: 1 million tons, 0.06–0.08 oz Au/ton	exploration, evaluation	upper Paleozoic carbonate rocks	Oligocene?
Rain	1984: 8.3 million tons, 0.083 oz Au/ton 1986: 10 million tons, 0.08 oz Au/ton 1987: 10.1 million tons, 0.08 oz Au/ton	production scheduled for 1987–88	Webb Formation	36–37 m.y.
Saval Canyon	1986: 2.5 million tons, 0.121 oz Au/ton	evaluation	lower Paleozoic carbonate rocks	Cretaceous or Tertiary
Winters Creek	1986: 1.4 million tons, 0.146 oz Au/ton	evaluation, exploration	lower Paleozoic carbonate rocks	Cretaceous or Tertiary
Woods Gulch	1987: 720,000 tons, Au mineralization	pre-production	lower Paleozoic sedimentary rocks, andesite-dacite dikes and sills	Cretaceous or Tertiary
Wright Window	1986: 1.3 million tons, 0.095 oz Au/ton	evaluation, exploration	lower Paleozoic carbonate rocks	Cretaceous or Tertiary
ELKO & EUREKA COUNTIES				
Carlin Trend	Prospects with significant mineralization: Bobcat, near Genesis, 25 ore-grade holes, 1986; Capstone, north of Post, 60 ore-grade holes, 1986; Gold Quarry (Deep West), 15 deep ore-grade holes, 1986; Gnome, near Rain, 3 million tons ore-grade, 1986; Lantern, between Carlin and Blue Star, four ore-grade holes, 1986; North Star, north of Genesis, feasibility studies to determine total ore reserves, 1986; Tusc, eight ore-grade holes, 1986.			
ESMERALDA COUNTY				
Boss Mine	1987: 500,000 tons, 0.07 oz Au/ton	heap-leach	Ordovician sedimentary rocks	Miocene?
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.
Hasbrouck	1982: 5 million tons, 0.06 oz Au and 1.5 oz Ag/ton 1986: 12.9 million tons, 0.0291 oz Au and 0.59 oz Ag/ton	no production	Siebert Formation tuff and volcaniclastic rocks	16 m.y.
Weepah	1986: 200,000 tons, 0.1 oz Au and 0.4 oz Ag/ton	1986–87: 2,500 oz Au/month	Wyman Formation	Cretaceous
EUREKA COUNTY				
Blue Star	1987: 1.95 million tons, 0.066 oz Au/ton	1974–84: intermittent	lower Paleozoic sandy siltstone and carbonate rocks, granodiorite	37.5 m.y.
Buckhorn	1984: *Cominco:* 5 million tons, 0.044 oz Au, 0.585 oz Ag/ton *Northern Dynasty:* 2 million tons, 0.056 oz Au, 0.224 oz Ag/ton 1986: 3.215 million tons, 0.048 oz Au, 0.58 oz Ag/ton 1987: *oxide*—1.6 million tons, 0.047 oz Au/ton; *sulfide*—1.0 million tons, 0.075 oz Au/ton	30,000 oz Au and 270,000 oz Ag/year (projected by Cominco)	basaltic andesite, sinter, and silicified sediments	14.6 m.y.

BULK-MINEABLE, PRECIOUS-METAL DEPOSITS (continued)

Deposit name	Reserves	Production	Host rock	Mineralization age
EUREKA COUNTY (continued)				
Bullion Monarch	1987: 1 million tons, 0.10 oz Au/ton	exploration, evaluation	lower Paleozoic sedimentary rocks	Tertiary or Mesozoic
Carlin	1984: 4.5 million tons, 0.16 oz Au/ton 1987: 1.5 million tons, 0.127 oz Au/ton	1965–84: 14 million tons, 4,300,000 oz Au	Roberts Mountains Formation	~37 m.y.
Genesis	1987: 14 million tons, 0.097 oz Au/ton	1986: production commenced	Ordovician-Devonian limestone, argillite chert	~36–37 m.y.
Gold Bar	1984: 2.8 million tons, 0.09 oz Au/ton 1987: ~600,000 oz Au, ~0.1 oz Au/ton	1987: 45,000 oz Au/year	Devonian Nevada Formation	Eocene
Goldstone-Gold Ridge	1987: 280,000 oz Au	exploration, evaluation	Paleozoic sedimentary rocks	
Gold Strike (Bazza, Post)	1983: 250,000 tons, 0.1 oz Au/ton; 3 million tons, 0.04 oz Au/ton 1987: *Post oxide*—1.4 million oz Au; *Deep Post and Betze*—7.3 million oz Au	1980–86: 221,000 oz Au 1986: 48,000 oz Au 1987: 52,000 oz Au	Vinini Formation, granodiorite, latite, skarn	~36–37 m.y.
Gold Quarry	1984: 183 million tons, 0.043 oz Au/ton (45 million tons, 0.078 oz Au/ton) 1987: 197.8 million tons, 0.042 oz Au/ton	1985: 170,000 oz Au/year	Ordovician to Devonian chert, shale, siltstone, and impure carbonates, in part, Vinini Formation	~30–38 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.?
Maggie Creek	1984: 3.6 million tons, 0.079 oz Au/ton 1986: 6.7 million tons, 0.045 oz Au/ton	1984: 1,250,000 tons 1986: intermittent production	Ordovician to Devonian siltstone, chert, sandstone, impure limestone	Cretaceous or Tertiary
Newmont Mines	1987: 14 million oz Au	1987: 585,000 oz Au		
Pete	1987: 572,000 tons, 0.198 oz Au/ton	exploration	Roberts Mountains Formation	36–37 m.y.
Post	1987: Newmont Gold Co. holdings only—22 million tons, 0.052 oz Au/ton	1987: pre-production	Vinini Formation	36–37 m.y.
Ratto Canyon	1984: ~200,000 oz Au	exploration phase	Dunderberg Shale, Hamburg Dolomite	Oligocene
Tonkin Springs	1983: 1.84 million tons, 0.089 oz Au, 0.204 oz Ag/ton 1987: 1.5 million tons, 0.05 oz Au/ton; 2.5 million tons, 0.09 oz Au/ton	1987: ~9,700 oz Au	Vinini Formation, dacitic dikes	Oligocene?
Windfall	3 million tons, 0.03 oz Au/ton	1908–16: 65,000 tons, 0.365 oz Au/ton 1975–84: 3 million tons, 0.03 oz Au/ton	Hamburg Dolomite	Eocene or Oligocene
HUMBOLDT COUNTY				
Ashdown	1987: 1.16 million tons, 0.125 oz Au/ton	exploration	Mesozoic granitic rocks	Mesozoic
Chimney Creek	1987: 20.5 million tons, 0.065 oz Au/ton	1987: ~150,000 oz Au/year; 1988: 150,000 oz Au/year scheduled	Etchart Limestone	Cretaceous or Tertiary
Crofoot	1987: 23.45 million tons, 0.027 oz Au/ton	pre-production	Camel conglomerate, rhyolite dikes	1–2 m.y.
Getchell	1983: 3.25 million tons, 0.18 oz Au/ton (possible 10 million tons, 0.16 oz Au/ton) 1987: 1.3 million oz Au, 0.17 oz Au/ton	1938–50, 1962–67: 788,875 oz Au, 2,113,030 tons, 0.37 oz Au/ton 1987: ~15,000 oz Au	Comus Formation, Preble Formation, granodiorite dikes, granodiorite	90 m.y.
Lewis	1984: 10 million tons, 0.04 oz Au/ton 1987: 9 million tons, 0.032 oz Au/ton	1984: 3,500 tons/day 1987: ~8,800 oz Au	Camel conglomerate rhyolite dikes	1–2 m.y.

continued

BULK-MINEABLE, PRECIOUS-METAL DEPOSITS (continued)

Deposit name	Reserves	Production	Host rock	Mineralization age
HUMBOLDT COUNTY (continued)				
Marigold	1987: 8 million tons, 0.0935 oz Au/ton	pre-production	Paleozoic chert and argillite	Tertiary?
Pinson	1980: 3.245 million tons, 0.119 oz Au/ton 1984: *CX zone:* 490,000 tons, 0.106 oz Au/ton; 500,000 tons heap-leach 1985: 1.049 million tons, 0.09 oz Au/ton 1986: 4.835 million tons, 0.086 oz Au/ton mill-grade; 1.064 million tons, 0.027 oz Au/ton heap-leach 1987: 4.0 million tons, 0.09 oz Au/ton mill-grade ore; 1.8 million tons, 0.028 oz Au/ton heap-leach	1,500 tons/day, 56,000 oz Au 1986: 67,000 oz Au 1987: 60,000 oz Au/year	Comus Formation	90 m.y.
Preble	1985: 1.8 million tons, 0.062 oz Au/ton 1986: 3.16 million tons, 0.093 oz Au/ton heap-leach; 80,000 tons, 0.242 oz Au/ton mill-grade 1987: 46,000 tons, 0.16 oz Au/ton mill-grade81,000 tons, 0.056 oz Au/ton heap-leach	1985: 360,000 tons, 17,000 oz Au 1987: 28,000 oz Au	Preble Formation	90 m.y.?
Sleeper	1985: 4.2 million tons, 0.13 oz Au and 0.73 oz Ag/ton (of which 1.4 million tons contains 0.35 oz Au and 1.0 oz Ag/ton) 1987: 2,225,000 oz Au	1986: 128,000 oz Au, 94,000 oz Ag 1987: 158,696 oz Au	Miocene "latite" flows and dikes Triassic slate and phyllite	5.9 m.y.
LANDER COUNTY				
Austin Gold Venture	1986: 1.75 million tons, 0.16 oz Au/ton 1987: 1.2 million tons, 0.186 oz Au/ton	1986: 55,000 oz Au 1987: 52,000 oz Au	Antelope Valley Limestone	Cretaceous or Tertiary
Cortez	mined out	1968–82: 3,562,100 tons, 0.279 oz Au/ton	Roberts Mountains Formation	34 m.y.
Cove	1987: 4 million oz Au, 250 million oz Ag	pre-production	Panther Canyon Fm. (conglomerate, sandstone), Augusta Mountain Formation (limestone), both of Triassic age	39.5 m.y.
Fire Creek	1982: 350,000 tons, 0.06 oz Au/ton	1983–84: 767 oz Au	basaltic andesite	Miocene
Fortitude (Copper Canyon) (Battle Mtn.)	1984: 16 million tons, 0.15 oz Au, 0.57 oz Ag/ton 1986: 7 million tons, 0.23 oz Au, 0.57 oz Ag/ton 1987: 10.69 million tons, 0.24 oz Au/ton, 0.69 oz Ag/ton	1978–84: *Tomboy-Minnie deposits:* 3.9 million tons, 0.09 oz Au, 0.28 oz Ag/ton 1986: 259,000 oz Au, 902,000 oz Ag 1987: 255,000 oz Au	Battle Formation, Antler Peak Limestone, Pumpernickel Formation	37 m.y.
Gold Acres and Little Gold Acres	1987: 4.8 million tons, 0.105 oz Au/ton	1942–84: 2.4 million tons, 0.13 oz Au/ton; 2 million tons, 0.041 oz Au/ton leached. *Little Gold Acres:* 800,000 tons, 0.124 oz Au/ton	Roberts Mountains Formation, Wenban Limestone, Valmy Formation, quartz porphyry dikes	92.8–94 m.y. and 36 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 mineable by open-pit methods)	no production	Valmy Formation	Oligocene?
McCoy	1981: 2.5 million tons, 0.08 oz Au, 1 oz Ag/ton 1986: 6 million tons, 0.055 oz Au/ton 1987: 14 million tons, 0.05 oz Au/ton	1986: 50,000 oz Au 1987: 200,000 oz Au, 5 million oz Ag	Augusta Mountain Formation, granodiorite	36 m.y. 39 m.y.
Robertson	5 million tons, 0.05 oz Au/ton			
Surprise	1987: 225,000 oz Au	1987: 2,000 oz Au	skarn	37 m.y.

continued

BULK-MINEABLE, PRECIOUS-METAL DEPOSITS (continued)

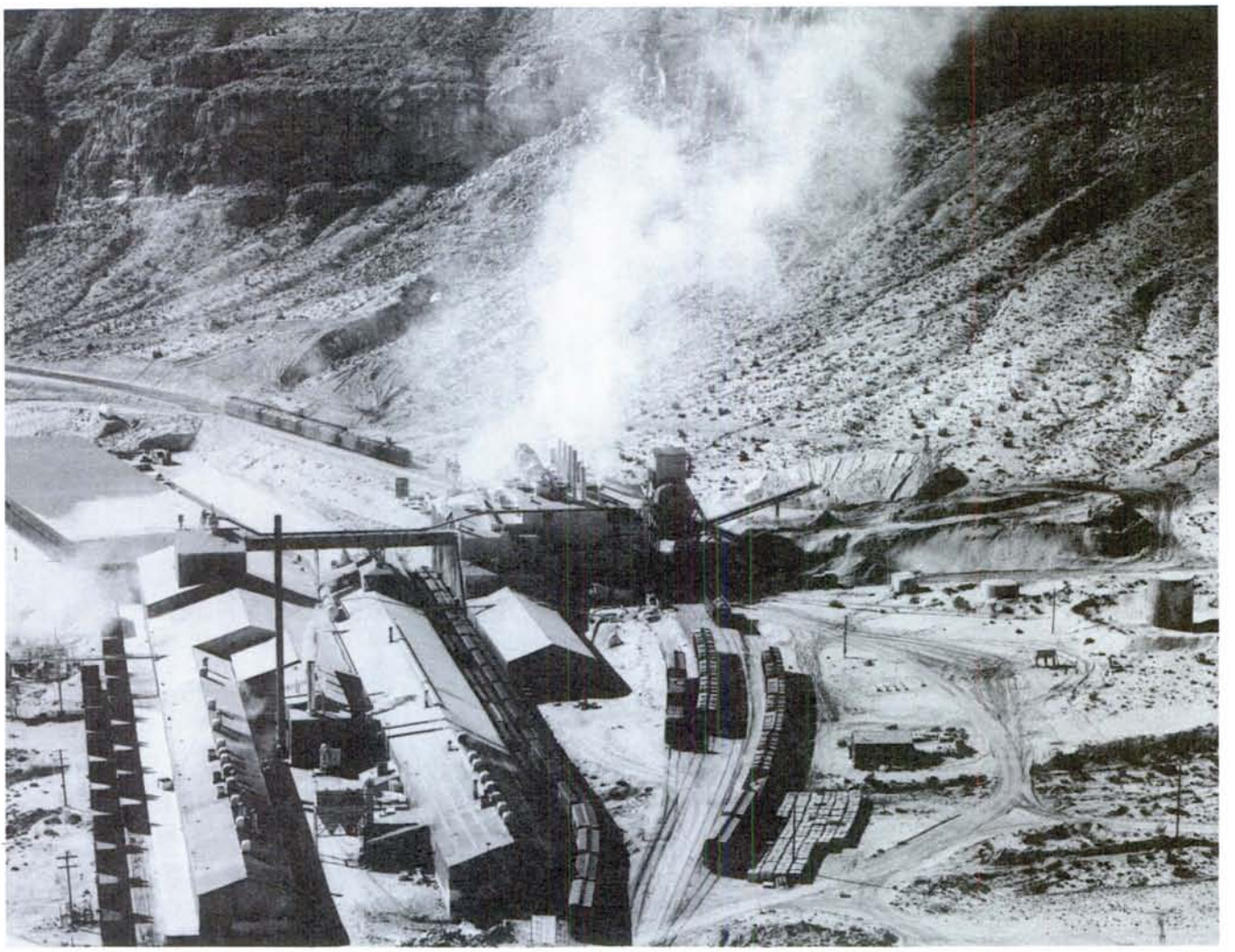
Deposit name	Reserves	Production	Host rock	Mineralization age
LINCOLN COUNTY				
Atlanta	1980: 1.1 million tons, 0.08 oz Au and 1.6 oz Ag/ton	1980: 88,000 oz Au, 1,710,000 oz Ag 1987: idle	Pogonip Group, Ely Springs and Laketown Dolomites, Oligocene silicic tuff, dacite dikes	early Miocene?
MINERAL COUNTY				
Aurora	1983: 1.5 million tons, 0.129 oz Au and 0.3 oz Ag/ton	1930's: 500,000 tons, 0.2 oz Au/ton 1983: 85,000 tons, 10,000 oz Au	andesite, rhyolite	10 m.y.
Borealis	1981: 2.1 million tons, 0.08 oz Au and 0.5 oz Ag/ton 1984: 2.5 million tons, 0.07 oz Au/ton 1987: 1.132 million tons, 0.113 oz Au/ton	1981–84: 2.1 million tons, 170,000 oz Au 1986–87: 40,000 oz Au/year	rhyolite flow dome, andesite flows, breccias, volcaniclastic rocks	5 m.y.
Candelaria	1982: 18.5 million tons, 1.09 oz Ag and 0.009 oz Au/ton 1986: 15.8 million oz Ag and 95,000 oz Au added to reserve	1982: 1.7 million oz Ag, 9,000 oz Au 1987: 3 million oz Ag/year; total production was 10 million oz Ag as of June 1987	Candelaria Formation serpentinite, granitic dikes	Cretaceous
Rawhide	1986: 24.1 million tons, 0.045 oz Au and 0.47 oz Ag/ton (additional 15 million tons, 0.014 oz Au/ton possible)	pre-production	rhyolite plugs, flows, tuffs, breccias	16 m.y.
Santa Fe	1984: 8 million tons, 0.032 oz Au and 0.26 oz Ag/ton 1987: 8.5 million tons, 0.037 oz Au/ton and 0.316 oz Ag/ton	evaluation phase	Luning Formation	Miocene
Sullivan	1987: 10.2 million tons, 0.039 oz Au and 0.086 oz Ag/ton and 0.37% Cu	exploration	Mesozoic granodiorite	Mesozoic
NYE COUNTY				
Divide	1987: 306,000 tons, 0.057 oz Au/ton and 0.45 oz Ag/ton	evaluation	Miocene silicic tuff	16 m.y.
Gold Bar	1987: 1.23 million tons Au ore	exploration, evaluation	silicic volcanic rocks	Miocene
Ketchup Flat	1987: 160,000 oz Au, 1,688,000 oz Ag		Miocene volcanic rocks	Miocene
Manhattan	1983: 5 million tons, 0.036 oz Au/ton 1986: *east pit*—1 million tons, 0.036 oz Au/ton; *west pit*—2.5 million tons, 0.08 oz Au/ton 1987: 2.5 million tons, 0.057 oz Au/ton	1905–59: 500,000 oz Au 1983: 26,000–27,000 oz Au 1986: 3,000 tons/day 1987: ~30,000 oz Au	Gold Hill Formation	16 m.y.
Northumberland	1981: 17 million tons, 0.045 oz Au/ton 1986: 773,000 tons, 0.07 oz Au/ton	1939–42: 220,284 tons, 327,000 oz Au 1981–84: 950,000 tons/year 1986: leaching existing heaps only	Roberts Mountains and Hanson Creek Formations, granodiorite, tonalite, quartz porphyry dikes	85 m.y.
Paradise Peak (Goose)	1984: 10 million tons, 0.1 oz Au and 3 oz Ag/ton 1986: 12 million tons, 0.097 oz Au and 3.52 oz Ag/ton 1987: 1.1 million oz Au, 37.8 million oz Ag	1986: 143,000 oz Au, 1,088,000 oz Ag 1987: 188,000 oz Au, 3,084,800 oz Ag	rhyolite flows, ash-flow and air-fall tuffs, and andesite flows	Miocene
Round Mtn.	1977: 12 million tons, 0.061 oz Au and 0.07 oz Ag/ton 1984: 195 million tons, 0.043 oz Au and 0.08 oz Ag/ton 1987: 194 million tons, 0.035 oz Au/ton	1977–84: 313,480 oz Au, 160,419 oz Ag 1984: 70,000 oz Au 1987: ~165,000 oz Au	rhyolite ignimbrite	25 m.y.
St. Joe-Bullfrog	1987: 60 million tons ore, 3.215 million oz Au, 3.375 million oz Ag	exploration, evaluation	silicic ash-flow tuff	Miocene
Sterling	1983: 200,000 tons, 0.20 oz Au/ton (possible 300,000 tons additional reserves of similar grade)	1984: 58,000 tons, 9,000 oz Au 1987: 7,000 oz Au	Wood Canyon and Bonanza King Formations	14 m.y.

BULK-MINEABLE, PRECIOUS-METAL DEPOSITS (continued)

Deposit name	Reserves	Production	Host rock	Mineralization age
PERSHING COUNTY				
Florida Canyon	1987: 22 million tons, 0.023 oz Au/ton	1987: 48,000 oz Au	Grass Valley Formation	Cretaceous or Tertiary
Relief Canyon	1983: 9 million tons, 0.032 oz Au/ton 1986: 3.3 million tons, 0.03 oz Au/ton	1984: 24,500 oz Au, 1 million tons 1986–87: 30,000 oz Au/year	Natchez Pass Limestone, Grass Valley Formation	Cretaceous
Rochester	1981: 75 million tons, 1.5 oz Ag/ton 1987: 117 million tons, 0.011 oz Au and 1.55 oz Ag/ton	1986: 4 million oz Ag, 43,000 oz Au 1987: > 4 million oz Ag, 27,000 oz Au	Koipato Group, Weaver Rhyolite	Late Cretaceous
Standard	mined out	1932–51: 884,000 tons, 46,602 oz Au, 102,721 oz Ag	Natchez Pass Limestone, Grass Valley Formation	73 m.y.
Trinity	1987: 1 million tons, 5.25 oz Ag/ton	1987–89: 4.6 million oz Ag projected	rhyolite plugs	Miocene
STOREY COUNTY				
Flowery	1986: 500,000 tons, 36,000 oz Au, 428,000 oz Ag		Alta Formation	12 m.y.
WASHOE COUNTY				
Hog Ranch	1984: 2.5 million tons, 0.085 oz Au/ton 1986: 5 million tons, 0.08 oz Au/ton 1987: 6.8 million tons, 0.054 oz Au/ton	1986: 50,000 oz Au	rhyolite, explosion breccia, sinter	15–16 m.y.
WHITE PINE COUNTY				
Alligator Ridge	1983: 5 million tons, 0.09 oz Au/ton 1986: 1.79 million tons, 0.064 oz Au/ton	1981–82: 2 million tons, 0.11 oz Au/ton 1983–87: 60,000 oz Au and 14,000 oz Ag/year	Pilot Shale	early Oligocene?
Green Springs	1987: 1.943 million tons, 0.053 oz Au/ton		Paleozoic sedimentary rocks	Oligocene?
Illipah	1987: 57,000 oz Au	1987: ~ 25,000 oz Au/year	Paleozoic sedimentary rocks	Oligocene?
Little Bald Mtn.	1986: 1 million tons, 0.10 oz Au/ton 1987: 220,000 tons, 0.14 oz Au/ton	1985–86: 140,000 tons, 0.08 oz Au/ton	Antelope Valley Formation	Eocene
Star Pointer	1986: 1.5 million tons, 0.14 oz Au, 0.3 oz Ag/ton (approximately 1.3 million tons averaging 0.08 oz Au/ton present in district)	1986: 48,000 oz Au, 96,000 oz Ag 1987: 50,207 oz Au	Rib Hill Sandstone Riepe Spring Limestone	Cretaceous
Taylor	1980: 10 million tons, 3 oz Ag/ton	1980: 1,200 tons/day	Guilmette and Joana Limestones, rhyolite dikes	Eocene or Oligocene
Top	1986: *proven*—2.5 million tons, 0.10 oz Au/ton; *possible*—2.65 million tons, 0.087 oz Au/ton	1986: 50,000 oz Au	granite porphyry Cambrian shale and limestone	35–38 m.y.
White Pine		1988: 16,000 oz Au/year projected	Paleozoic sedimentary rocks	Oligocene?

Industrial Minerals

by Stephen B. Castor



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

The total value of industrial minerals produced in Nevada in 1987 is estimated at about 220 million dollars, an increase of about 15 percent over the 1985 estimate. Increases in dollar values for sand/gravel, diatomite, gypsum, lithium carbonate, silica sand, stone, and lime production have offset decreases in barite and magnesia.

According to information released by the Nevada State Division of Mine Inspection, in 1987 there were 172 industrial mineral mines or mills operating in Nevada with more than 1,500 employees. The sand and gravel industry was the largest segment with 105 operations and over 500 employees.

The most important industrial mineral commodities produced in 1987, in terms of value, were sand/gravel, diatomite, cement, lithium carbonate, magnesia, gypsum, lime, and silica sand. Other industrial mineral commodities produced in Nevada in 1987 were barite; clay minerals; lightweight aggregate; limestone and dolomite; fluorspar; salt; zeolite; perlite; decorative and crushed stone; and gemstones.

BARITE. A preliminary report by the U.S. Bureau of Mines lists Nevada barite production in 1987 at 216,000 tons, a 17 percent increase over 1986, but far below the 1980 high of about two million tons. This decrease is mainly due to a drop in oil well drilling, but also reflects increased imports of foreign barite, particularly into the large Gulf Coast market.

Many of the smaller Nevada barite producers have been forced out of business in the past few years, and some larger operations have been consolidated. In 1987, **Dresser Industries' Magcobar Minerals** operation and the **IMCO Services** properties, both in the Battle Mountain area, were combined under the name of **M. I. Drilling Fluids**. The other large Nevada barite producer, **Millpark, Inc.**, was formed by the merger of the **Milchem** and **Newpark** operations in

Digitized by Google

late 1986. In 1987, both companies produced from extensive stockpiles of unground barite. Some mining is planned for 1988, when stockpiled material will be inadequate to meet expected demand.

BORATES. The **American Borate Co.** colemanite processing plant at Armargosa Valley in Nye County, which processed ore from nearby Death Valley, California, was shut down in 1986, and remained idle through 1987. Some stockpiled ore will be processed in 1988. A revival in exploration for borate deposits in Nevada began in 1987, due mainly to continued high prices for colemanite, which is used in fiberglass manufacture.

CEMENT. The **Nevada Cement Co.** plant at Fernley, about 30 miles east of Reno, was the sole producer of cement in Nevada in 1987. Annual production at this plant is relatively stable at about 400,000 tons, which is equally divided between northern Nevada and northern California market areas. Tertiary freshwater limestone from a quarry 5 miles southeast of Fernley and clay from a deposit northwest of Pyramid Lake are used as raw materials.

A cement plant was under construction in 1987 by **Las Vegas Cement Co.**, Inc. at Logandale in Clark County, about 45 miles northeast of Las Vegas. Locally mined limestone and clay will be utilized. Initial production at 600 tons/day is slated for 1988. In addition, a new cement plant proposed by the **Great Star Cement Co.** at Apex, about 15 miles northeast of Las Vegas, is expected to start up in 1989.

CLAY. **Industrial Minerals Ventures, Inc.**, is the largest producer of clay mineral products in Nevada. The company mines bentonite, sepiolite, and saponite from three locations in the vicinity of Armargosa Valley, Nye County, and hectorite from a nearby California site. These clay minerals are processed at a plant 15 miles southeast of Armargosa Valley into more than twenty different products. In 1986 and 1987, production emphasis shifted from bentonite drilling mud to industrial clay products because of the worldwide slowdown in oil well drilling. At present, sepiolite accounts for 80 percent of the clay mined by the company. Sepiolite is useful in asbestos replacement or as a substitute for attapulgite clay in some products. Developing markets in agriculture, and for organoclays, may spur increased production in the future. The company markets several different organoclay products, which are hydrophobic materials made by reacting clay minerals with organic compounds.

White montmorillonitic clay, such as that mined underground in small amounts by the **Vanderbilt Minerals Co.**, at Beatty, is in demand as a filler and thickening agent because of its brightness. This clay is mixed with materials that the company mines elsewhere and sold nationwide for various uses, mainly in pharmaceutical and cosmetic products.

DIATOMITE. Diatomite was the most important industrial mineral commodity, other than sand and gravel, in Nevada in 1987. It is likely that production will increase in 1988. The U.S. is the world's largest producer and consumer of diatomite, with Nevada second only to California in production. Worldwide exports of U.S. diatomite, already strong, have been enhanced by the drop in value of the dollar.

Nevada diatomite is mined from Miocene or Pliocene lacustrine deposits up to 200 feet thick in the west-central part of the state. By contrast, most California production is from marine diatomite.

Eagle Picher Industries is the largest Nevada diatomite producer, with mines and plants producing filter-grade diatomite northeast of Lovelock, and absorbant-grade diatomite near Fernley. The capacity for filter-grade production is 100,000 tons/year.

Grefco, Inc., operates a 15,000-ton/year plant which produces absorbant-grade diatomite from the Basalt Mine, in Esmeralda County. **Canyon Resources** purchased the **Cyprus Minerals** absorbant-grade diatomite operation near Fernley and had relatively minor production in 1987, but plans to increase output by 1989.

In 1987, **Moltan Co.** was engaged in mine development and plant construction for an operation to produce industrial absorbants and cat litter from a low-grade diatomite deposit in Churchill County north of Fernley. Start-up is expected in early 1988.

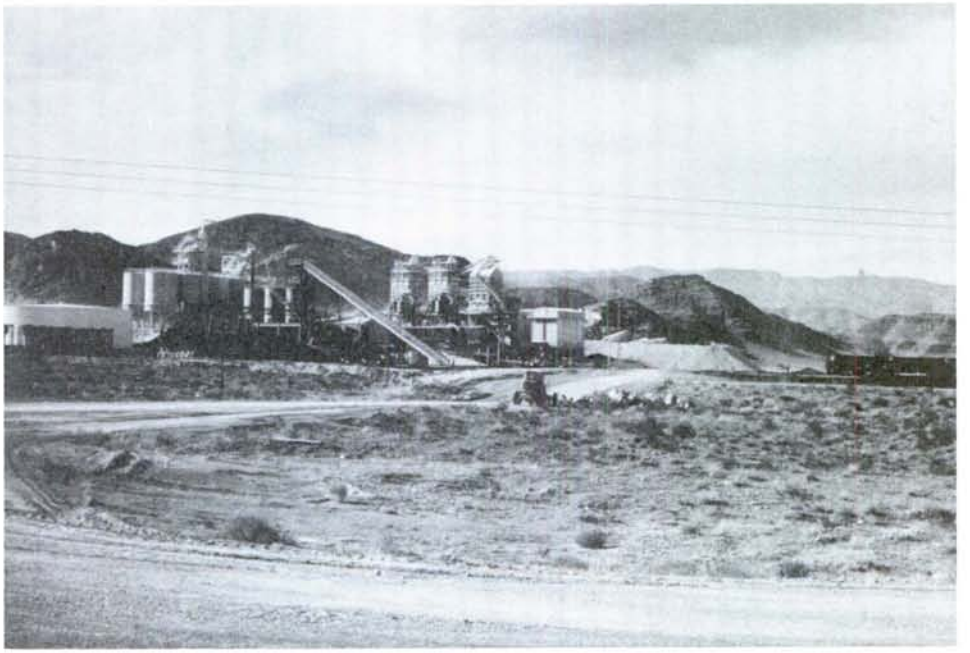
FLUORSPAR. **J. Irving Crowell, Jr. and Son**, of Beatty, Nye County, extract about 3,000 tons of fluorspar annually from complex replacement bodies cutting Cambrian dolomite at the Daisy Mine. This family operation has been in production continuously since 1928. The fluorspar, which is hand-sorted, contains about 80 percent CaF_2 and 2 to 5 percent SiO_2. It is shipped to California, where it is used in cement manufacture.

GYPSUM. Gypsum production in Nevada remained high in 1987, mainly due to continued strength of the construction industry in California and Nevada. It is likely that 1988 will see a production increase of more than 10 percent over 1987.

U.S. Gypsum, with a plant at Empire in Washoe County, and a mine 6 miles to the east in Pershing County, was the largest Nevada gypsum producer in 1987, at 440,000 tons. More than 80 percent of this was used in wallboard and plaster, and most of the remainder shipped to cement plants in California. Projected production in 1988 is about the same, but some shipment to agricultural users is planned.

Pabco Gypsum, near Lake Mead in Clark County, became the second largest Nevada gypsum producer following a late 1986 increase in the capacity of its wallboard plant. This operation utilizes relatively low-grade gypsum ore extracted from a flat-lying deposit of Tertiary age with surface exposure in excess of 5 square miles. Impurities (mostly clay) are removed in a washing plant before the gypsum is shipped or calcined.

Domtar Industries' acquisition of the **Genstar Gypsum Products** mine at Blue Diamond, Clark County, was blocked by the U.S. Justice Department in early 1987. This operation, which includes a wallboard plant and calcining facilities for its high-grade gypsum ore, was subsequently sold to **James Hardie Industries, Ltd.** of Australia. The ore at Blue



Genstar lime plant at Apex, Clark County. *Keith Papke photo.*

Diamond is mined from remnants of a once-continuous gypsum-rich sequence in hills atop Permian limestone.

In 1987, the **Georgia Pacific Corp.** opened a new wallboard plant at Apex in Clark County. This plant utilizes high-grade gypsum ore from a quarry on Weiser Ridge, which necessitates quarry to plant haulage of nearly 30 miles. The ore is produced from gypsum beds up to 20 feet thick which occur in a Permian marine evaporitic sequence up to 100 feet thick. The operation is expected to increase from the current production rate of about 200,000 tons/year to 300,000 tons/year in the future.

The **Art Wilson Co.** produces gypsum and anhydrite from the Adams Mine, about 5 miles northeast of Carson City. Relatively pure gypsum is shipped to cement manufacturers, including the **Nevada Cement Co.** plant in Fernley. Mixed gypsum and anhydrite is sent to agricultural users, mostly in California and Idaho.

LIME. Nevada lime production was up in 1987, mostly due to increased use of high-calcium lime by the booming western gold mining industry for pH control of leach fluids. A considerable increase in sales is forecast because 12 new leaching operations are anticipated to start up at Nevada gold mines in 1988. More than one company is said to be contemplating development of lime resources in northern Nevada to meet heavy local demand.

At present, **Chemstar, Inc.**, previously known as **Genstar, Inc.**, in Clark County, is the only Nevada lime producer. This company makes high-calcium lime at a rate of 360 tons/day at its Apex plant located about 15 miles northwest of Las Vegas. High purity, fine-grained limestone from the Crystal Pass Member of the Devonian Sultan Limestone is used for plant feed. Chemstar also operates a plant at Henderson which makes dolomitic lime, mainly for use in stucco and masonry mortar. Dolomite feed for this plant comes from a quarry near Sloan. Uncalcined limestone and dolomite products are also sold by the company.

LITHIUM CARBONATE. **Foote Minerals Co.** at Silver Peak in Esmeralda County recovers lithium carbonate by processing brine pumped from beneath the Clayton Valley dry lake. Lithium carbonate production from this operation in 1986 amounted to about 12 million pounds, and 1987 production was higher. In April 1987, **U.S. Borax** announced its intent to purchase Foote's lithium operations, but later terminated purchase discussions. In December, 1987, **Newmont Mining**, owner of 82 percent of the Foote shares, announced that it had reached agreement in principle with **Cyprus Minerals Co.** whereby Cyprus would pay $90 million to acquire all outstanding Foote shares.

MAGNESIA. Production at the **Basic, Inc.**, magnesite mine and magnesia plant at Gabbs, Nye County, was up slightly in 1987 compared with 1986, but still well below the peak output in 1981. The operation ran at less than 25 percent of plant capacity in 1987. Competition from foreign producers has been a major factor in this decline.

Although minor amounts of refractory magnesia are still processed at Gabbs, emphasis in the 1980's has shifted to caustic magnesia production. Sales of caustic magnesia for agricultural use accounted for about 80 percent of production in 1987. In the near future, annual production increases of about 10 percent are anticipated. In 1988, improved plant technology will make a relatively dust-free, finely-ground agricultural product available, which should increase

Digitized by Google

Basic's share of the magnesia market. In addition, increased use of oxychloride cement, which produces quick-setting, terrazo-like concrete with high tensile strength that requires no expansion joints, may augment agricultural demand. Magnesite at Gabbs occurs in altered Triassic dolomite, forming the largest commercial deposit in the U.S., with a surface extent of about a square mile.

PERLITE. The **Wilkin Mining and Trucking Co.** mines perlite underground at the Pahroc Mine in Lincoln County, where crude perlite has been produced since 1951. In 1987, the company began producing expanded perlite in its new milling and popping plant at Caliente, about 30 miles east of the mine. Four sizes of expanded perlite, in addition to crude perlite, are sold, mostly to horticultural users in California.

SALT. The **Huck Salt Co.** produces some salt every year from a dry lake near Fallon in Churchill County. Most of the salt is sold locally for road deicing. This operation has operated more-or-less continuously for 70 years.

SAND AND GRAVEL. In 1987, Nevada's sand and gravel producers benefitted from the continuing boom in local construction, producing an estimated 13.4 million tons. 1988 should be a year of further growth, with several large residential developments and three major hotel projects in the Las Vegas area, as well as some hotel expansions planned in the Reno/Tahoe area. In addition, future interstate highway construction and plans to build a new bridge over the Colorado River near Boulder Dam, should lead to continued high sand and gravel use.

The **Robert L. Helms Construction Co.** of Sparks was the largest sand and gravel producer statewide in 1987; this production is from several different operations, including a large new pit along the Truckee River about 15 miles east of Reno. Curtailment of sand and gravel operations in the metropolitan Reno/Sparks area has made the **Paiute Pit Aggregates, Inc.** operation near Wadsworth competitive, even though a 30-mile haul is necessary to reach users in the Reno/Sparks area. The largest single operation in the Reno area is **Granite Construction Company's** Patrick Pit about 10 miles east of Reno.

At least six of the ten largest sand and gravel producers in the state are in the Las Vegas area, where **WMK Transit Mix, Inc.**, of Henderson is the largest at about 1.5 million tons/year. Because WMK was unsuccessful in an application for a permit to mine on BLM land in the Henderson area, most current production is from the Buffalo Pit in southwest Las Vegas. Seven other operators in the Las Vegas area each produce at or above 400,000 tons/year. The newest sand and gravel production area is near Lone Mountain, a few miles northwest of Las Vegas, where limestone pebble gravels with low fine contents are mostly mined for paving and concrete use. The **Las Vegas Paving Corp.** operation appears to be the largest Lone Mountain producer. Southwest of Lone Mountain, surface preparation for large residential developments begun in 1987 has made large amounts of screened base material available, temporarily cutting into markets hitherto supplied by conventional pit operations.

Gravel deposits in the Las Vegas area appear to be adequate to meet demand far into the future. However, area construction operations will have to travel farther for new sand and gravel developments, because the U.S. Bureau of Land Management has redlined an area surrounding Las Vegas for new mining permits.

SILICA. **Simplot Silica Products** at Overton has enjoyed slow, but steady, production increases in the 1980's. At present, about 80 percent of sales are to glass manufacturers, with the rest mostly used as foundry sand. Simplot's material is high in silica (99.2 percent) and low in alumina (0.3 percent) when compared with other west coast operations. In 1988, the modifications to the classification system will lead to increased efficiency and product quality improvement at the Overton plant. Future sales projections look very good, because Simplot now supplies silica to a large new glass plant at Victorville, California.

STONE. In addition to small operations utilizing various types of crushed stone for concrete or asphalt aggregate and railroad ballast, the crushed stone industry in Nevada also includes an estimated 500,000 tons/year of lightweight aggregate production. Lightweight aggregate, which is produced by crushing and screening deposits of pumiceous rhyolite, is used in the manufacture of low-density concrete and blocks. **Rillite Aggregate Co.** near Reno is the largest producer, mostly for use in local concrete plants. **Naturalite Aggregate Corp.**, also located in the Reno area, ships significant amounts of its products to California. **Southern Nevada Liteweight** operates a quarry in the McCullough Range about 20 miles south of Las Vegas.

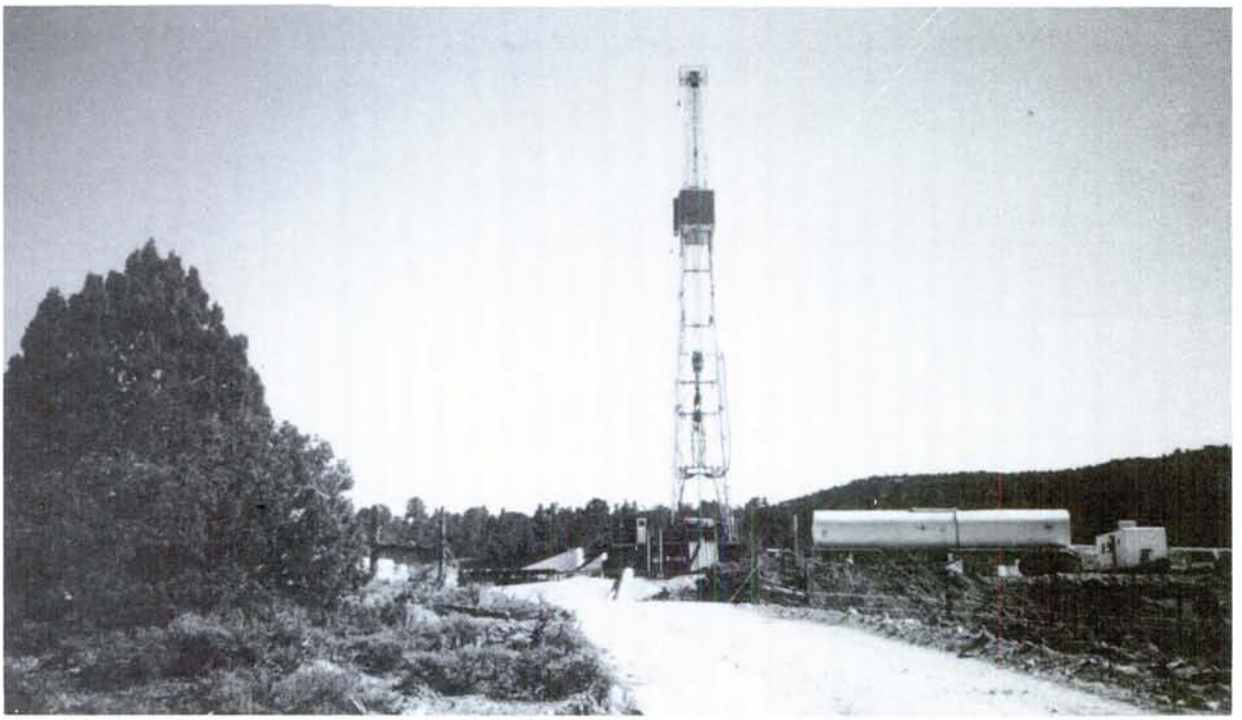
ZEOLITES. **East West Minerals, Inc.**, which purchased several U.S. zeolite properties from the **Anaconda Minerals Co.** in 1985, produced from two Nevada operations in 1987. Because of their unique ion-exchange properties, zeolites have excellent potential in the growing absorbant market. However, competition with synthetic zeolites and the small size of most producers has slowed market expansion for natural zeolites.

At its Ash Meadows plant, near Armargosa Valley, Nye County, East West processes clinoptilolite trucked from a deposit in California. Plant capacity is 8,000 tons/year. The ore, said to have the highest clinoptilolite content of any commercial deposit worldwide, is screened to eight different product sizes. Most sales are to the aquaculture and agriculture industries. Other uses are in sewage and wastewater treatment, where clinoptilolite is particularly valuable because it is an effective absorbant for ammonia and heavy metal cations, such as lead.

At the Eastgate plant in Churchill County 60 miles east of Fallon, East West initiated production of mordenite in 1987. This plant has an annual capacity of 30,000 tons/year; however, production has been discontinued pending installation of drying equipment. The company is said to be looking for financial assistance for this project. Plant feed consists of altered Pliocene tuff containing some clinoptilolite as well as mordenite. Mordenite is mainly used in cat litter, and as an oil and grease absorbant.

Oil and Gas

by Becky S. Weimer



Blair Exploration, Inc. Federal White Pine No. 1, 1987. *Scott McDaniel photo.*

EXPLORATION

During 1987, 17 wells totalling 94,296 feet were drilled in the search for oil and gas in Nevada. This footage is an 8 percent decrease from 102,469 feet drilled in 1986. The average depth of the wells drilled was 5,547 feet, an increase from an average depth of 5,123 feet in 1986. One or two drill rigs were usually active at any given time in Nevada throughout 1987.

Blair Exploration drilled the deepest (11,090 feet) well, the **White Pine No. 1** in NE¼SE¼ sec. 17, T18N, R59E, White Pine County. Traces of oil were recorded from 3,350 to 4,480 feet, and numerous shows were reported from 5,200 to 7,700 feet.

Several other wells had shows of oil during 1987 drilling. The **Amoco Production Co. Blackburn No. 17** well, drilled to a depth of 7,392 feet in SW¼NE¼ sec. 7, T27N, R52E in Eureka County, had shows at 6,340 to 6,360 feet in the Miocene Humboldt Formation, and at 6,990 to 7,030 feet in the Oligocene Indian Well Formation.

The **David M. Evans Mary Kay No. 1** well was drilled as a stepout from the Blackburn field in Eureka County. It is located in SE¼NW¼ sec. 7, T27N, R52E, just ¼-mile west of the producing Blackburn No. 16 well (completed in 1985 with an initial pumping potential of over 1,300 barrels of oil per day from the Devonian Nevada Formation) and ¾-mile northwest of the Blackburn No. 14 well (also completed in 1985 and flowing around 900 barrels of oil per day from 6,950 to 7,024 feet in the Nevada Formation). The Mary Kay No. 1 had numerous shows of oil from 5,100 to 6,900 feet in the Miocene Humboldt and Oligocene Indian Well Formations.

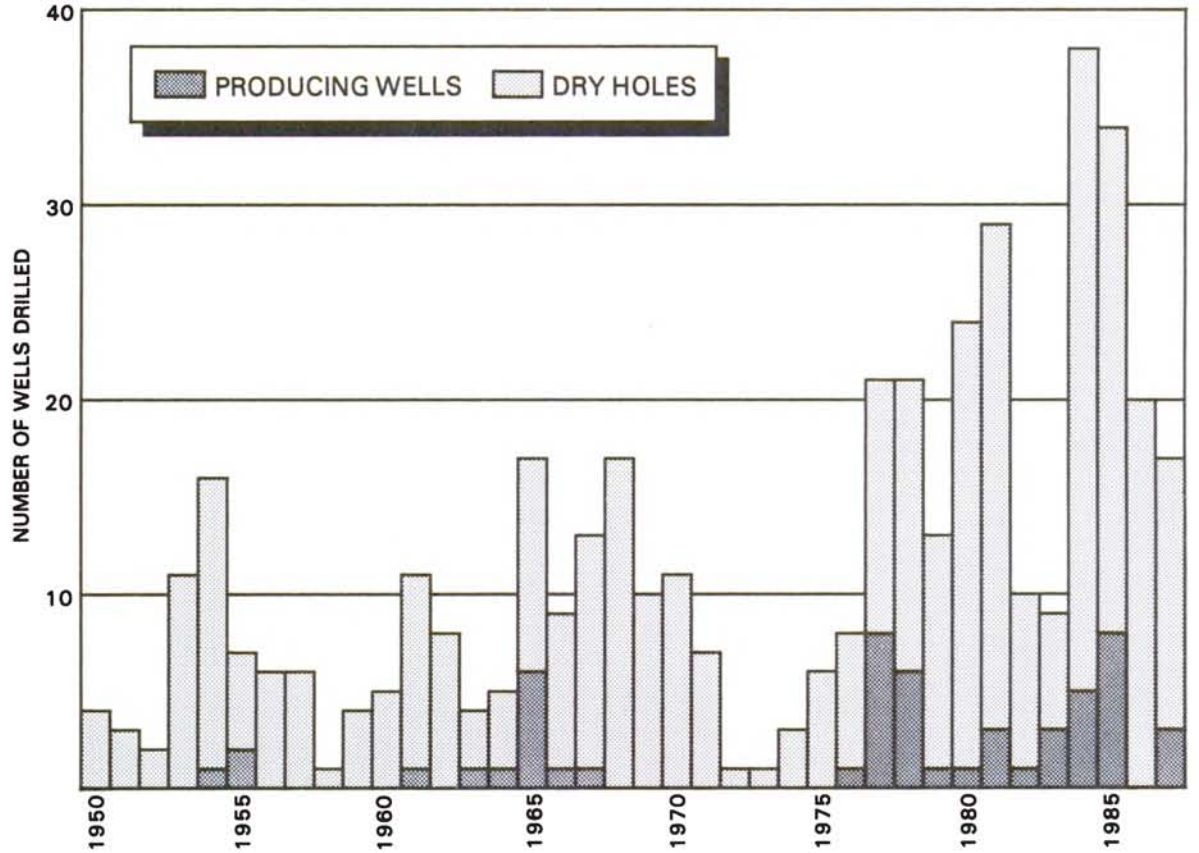
Dixie Operating Co. and Foreland Corp. drilled the **Foreland-Willow Creek No. 1-34** in NE¼SW¼ sec. 34, T29N, R52E in Eureka County in 1987, but it stands temporarily suspended at a depth of about 10,100 feet. All records are still confidential, but it is reported that Foreland will try to put this well into production in 1988. Production casing was run and testing in the Mississippian was completed in October 1987.

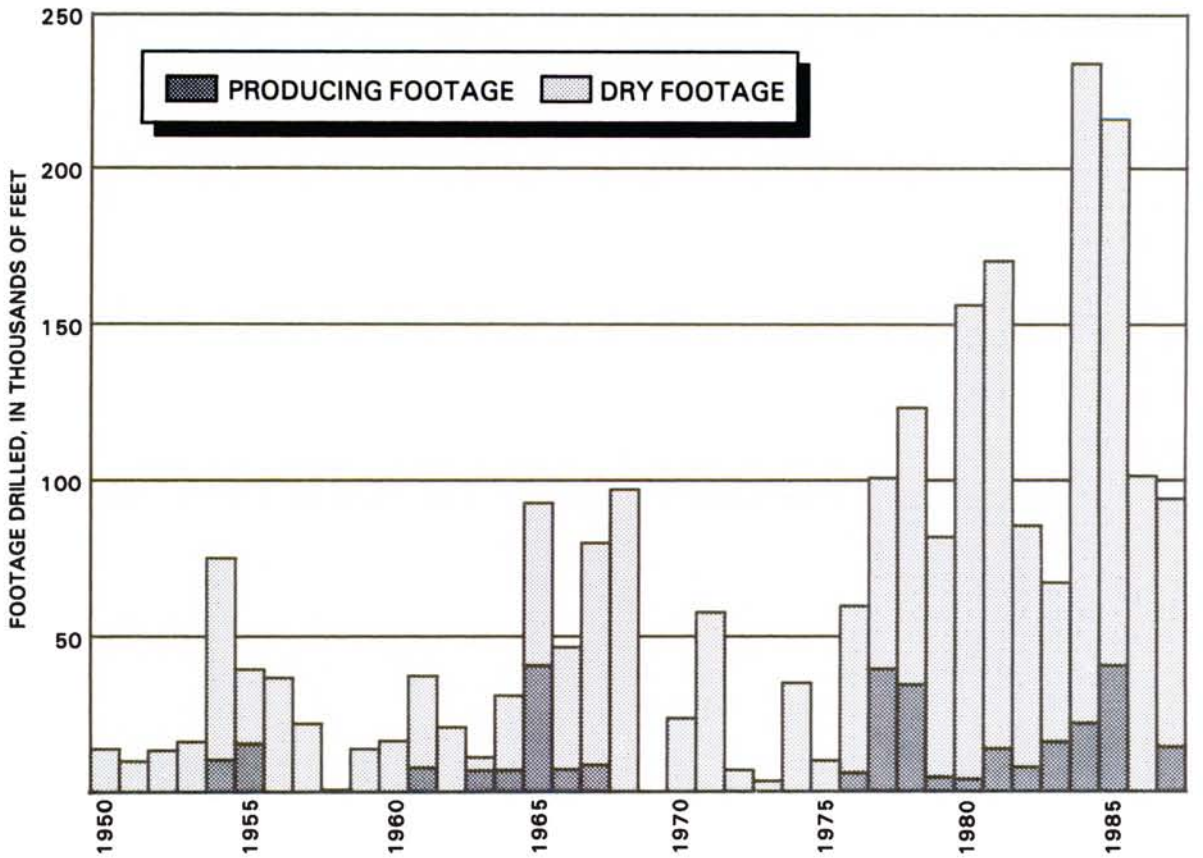
The total Nevada acreage under competitive oil and gas leases stayed the same at 2,071 acres (20 leases) from fiscal 1986 to 1987. The acreage under noncompetitive (including over-the-counter and simultaneous) leases decreased 28 percent from 8,311,547 acres (4,069 leases) in 1986 to 5,989,490 acres (2,830 leases) in 1987.

LEGISLATION

Lease rental rates remained at $1.00 per acre in 1987 in response to President Reagan's instruction to reduce the burden on domestic oil production. These rates will increase to a minimum of $1.50 per acre in 1988 and to $2.00 per acre in 1993 under the new provisions set forth in the **Federal Onshore Oil and Gas Leasing Reform Act of 1987**, part of

Digitized by Google





Oil wells drilled in Nevada.

Digitized by Google

Congress' Budget Reconciliation legislation enacted on December 22, 1987.

Two immediate effects of this legislation were the suspension of processing of lease applications received on or after December 22, 1987, and the discontinuance of the simultaneous leasing program or "lottery". Applications submitted prior to December 22 would be processed under the old regulations.

Congress has mandated that the BLM prepare, present for public comment, and finalize new regulations to impliment a modified onshore oil and gas leasing program by June 20, 1988. Six test lease sales will be held throughout the U.S. in this 180-day period.

This new legislation has effected major changes in the oil and gas leasing program. All lands will now be available competitively through an oral-bidding lease sale process. Along with this, determinations of Known Geologic Structures (KGS) have been eliminated.

Lease sales will be held at least quarterly for each state where lands are available. Notice of a lease sale and lands to be offered will be posted at least 45 days prior to the auction by both the BLM and the Surface Managing Agency. Leases and assignments will be issued/approved within 60 days. After the competitive sale process is finished, the unsold parcels will be available for noncompetitive, over-the-counter leasing for a period of 2 years, after which they must again be offered competitively.

The minimum acceptable bid is set at $2.00/acre for the next two years, thereafter it may be raised by the Secretary of the Interior. This eliminates the system for determining the economic value of the tract to determine the minimum bid.

The maximum lease size is set at 2,560 acres in all states except Alaska. Under the old regulations, the maximum competitive lease size was 640 acres, and the maximum noncompetitive lease size was 10,240 acres. The minimum lease rental rate is $1.50/acre/year for the first 5 years, and $2.00/acre/year thereafter. The length of lease remains the same at 5 years for competitive leases and 10 years for noncompetitive leases. The minimum royalty rate remains at 12.5 percent.

Applications for permit to drill (APD) must be publicly posted in the issuing BLM office and the Surface Managing Agency's office for 30 days prior to approval. This time frame may restrict the flexibility the BLM has had in the past to accommodate companies with rental commitments for expensive on-site drilling equipment.

Drilling lease bonds remain the same. Left out of the new legislation was a land-use provision that the BLM decide in advance which lands were suitable or not suitable for oil and gas leasing, but leases will not be issued or approved to parties who have failed to properly reclaim other leases. The Secretaries of Agriculture and the Interior will establish the standards for the reclamation bonds. No National Forest lands or lands under study or recommended for wilderness may be leased.

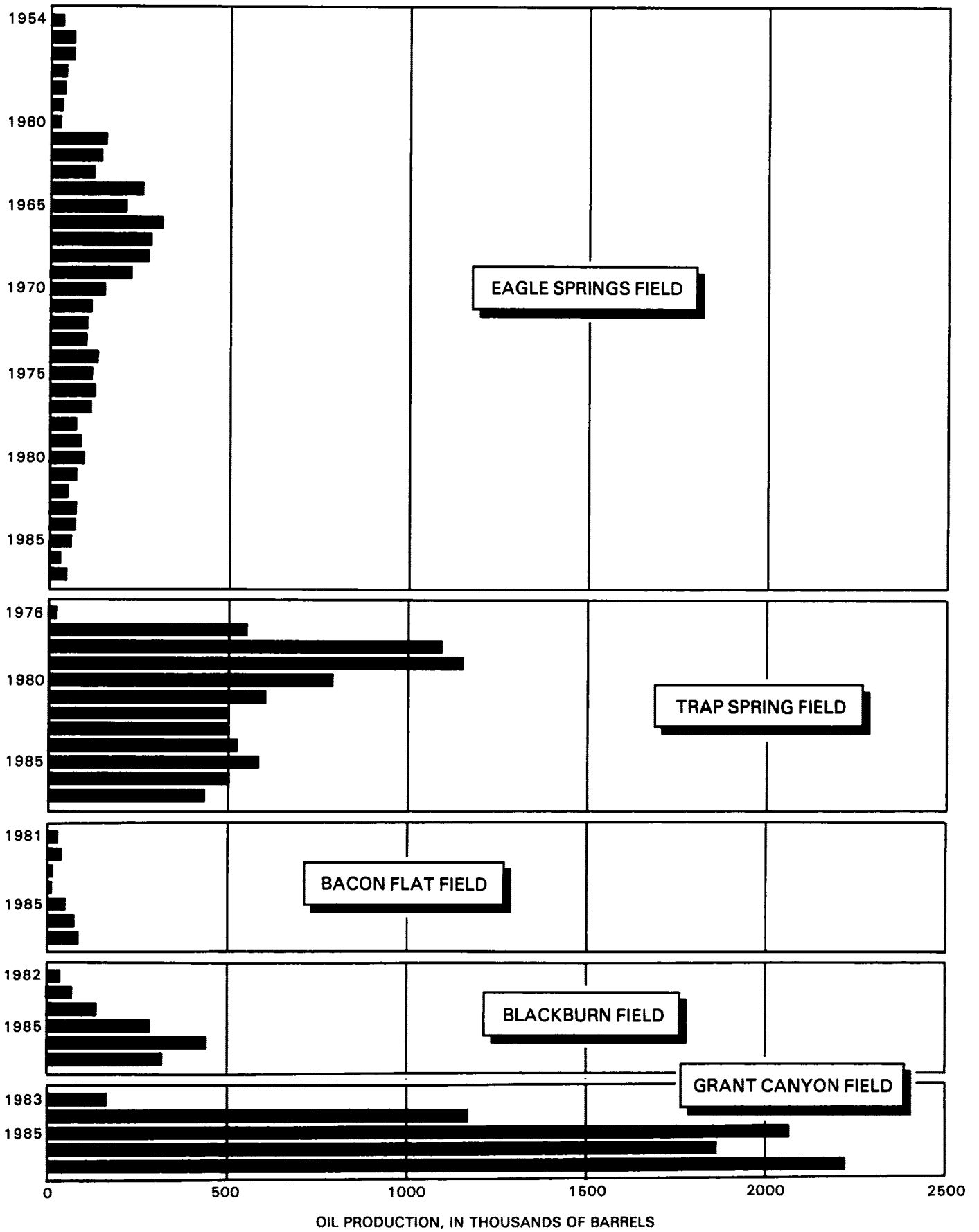
PLANS FOR 1988

Near the end of 1987, several companies had revealed their drilling plans for the coming year. **Exxon Co. USA** will be implementing Phase I of their Pinon Development Contract under which they will begin to explore some 638,000 acres in Elko, Eureka, and White Pine Counties for a period up to 10 years. The contract was approved by the BLM in late 1986. The first well to be drilled is the **Aspen No. 1** in SE¼NE¼ sec. 21, T28N, R54E in Elko County. The proposed depth is 13,000 feet.

In December, the Development Contract for the Bristlecone Area in Eureka, White Pine, and Elko Counties was approved for the **Anschutz Corp**. No further details are available.

OIL AND GAS WELLS DRILLED AND COMPLETED DURING 1987

County	Company	Well	Permit no.	Depth (feet)
Clark	Ruby Drilling Co., Inc.	Thomas Gap J.P. Fed. No. 1	479	2,030
Clark	Ruby Drilling Co., Inc.	Thomas Gap Fed. No. JP-1A	485	1,400(?)
Elko	Quintana Petroleum Corp.	Magnesun Fee No. 1-21	489	1,861
Eureka	Amoco Production Co.	Blackburn No. 17	491	7,392
Eureka	Dixie Operating Co.	Foreland-S.P. Land Co. No. 1-5	492	5,782
Eureka	Dixie Operating Co.	Foreland-North Blackburn No. 1-34	494	9,341
Eureka	Dixie Operating Co.	Foreland-Pony Creek No. 1-22	495	8,500
Eureka	David Evans	Mary Kay No. 1	488	7,505
Lincoln	Amoco Production Co.	Saguaro No. 1	484	6,930
Lincoln	Foreland Corp.	Cave Valley Wash No. 1-28	496	3,909
Nye	Apache Corp.	South Grant Fed. No. 11-32	498	4,681(?)
Nye	David M. Evans	Taylor No. 1	497	4,732
Nye	Makoil, Inc.	Munson Ranch No. 14-32	455	3,850
Nye	Pioneer Oil & Gas	Willow Springs No. 1-31-33	481	6,071
Nye	Pioneer Oil & Gas	Lone Tree No. 1-14-43	482	4,703
Nye	Pioneer Oil & Gas	Lone Tree No. 2-23-23	483	4,519
White Pine	Blair Exploration	White Pine No. 1	486	11,090
			Total	94,296



Production of Nevada's major oil fields; Kate Spring and Tomera Ranch production is too small to show in this bar graph.

PRODUCTION OF NEVADA'S OIL FIELDS[1]
(barrels)

Period	Eagle Springs (1954)[2]	Trap Spring (1976)	Currant (1979)	Bacon Flat (1981)	Blackburn (1982)	Grant Canyon (1983)	Kate Spring (1986)	Tomera Ranch (1987)	Total	Change
thru 1984	3,721,833	5,710,219	641	89,064	238,074	1,331,900	–	–	11,091,371	
1985	58,807	582,822	0	47,942	284,013	2,065,747	–	–	3,039,564	+59%
1986	28,408	498,996	0	72,643	441,163	1,862,784	1,521	–	2,905,515	– 4%
1987	45,821	432,690	0	84,156	318,553	2,221,642	5,494	1,032	3,109,388	+ 7%
TOTAL	3,854,869	7,224,727	641	293,805	1,281,803	7,482,073	7,015	1,032	20,145,965	

[1]Compiled by Nevada Department of Minerals.
[2]Field discovery date.

Finally, **BTA Oil Producers** of Midland, Texas planned to drill an offset to the Bacon Flat field in Railroad Valley. The Bacon Flat No. 1 well was completed as a producer by Northwest Exploration in 1981. Initial production was 270 barrels of oil per day from a probable Devonian interval between 5,316 and 5,354 feet.

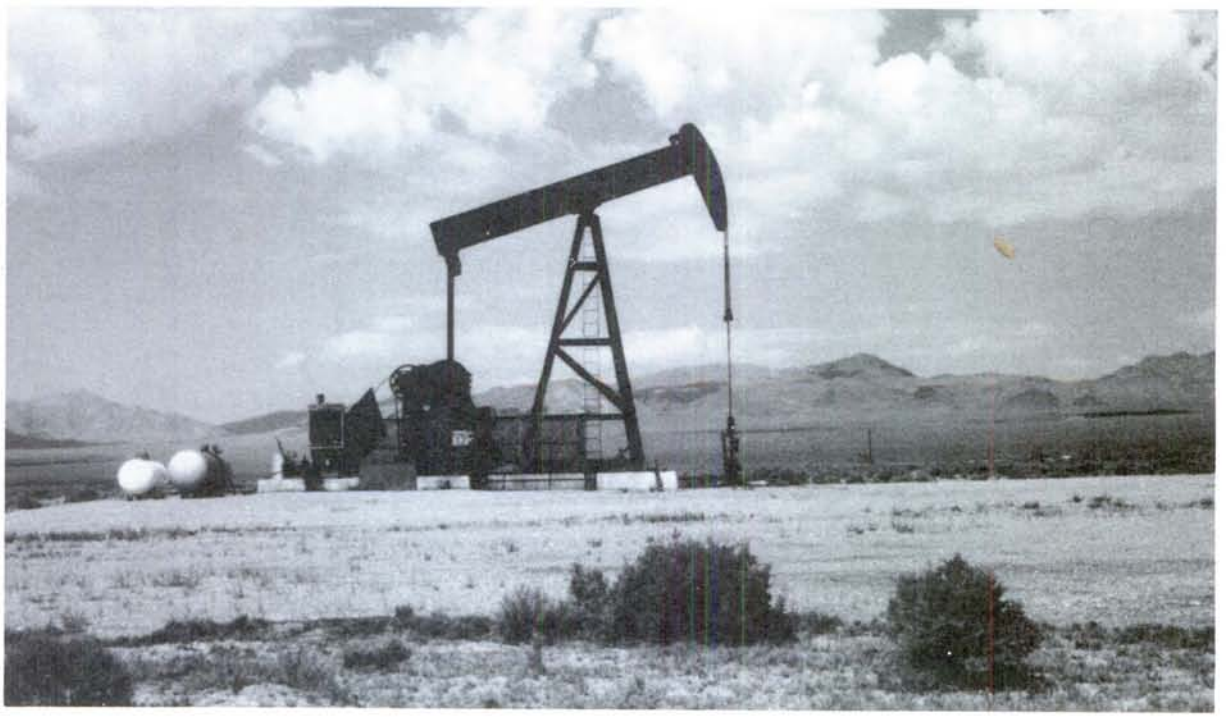
PRODUCTION

Low oil and gas prices, lack of capital, and the continual reshaping of the petroleum industry were the key factors in the decline of well completions nationwide in 1987, according to the Oil and Gas Journal (v. 85, no. 4, p. 56–63).

According to the American Petroleum Institute, petroleum imports from Arab members of OPEC were averaging 1,445,000 barrels per day in November 1987, compared to 305,000 barrels per day in January 1985. This increase is due in part to a reorganization and expansion plan by OPEC members, particularly the Saudis, to seek marketing and refining operations abroad, particularly in the U.S. and western Europe, which they hope will result in a fully integrated operation for the Saudi oil industry.

OPEC production remained over quota at 18.3 million barrels a day in December 1987, eroding prices here in the U.S. (Petroleum Information, v. 61, no. 42). Nevada well-head prices averaged $9.00 per barrel in 1987.

In Nevada, several companies continued to suspend production on their leases in Railroad Valley, taking advantage of President Reagan's 1986 initiative to lessen the burden on domestic oil production. Under this 1986 policy which is authorized by the Mineral Leasing Act of 1920, any oil and gas lease with wells on federal land may opt to suspend production temporarily, rather than prematurely abandon the lease because of poor domestic oil prices. The purpose of this policy is to preserve our



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

Digitized by Google

Nevada Refining Company plant at Tonopah. *Nevada Department of Minerals photo.*

domestic oil and gas reserves and provide for the collection of royalties and taxes on these leases in the future.

Out of 49 wells capable of producing within the state in 1987, only 36 were active. Makoil, Inc. (which had in November taken over production of the Munson Ranch wells formerly operated by Western Avenue Properties and the Zuspann wells formerly operated by Troy Oil), Marathon Oil Co., and Apache Corp. suspended production on various leases in the Trap Spring field beginning as early as June 1986 and effective through May 31, 1989, unless production becomes economically feasible before that time. Similarly, John A. Lyddon, Operator suspended production on all of its producing wells in the Eagle Springs field on October 1, 1986 and effective through May 31, 1989.

On the positive side, three new wells were put into production, and another new field was discovered in 1987, resulting in 36 wells actively producing in 7 fields in Nevada during the year. The Currant No. 1 well, the only producing well in the Currant field, was plugged and abandoned in April 1986.

The total net oil production in the state in 1987 was 3,109,388 barrels, a record production figure for Nevada. According to the Nevada Department of Minerals, this was a 353 percent increase in production over 1980, when production totalled 881,000 barrels. During that seven-year period, a total of 172 exploration wells were drilled with 26 wells becoming producers, a 15 percent success rate, which is higher than the national average of 10 percent (Nevada Department of Minerals figures).

No gas is produced in Nevada, and all of the oil is transported by tank truck to two refineries within Nevada (Petro Source, Inc's. 5,000 barrel-per-day plant at Currant in Railroad Valley, and Nevada Refining Company's 5,000 barrel-per-day plant at Tonopah) or outside the state at Petrosource's Salt Lake City, Utah or Fredonia, Arizona operations. The major products refined from Nevada's crude oil are No. 1 and No. 2 diesel, kerosene, stove oil, asphalt, and bottom oil.

Late in 1987, the **Grant Canyon field** (discovered in 1983) surpassed the Trap Spring field (discovered in 1976) as Nevada's largest producer. Both fields were discovered by Northwest Exploration Company and are now operated by Apache Corp. In November and December of 1987, the two producing wells in the Grant Canyon field, the **Grant Canyon No. 3** and **No. 4**, were producing a combined average of over 6,000 barrels of oil daily, or about 70 percent of Nevada's total production. The Grant Canyon No. 3 well is believed to be the largest onshore flowing well in the lower 48 states, producing over 2,000 barrels of oil per day since being put into production in September 1984. The most recent 1987 daily production on the No. 3 well varied from 3,000 to more than 4,000 barrels.

NEW PRODUCERS IN 1987

Nevada's first new producer of 1987 was the **Makoil, Inc. Munson Ranch No. 14-32** (originally permitted by Western Avenue Properties) in SW¼NE¼ sec. 14, T9N, R56E in Nye County's Trap Spring field. It was completed to a total depth of 3,850 feet in September, and began production in October. It is producing 200+ barrels of oil per day from a zone 3,640 to 3,850 feet deep, and is the fourteenth consecutive producer drilled by Makoil and its predecessor, Western Avenue Properties, in

Digitized by Google

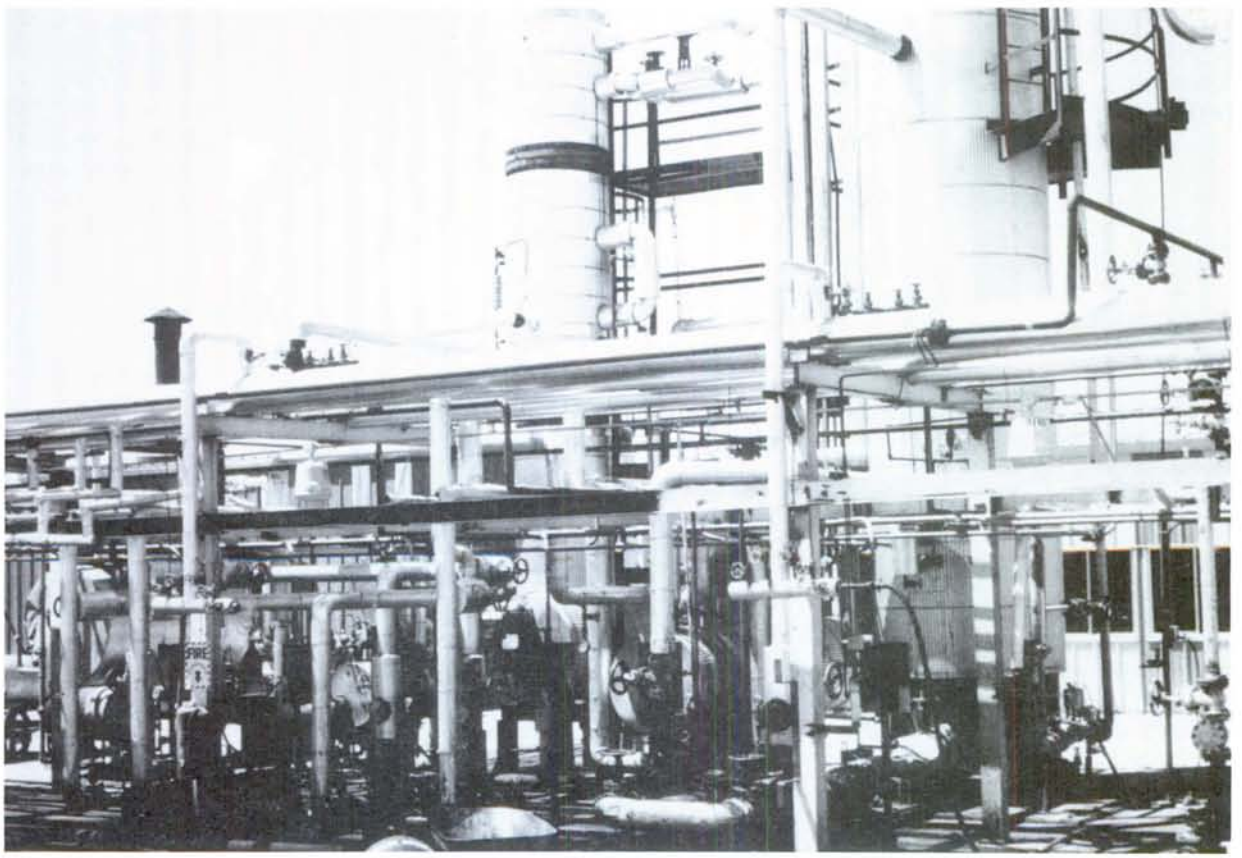
the Munson Ranch unit in the Trap Spring field during the past five years.

The second new producer was the **David M. Evans Taylor Federal No. 1** well located in SE¼NE¼SE¼ sec. 3, T8N, R57E in Nye County's Kate Spring field. It was completed to a total depth of 4,732 feet in October and began production in November. It was completed for an initial flowing potential of 960 barrels of 10°–12° API gravity oil per day from the Devonian Guilmette dolomite through perforations at 4,623 to 4,643 feet. Located on a structural high, a stair-stepping range-front fault block, the well was drilled directly into Paleozoic rocks with no overlying Tertiary volcanics, the same geologic conditions as occur in the Grant Canyon field about 8 miles to the south-southwest. The well presently produces about 90 barrels of 56°F pourpoint oil per day, along with a little gas.

The Taylor No. 1 was drilled as an offset to Marathon's Kate Spring No. 1 well, the only other well in the field so far, which has been shut-in since October 1986. This well initially produced 345 barrels of 10.5° API gravity oil and 1,371 barrels of water per day from the Pennsylvanian Ely Limestone between 4,722 and 4,824 feet. A fault apparently separates the two wells (Petroleum Information, v. 60, no. 46).

The **Dixie Operating Co. Foreland-Southern Pacific No. 1-5** well became Nevada's third new producer in 1987, and the first producing well to be located on state land in Nevada. Drilled in NE¼NE¼ sec. 5, T30N, R52E in Eureka County, this well establishes Nevada's seventh field, the **Tomera Ranch field**, the second to be discovered outside of Railroad Valley. The well was completed in August to a total depth of 5,782 feet, and began production in December with a total of 1,032 barrels. It is Nevada's shallowest producing well, pumping about 85 barrels of 30° API gravity oil per day from the Tertiary Indian Well Formation (volcanic tuff) at about 1,800 feet. Shows were also found in the Mississippian Chainman and the Devonian Nevada Formations. The Blackburn field, 19 miles to the south, produces from all three of these formations.

The No. 1-5 was the first in a series of four wells drilled by Dixie Operating Co., Alford Oil Corp., and Foreland Corp. in 1987. Their drilling program encompasses a 18-mile north-south trend situated north-northeast of the Blackburn field. The second wildcat drilled in the program was the **Foreland-Willow Creek No. 1-34** in NE¼SW¼ sec. 34, T29N, R52E. It was drilled to a depth of about 10,000 feet in October and temporarily suspended. Good shows were reported, and it is planned to make this well a producer in 1988. The third well in the program was the **Foreland-North Blackburn No. 1-34** in NE¼SW¼NE¼ sec. 34, T28N, R52E and drilled to a depth of 9,341 feet in September. No shows were



Tonopah refinery (Nevada Refining Company). *Nevada Department of Minerals photo.*

Digitized by Google

FEDERAL OIL AND GAS LEASES IN EFFECT IN FISCAL YEARS 1986 AND 1987

County	NUMBER OF LEASES								ACREAGE							
	Competitive		Noncompetitive		Over-the-counter		Simultaneous		Competitive		Noncompetitive		Over-the-counter		Simultaneous	
	FY86	FY87	FY86	FY87	FY86	FY87	FY86	FY87	FY86	FY87	FY86	FY87	FY86	FY87	FY86	FY87
Carson City	0	0	0	–	–	0	–	0	0	0	0	–	–	0	–	0
Churchill	0	0	284	–	–	77	–	16	0	0	484,105	–	–	185,143	–	38,594
Clark	0	0	107	–	–	75	–	70	0	0	248,133	–	–	132,730	–	115,725
Douglas	0	0	0	–	–	0	–	0	0	0	0	–	–	0	–	0
Elko	0	0	598	–	–	194	–	188	0	0	1,394,079	–	–	520,477	–	481,266
Esmeralda	0	0	0	–	–	1	–	0	0	0	0	–	–	1,287	–	0
Eureka	0	0	523	–	–	169	–	185	0	0	1,151,515	–	–	398,317	–	498,162
Humboldt	0	0	29	–	–	16	–	0	0	0	37,883	–	–	10,502	–	0
Lander	0	0	53	–	–	8	–	7	0	0	95,442	–	–	16,086	–	9,817
Lincoln	0	0	518	–	–	234	–	107	0	0	1,244,675	–	–	550,265	–	277,859
Lyon	0	0	0	–	–	0	–	0	0	0	0	–	–	0	–	0
Mineral	0	0	10	–	–	0	–	0	0	0	30,615	–	–	0	–	0
Nye	20	20	1,050	–	–	293	–	563	2,071	2,071	1,764,802	–	–	556,606	–	790,206
Pershing	0	0	29	–	–	22	–	2	0	0	67,719	–	–	47,068	–	13,438
Storey	0	0	0	–	–	0	–	0	0	0	0	–	–	0	–	0
Washoe	0	0	55	–	–	1	–	0	0	0	14,655	–	–	1,040	–	0
White Pine	0	0	813	–	–	183	–	419	0	0	1,777,921	–	–	374,962	–	969,934
TOTAL	20	20	4,069	–	–	1,273	–	1,557	2,071	2,071	8,311,546	–	–	2,794,486	–	3,195,001

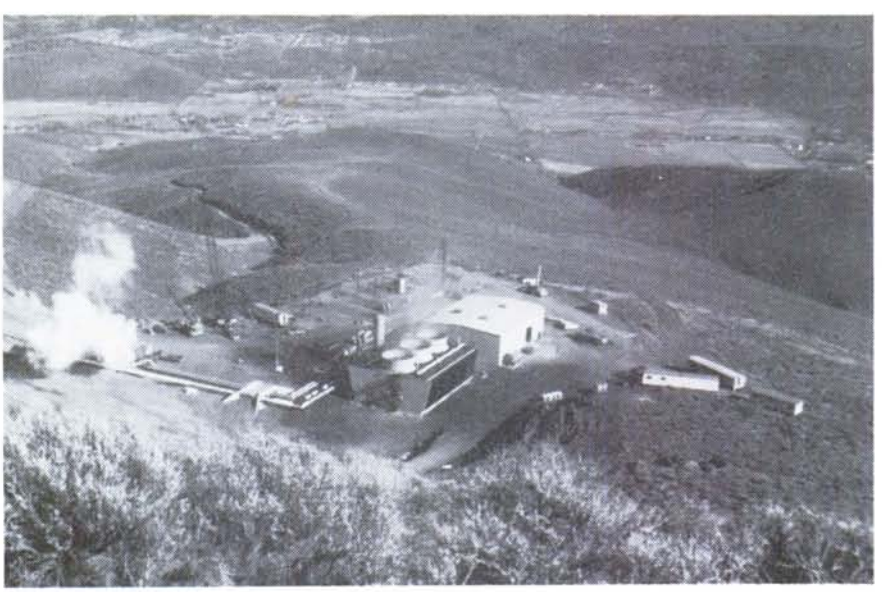
Data from the U.S. Bureau of Land Management.
FY86 = Oct. 1985–Sept. 1986; FY87 = Oct. 1986–Sept. 1987.

reported. The **Foreland-Pony Creek No. 1-22** in SW¼NE¼ sec. 22, T28N, R52E was the fourth well to be drilled in the program. A depth of 8,500 feet was reached in December, and no shows were reported. A fifth well by the same group was spudded in December and reached a depth of 8,400+ feet by the end of 1987. The **Foreland-Southern Pacific No. 1-27** in NW¼SE¼ sec. 27, T29N, R52E—midway between the Blackburn and Tomera Ranch fields—swabbed 403 barrels of 30° API gravity oil per day from 5,800 to 6,400 feet in the Oligocene Indian Well and Mississippian Chainman Formations (Petroleum Information, v. 61, no. 38). More wells are planned in this series for 1988.

OTHER NEWS

The Nevada Petroleum Society, originated in Reno, Nevada in February 1986, officially became a part of the Rocky Mountain Section of the American Association of Petroleum Geologists in September 1987. It currently has a membership of about 65 and holds meetings the third Thursday of every month in Reno. For more information, call Ellis Hammett at (702) 784-5136 or write him at the U.S. Bureau of Land Management, 850 Harvard Way, Reno, NV 89520.

The Nevada Bureau of Mines and Geology is publishing a new bulletin on oil and gas developments in Nevada through December 1986 to be released in Fall 1988.

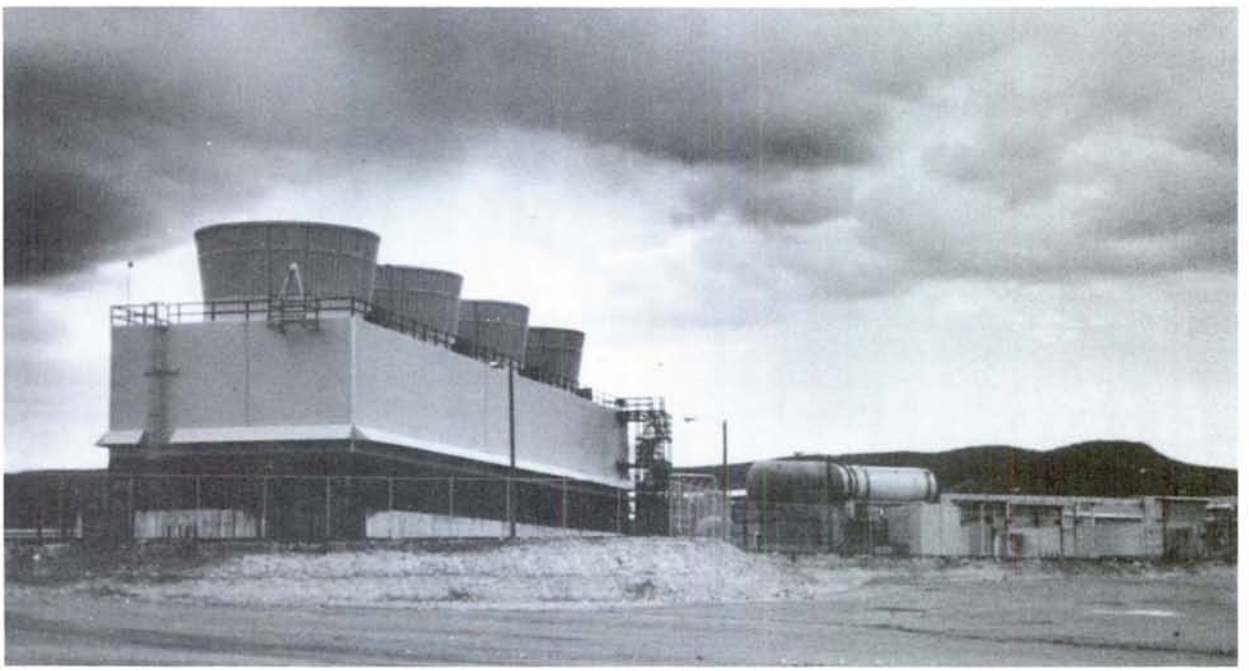


Yankee/Caithness geothermal power plant, Steamboat Springs, Washoe County. *David N. Anderson photo.*

Digitized by Google

Geothermal Energy

by Keryl L. Fleming and Larry J. Garside



Chevron Geothermal Company Beowawe generating plant. *H. F. Bonham, Jr. photo.*

Fifty-one geothermal well permits were issued by the Nevada Department of Minerals during 1987: 25 industrial class, 6 commercial class, 8 domestic class, and 12 unclassified. The unclassified group consisted of observation and thermal gradient wells. As of the end of August 1987, there were 163 non-competitive geothermal leases totaling 268,903 acres, and 39 competitive geothermal leases totaling 72,148 acres. This total of 341,051 acres is a decrease of nearly 300,000 acres leased since 1980, reflecting the fact that industry interest has concentrated on proven development areas (BLM Nevada Progress Report, 1987).

Five industrial-class geothermal production wells were drilled in 1987 with a total footage of over 10,000 feet, 15 percent of the total footage drilled for production wells in 1986 and less than any year since 1977. This considerable decrease is a result of the development of shallower resources and the utilization in new power plants of wells drilled in previous years. Most of the drilling took place in the Steamboat Hot Springs area of Washoe County. The exact footage is unknown due to confidentiality requirements on information submitted for state regulatory purposes. This list does not include industrial-class injection wells.

Nevada had nearly 30 megawatts (MW) of net geothermal generating capacity on line during most of 1987. These operating facilities include: Chevron's 9 MW Desert Peak (Churchill County) and 14 MW Beowawe (Eureka County) facilities, Ormat Energy System's 5.5 MW facility at Steamboat Hot Springs (Washoe County), and Tad's Enterprises 1.2 MW facility at Wabuska (Lyon County). Ormat brought its San Emidio facility on line in late 1987 at 2.6 MW, and the Ormat Soda Lake plant also began production late in the year (about 3.5 MW), bringing the total Nevada net geothermal generating capacity to about 35.8 MW by the end of the year.

The annual meeting of the **Geothermal Resources Council** was held in Reno in October; sessions held covered many aspects of the geothermal industry. A number of Nevada projects were described at the meeting, and several Nevada articles of interest were published in the transactions.

In late July 1987, the **Nevada Public Service Commission** reduced the price that **Sierra Pacific Power Co.** must pay for future electricity from independent producers who generate power from alternative power sources such as geothermal, hydroelectric, trash burning, and cogeneration. The Public Utilities Regulatory Policies Act (PURPA), enacted in 1978 to promote energy conservation and efficiency, requires Sierra Pacific to purchase electricity from such non-utility, independent producers. Nevada's non-utility producers are geothermal generating facilities. Under a 1986 Nevada Public Service Commission decision, the rate for the non-utility qualifying facilities (QF) was set at 6.3 cents per kilowatt-hour, with a maximum of 35 MW to be purchased at that price. In the July 1987 decision, the Nevada Public Service Commission established a lower price

Digitized by Google

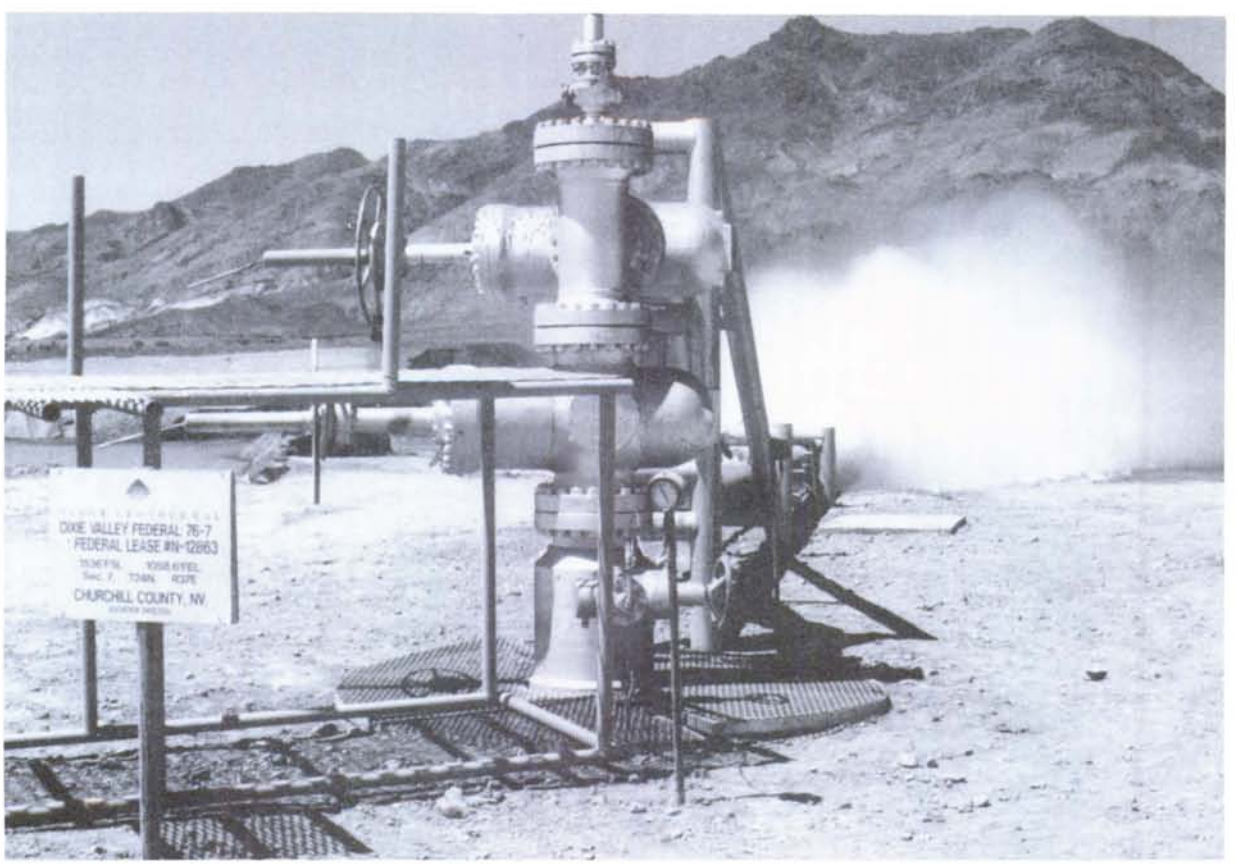
for QF producers on line by the end of 1990. Sierra Pacific was also ordered to increase its purchases to 85 MW of this QF power before that time. Of that amount, no more than 35 MW will be purchased at the 6.3 cent rate and the remainder will be purchased at or below the 5.2 cent rate. Sierra Pacific estimates that it will purchase 292,000 megawatt-hours of electricity from QF producers in 1988 (Energy Line, Sierra Pacific Power Co. Newsletter, Oct. 1987). Sierra Pacific has reported that its gross winter peak demand for electricity in 1986 was 739 MW. Thus, the QF electricity is about 5 percent of peak demand now and could increase to about 10 percent by 1991.

U.S. Senator (Nevada) **Chic Hecht** sponsored legislation in May 1987 to amend the Geothermal Steam Act of 1970 to make it easier for companies to acquire and retain geothermal leases from the federal government. A similiar bill was introduced in the House of Representatives (HR 2794) by **Robert Matsui** (California). The bill proposed extensions beyond the 10-year primary lease period if lease holders live up to the diligence requirements of the U.S. Department of Interior. The purpose of the legislation is to allow more time for lease holders to make power-sale agreements, or to do exploration or development, in a period of time when electricity demand has not been increasing, and few markets are available for the power. The bill was stalled in committee and was not be considered until 1988 (Regional Geothermal Progress Monitor, July–Sept. and Oct.–Dec. 1988; Pay Dirt, July 1987).

The **U.S. Naval Facilities Engineering Command** is "exploring solicitation of a new expression of interest" for developing the geothermal field and electrical production at the Fallon Air Station (Churchill County) following withdrawal of its contractor there last year. **Helioscience General** abandoned its effort to develop the Fallon resource of up to 75 MW after winning a contract three years ago, apparently after failing to come up with third-party financing. The Navy reports that third-party financing would have to be utilized by the contractor, because they have no funds for geothermal development. The Fallon Air Station has only a small (3 MW) requirement, and the surplus geothermal power would be delivered to and sold by a federal entity, the Western Area Power Administration. The only reservoir assessment at Fallon since the contract with Helioscience was a recent geothermal gradient well drilled by the Navy with U.S. Department of Energy assistance. (Regional Geothermal Progress Monitor, Feb. 1987)

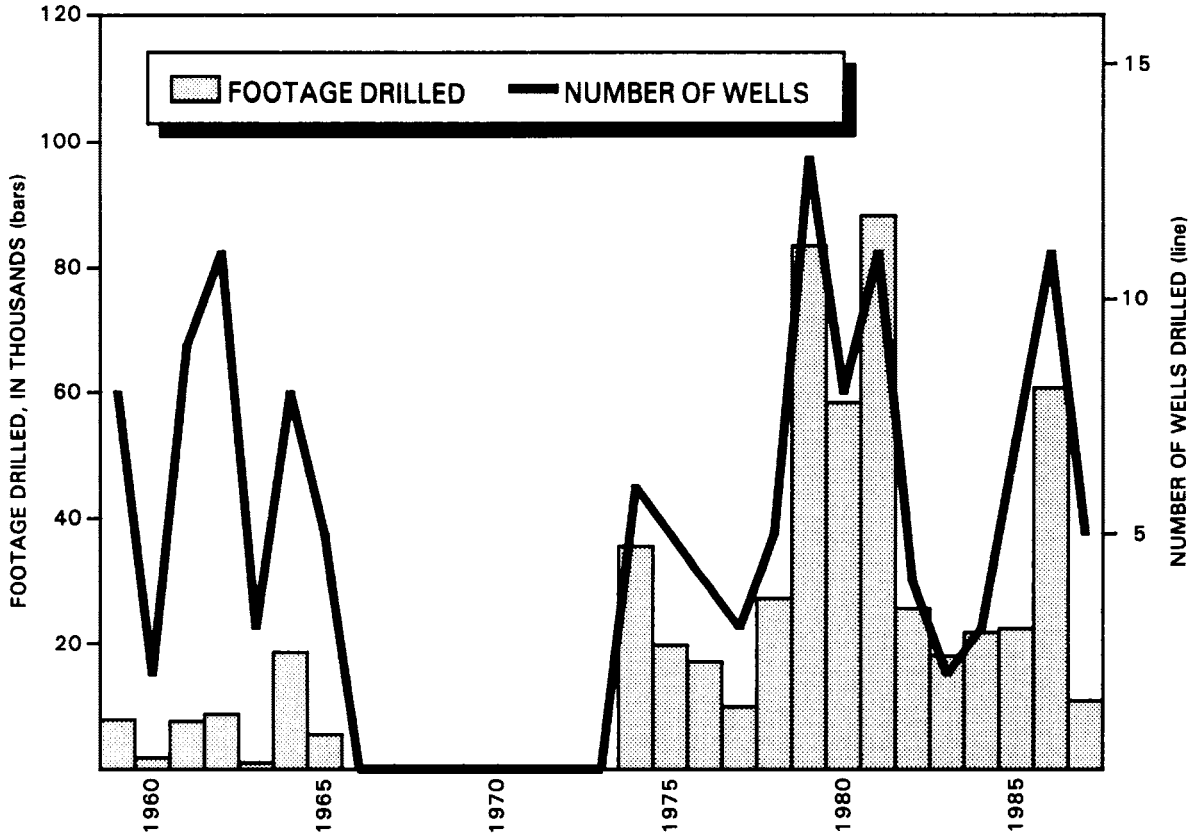
The **Stanton Drive Elementary School** of the Carson City School District will be heated by geothermal resources and will be a state energy pilot project. Design Concepts West of Carson City was selected to design the school. (Regional Geothermal Progress Monitor, May-June 1987)

In May 1987, **Oxbow Geothermal Co.** of Reno began construction of its first geothermal power



Oxbow Geothermal Corporation Dixie Valley No. 76-7. *Nevada Department of Minerals photo.*

Digitized by Google



Industrial-class geothermal wells drilled in Nevada.

plant, with Ebasco Services, Inc. of New York City as the prime contractor. The 55 MW (net) double flash turbine/generator unit will be located in Dixie Valley, Churchill County. Power will be sold to Southern California Edison Co. through a 214-mile power line that will run from Dixie Valley to Bishop, California. The project is not expected to be on-line until September 1988. Total plant and transmission line cost is estimated at $170 million. (Geothermal Hot Line, v. 17, no. 1)

Chevron Resources and **Yankee/Caithness** received final approval from the BLM in midyear and began construction of the first of two 12.5 MW modular single flash geothermal electric plants at Steamboat Hot Springs. Approval was subject to 29 permit conditions, including the monitoring of possible contamination of local water supplies (Reno Gazette-Journal, July 9, 1987). Although located on private ground, the project area is within a Federal Geothermal Unit and therefore subject to BLM approval (Regional Geothermal Progress Monitor, March 1987). Construction of the $30 million facility by Geothermal Power Co. of New York was nearly completed by the end of the year. The unit will operate on production from three wells, water will be disposed of in an injection well. Turbine-inlet temperature is calculated to be 298° at 65 psia. The producing horizon is approximately ±2,300 feet. According to the Nevada Department of Minerals, Chevron Resources sold out before year-end to Yankee Power, Inc., Caithness Steam Co., and Sequa Geothermal Corp. Caithness Power, Inc. assumed responsibility as well field operator in October 1987. Power generated will be sold to Sierra Pacific Power Co.

In October 1987, **Ormat Energy Systems, Inc.** and **Chevron Resources** announced construction of a 3.6 MW (gross) geothermal power project in the Soda Lake KGRA in northern Nevada. The plant consists of three 1.2 MW Ormat Energy Converter modules. The project was placed in service in December 1987; electricity generated is sold under a 30-year power purchase agreement to Sierra Pacific Power Co. The plant was sold to two institutional investors but Ormat will continue to operate and maintain the project. (Geothermal Resources Council Bulletin, v. 16, no. 10)

Ormat Energy Systems purchased the rights to the geothermal resources of the **Empire Geothermal Project** in the San Emidio Desert KGRA, 10 miles south of Gerlach, Nevada. A power purchase agreement with Sierra Pacific Power Co. was also acquired. The 4.8 MW (gross) facility, consisting of four 1.2 MW Ormat Energy Converter modules, was constructed and placed in service by December 1987. Ormat has applied for another power purchase agreement with Sierra Pacific Power to increase power capacity to 10 MW (net). Two institutional investors have committed to purchasing the project upon completion. Ormat is responsible for developing the geothermal

GEOTHERMAL WELLS DRILLED IN NEVADA IN 1987

Company name	Well name	Proposed depth (ft)	Location	County
Industrial class:[1]				
Michael B. Stewart	Well #52-21	300	S21,T29N,R23E	Washoe
AMOR II Corp.	Well #42-21	600	S21,T29N,R23E	Washoe
Caithness Power, Inc.	Steamboat Hills 83A-6	2,910	S6,T17N,R20E	Washoe
Caithness Power, Inc.	Well #21-5	3,000	S5,T17N,R20E	Washoe
Western States Geothermal Co.	Well #32-5	4,000	S5,T17N,R20E	Washoe
Commercial class:[2]				
Round Mountain Gold Corp.	Well #62-36	1,000	S36,T10N,R43E	Nye
Round Mountain Gold Corp.	Well #34-25	600	S25,T10N,R43E	Nye
Round Mountain Gold Corp.	Well #36-25	600	S25,T10N,R43E	Nye
Florida Canyon Mining, Inc.[3]	Pegasus #1	580	S3,T31N,R33E	Humboldt
Florida Canyon Mining, Inc.[3]	Pegasus #5	570	S3,T31N,R33E	Humboldt

[1]power generating
[2]other non-domestic
[3]drilled in 1986, permitted in 1987

field and is the power plant supplier. (Geothermal Resources Council Bulletin, v. 16, no. 10)

One production well and four observation wells were drilled and completed in the **San Emidio Desert** during 1987 by **Michael B. Stewart**. AMOR II Corp., a subsidiary of Ormat, purchased the wells from Stewart in late 1987. (Nevada Department of Minerals)

Tad's Enterprises, in the **Wabuska KGRA**, doubled its capacity to 1.2 MW (net) by installing a second 600 KW (net) Ormat Energy Converter module. The unit will operate on geothermal fluids of 224°F from a depth of 350 feet. Cooling is accomplished by use of a cooling pond, which is also used to raise tropical fish. The second unit was placed on the Sierra Pacific Power grid on June 19, 1987. This is the first plant to come on line under the new rates set by the Nevada Public Service Commission. (Geothermal Resources Council Bulletin v. 16, no. 7)

Construction of a geothermal power plant at **Brady Hot Springs** by **Munson Geothermal** was suspended during 1987; Munson had negotiated a 10 MW contract with Sierra Pacific Power Co. (Geothermal Hot Line, v. 17, no. 1). Brady Hot Springs Geothermal Associates acquired a portion of the geothermal leases of Munson, and filed an application with the Public Service Commission of Nevada to construct a 6 MW (net) geothermal power generating plant at Brady Hot Springs. Electricity generated by the plant will be sold to Sierra Pacific Power Co. The successor to Munson retained the under-construction plant facility and some of the geothermal leases.

A DOE-funded study conducted by **UNLV Department of Earth Sciences** and **UNR Mackay School of Mines** evaluated the use of geothermal fluids to enhance gold and silver recovery in heap-leach mining operations. Ten operating mines were identified as having geothermal resources on or near the leaching operations. Recovery of precious metals in laboratory experiments was shown to increase from 17 to 40 percent when the heated geothermal solutions were applied in the cyanide leaching process. The use of heated solutions may also allow heap-leach activities to continue on a year-round basis, activities now subject to closure during the winter.

Geothermal Development Associates of Reno designed a well, pipeline, and heat exchange system at the **Round Mountain Gold Corp.** heap-leach operation at Round Mountain, Nevada. Geothermal fluids are pumped through the heat exchangers to warm the cyanide leaching solutions to 72°F. Well water flow rate is 650 gal/min at approximately 186°F. The geothermal fluids are re-injected after testing for potential process fluid contamination. (Geothermal Resources Council Bulletin v. 17 no. 5).

Geothermal fluids are also utilized to heat heap leach solutions at **Pegasus Gold Corporation's Florida Canyon Mine**, in the Humboldt House area (Rye Patch KGRA), Pershing County. The bottom-hole temperature of the geothermal well is 238°F; 180°F fluid is obtained from the well and, by use of a heat exchanger, heats leach solutions to an average of 56°F to prevent freezing during the winter. Geothermal fluids are also used as make-up water in the leach solutions.

The **UNR School of Veterinary Medicine** demonstrated the viability of propagating commercially important tropical fish using geothermal waters from the Hobo Hot Springs area. Platies, swordtails, and mollies were selected for the study due to their suitability for culture in high-pH waters. The fish were placed in tanks of thermally controlled (79°F), oxygenated geothermal water.

Directory of Mining Operations

by Keryl L. Fleming and Richard B. Jones

Round Mountain gold mine, Nye County.

Compiled from information supplied by the Nevada Division of Mine Inspection Department of Industrial Relations, Nevada Department of Minerals, U.S. Department of Labor Mine Safety and Health Administration.
EX = exploration, HL = heap leach, ML = mill, OS = other surface, OP = open-pit mine, PL = placer, UG = underground mine.

Operator	Mine/plant name	Location	Commodity	Type	Process/ activity	Employees	Address
CHURCHILL COUNTY							
Argus Mining Co.	Fondaway Canyon	S2,T22N,R33E	gold silver	ML,HL	cyanidation	3	Bill Janess, Owner 100 East Center Street Fallon, NV 89406
Art Wilson Co.	Iron Mine (stockpile)	S16,T24N,R34E	magnetite	OP	iron ore	2	Art Wilson, Owner P.O. Box 1160 Carson City, NV 89701
Belmont Resources (U.S.), Inc.	Wonder Mine	S4,T18N,R35E	gold silver	OP,HL	single bench	11	J. M. Dickinson P.O. Box 1586 Fallon, NV 89406
International Recovery Services, Inc.	Wonder Mine	S5,T18N,R35E	gold silver	OP,HL	single bench	5	Paul Davis P.O. Box 2270 Sparks, NV 89432-2270
Comstock Minerals	Dixie Comstock Mine	S27,T23N,R35E	gold silver	ML,HL	cyanidation	1	Robert J. Smith, Lessee Dixie Valley Road Fallon, NV 89406

continued

Digitized by Google

DIRECTORY OF MINING OPERATIONS (continued)

Operator	Mine name	Location	Commodity	Type	Process/ activity	Employees	Address
CHURCHILL COUNTY (continued)							
Cyprus Mines Corp.	Section 8 Mine	S8,T19N,R26E	diatomite	OP	single bench	1	Henry Turnbaugh, Superintendent P.O. Box 455 Fernley, NV 89408
Huck Salt Co.	Huck Salt Plant	S12,T16N,R31E	salt	OP,ML	scalping screening	3	Elmer Huckaby, Owner 895 Harrigan Road Fallon, NV 89406
Kenneth C. Jones	Desert Rat Mine	S14,T22N,R33E	gold silver	OP,HL		3	Kenneth C. Jones, Owner P.O. Box 1162 Fallon, NV 89406
Lombardo Turquoise Milling & Mining Co.	Shoshone Mine	S21,T21N,R40E	turquoise	UG	drifting stoping	2	Danielle M. Kohler, Manager 1300 East Main Street Austin, NV 89310
Moltan Co.	Moltan Mine & Plant	S28,T23N,R27E	diatomite	OP,ML	construction	22	W. M. Gurley, Owner P.O. Box 860 Fernley, NV 89408-0860
CLARK COUNTY							
Bounsall, Eddie	Treasure Hawk Mine & Mill	S34,T19S,R70E	gold silver	OP,ML	gravity concentration cyanidation	2	Eddie & Billy Bounsall, Owners P.O. Box 357 Logandale, NV 89021
CLC Mining, Inc.	Spirit Mountain Mine & Mill	S24,T3S,R64E	gold silver	OP,ML, HL	single bench	7	Lewis E. Young, President P.O. Box 907 Searchlight, NV 89046
Canyon Development & Mining, Inc.	Techatticup Mine	S2,T26S,R64E	gold	OP,ML, HL	single bench	4	Larry Clouse, President 624 Arrayo Boulder City, NV 89005
Chemstar Lime Co.	Apex Plant & Quarry	S23,25,T18S,R63E	limestone	OP,ML	multiple bench crushing calcining	29	Michael Eliasen, Plant Supervisor P.O. Box 3598 North Las Vegas, NV 89030
Chemstar Lime Co.	Dolomite Plant	S18,T22S,R63E	lime	ML	calcining	31	Dave Johnson, Vice President 2551 North Green Valley Parkway, Suite 201-B Henderson, NV 89015
Chemstar Lime Co.	Sloan Quarry & Mill	S13,T23S,R60E	limestone	OP,ML	multiple bench crushing screening	12	Earl Gillian, Quarry Supervisor Star Route 70, Box 2300 Las Vegas, NV 89124
Geneva Minerals, Inc.	Yucca Mine/Desert Queen Mill	S13,T26S,R63E	gold silver	OP,ML	single bench gravity concentration	5	T. D. Barnes, President P.O. Box 413 Henderson, NV 89044
Georgia Pacific, Inc.	Wallboard Plant	S25,T18S,R63E	gypsum	ML	calcining	4	Jean Wassenberg, Manager P.O. Box 30006 North Las Vegas, NV 89030
L. W. Aubry Co., *Contractor*	Wallboard Plant	S25,T18S,R63E		ML	calcining	19	L. W. Aubry, Owner P.O. Box 4128 Burlingame, CA 94010
Georgia Pacific, Inc.	Gypsum Mine	S10,T16S,R66E	gypsum	OP	single bench	7	Bob Shajary, Superintendent P.O. Box 30006 North Las Vegas, NV 89030
H. L. M. Co.	Jenko Mine & Mill	S15,T26S,R64E	gold silver	UG,ML	development gravity concentration	5	G. Leavitt, President 4663 Meredith Avenue Las Vegas, NV 89121
High Desert Mining	High Desert Test Plant	S9,T23S,R64E	gold silver	ML	construction vat leaching	5	Arby Vincent, President 8390 South 4th Street Henderson, NV 89015
James Hardie Gypsum, Inc.	James Hardie Gypsum Quarry and Mill	S32,T21S,R59E	gypsum	OP,ML	crushing screening calcining	123	James E. Price, Plant Manager Star Route 89033, Box 2900 Las Vegas, NV 89124
Kenoro, Inc.	Eldorado Project	S11,T27S,R63E	gold silver platinum	OP,ML	single bench construction	12	Daniel B. Blair, President 8390 South 4th Street Henderson, NV 89015

DIRECTORY OF MINING OPERATIONS (continued)

Operator	Mine name	Location	Commodity	Type	Process/ activity	Employees	Address
CLARK COUNTY (continued)							
Richfield International, *Contractor*	Eldorado Project	S11,T27S,R63E		ML	construction	13	John Thomas, Plant Manager P.O. Box 994 Searchlight, NV 89046
Las Vegas Cement, Inc.	Las Vegas Cement Plant	S10,T15S,R67E	cement	ML	construction	20	Aldo Dinardo, Owner & President P.O. Box 380 Logandale, NV 89021
Micron Minerals	Micron Mine & Mill	S6,T13S,R64E	gold	OP,ML	construction	5	Gordon Lee, President 2245-D Rennince Drive Las Vegas, NV 89118
Mining & Milling Corp. of America	Capitol Camps Mine & Mill	S13,T26S,R64E	gold silver	OP,ML	single bench construction gravity concentration	5	Paul R. Thompson, President P.O. Box 13507 Las Vegas, NV 89112-1507
Oro Plata Resources, Inc.	Oro Plata Mine	S17,T26S,R63E	silver	UG	rehabilitation	4	Floyd Robertson, President 5130 East Charleston Boulevard, Suite 5125 Las Vegas, NV 89122
Pabco Gypsum	Apex Gypsum Plant	S7,8,17,18, T20S,R64E	gypsum	OP,ML	crushing screening calcining	13	Stan Asbell, Manager P.O. Box 43327 Las Vegas, NV 89115
Plenty River Management Corp.	Plenty River Mine	S1,T20S,R63E	gold	ML	construction	13	Bryan Fitzpatrick, President 1050 East Flamingo Road, #349 Las Vegas, NV 89119
Precious & Strategic Minerals, Inc.	Man Joy Mill	S3,T23S,R63E	precious metals	ML	construction chemical extraction	10	Robert Baron, President 3890 South Nellis Boulevard Las Vegas, NV 89104
Snowbird Resources	Golden Dawn's Mine	S2,T29S,R63E	gold	OP,ML	single bench gravity concentration	6	M. R. Vandergrift, President 3355 Spring Mountain Road Las Vegas, NV 89102
Willoro, Inc.	Willoro Project	S35,36,1,2, T27S,28S,R63E	gold	OP	cyanidation	1	Robert R. Miller, Mine Manager 1557 Foothill Drive, Suite A103 Boulder City, NV 89005
DOUGLAS COUNTY							
Allen, David L.	Bovie Lou Placer Claims	S8,17,20, T13N,R24E	gold silver	PL	gravity	1	Allen, David L. 17 Smith Lane Yerington, NV 89447
Sonora Mining Corp.	Buckskin Mill	S13,T13N,R23E	gold	ML	development	18	Derek Barrett, General Manager P.O. Box 546 Yerington, NV 89447
ELKO COUNTY							
BMEX Corp.	Pav Lak Mine & Mill	S28,T46N,R58E	gold silver	UG,ML	flotation	7	Gordan Bird, President General Delivery Jarbidge, NV 89826
Dee Gold Mining Co.	Dee Gold Mine	S6,T37N,R50E	gold silver	OP,ML, HL	cyanidation	96	David S. Cook, General Manager P.O. Box 1193 Elko, NV 89801
Freeport-McMoran Gold Co.	Big Springs Joint Venture	S10,T42N,R53E	gold	OP		78	D. Scott Barr, Vice President and General Manager Mountain City Star Route Elko, NV 89801
Gibbons & Reed Co., *Contractor*	Big Springs Project	S10,T42N,R53E		OP	multiple bench	30	C. David Baer, Project Manager P.O. Box 30429 Salt Lake City, UT 84130
Freeport-McMoran Gold Co.	Freeport Gold Mill	S33,T41N,R54E	gold	ML,HL	cyanidation fluid bed roasting	366	Cecil L. Kinard II, Vice President and General Manager Mountain City Star Route Elko, NV 89801
Freeport-McMoran Gold Co.	Jerritt Canyon Joint Venture	S34,35,T41N,R53E	gold	OP	multiple bench	129	Robert W. Noel, Jr., Vice President Mountain City Star Route Elko, NV 89801

continued

DIRECTORY OF MINING OPERATIONS (continued)

Operator	Mine name	Location	Commodity	Type	Process/ activity	Employees	Address
ELKO COUNTY (continued)							
Harney Rock & Paving Co.	Pardo Quarry	S16,T35N,R56E	railroad ballast	OS	multiple bench crushing screening	10	Michael Hooker, General Manager P.O. Box 951 Elko, NV 89801
Heater, Phil	Big Four Mine & Mill	S25,T44N,R52E	gold silver	OP,ML	cyanidation	2	Phil Heater, Owner P.O. Box 187 Mountain City, NV 89831
Horizon Gold Shares	Tuscarora Gold Mine	S3,T39N,R51E	gold	OP,HL		33	Randall Bargelt, Mine Manager P.O. Box 37 Tuscarora, NV 89834
Kilborn International, *Contractor for:* Newmont Gold Mining Co.	Rain Mine	S33,T32N,R53E	gold	ML	construction	70	Chris Hartman, Project Manager 742 D Street Elko, NV 89801
Las Vegas Paving Corp., *Contractor for:* Newmont Gold Mining Co.	Rain Mine	S33,T32N,R53E	gold	OP	construction	5	Bryan Priyle, Project Manager P.O. Box 681 Carlin, NV 89822
Ludwig Mining and Milling	St. Elmo's Mine	S3,T44N,R56E	gold silver	UG,HL		4	Pete Ludwig, Manager 1325 Parkview Drive Elko, NV 89801
Nevada Precious Metals	Wells Mill	S11,T36N,R62E	gold silver	ML	flotation	2	Clayton Stock, Mill Manager General Delivery Wells, NV 89835
Stock, Clayton	Success Mine	S21,T46N,R58E	gold	UG		3	Clayton Stock, Owner General Delivery Jarbidge, NV 89826
Stock, Jerry	4M Mine	S28,T46N,R58E	gold	UG	drifting	2	Jerry Stock, Owner General Delivery Jarbidge, NV 89826
Utah Marblehead Lime Co.	Wendover Quarry	S13,14,T38N,R38E	limestone	OP,ML	crushing screening	18	Ernest E. Burgh, Vice President P.O. Box 596 Grantsville, UT 84029
ESMERALDA COUNTY							
Combined Metals Reduction Co.	Mill Maintenance Shop	S4,T1S,R36E	gold silver	OS	repair storage	8	L. T. Atkinson, President Route 264, Fish Lake Valley via Tonopah, NV 89050
Falcon Exploration	Boss Mine	S31,T3N,R39E	gold silver	OP,ML	multiple bench construction	24	Rick Moritz, General Manager P.O. Box 3719 Tonopah, NV 89049
Federal Claimstaking Agency, Inc.	Silver Sun Mine	S17,T3S,R38E	gold silver	ML,HL		1	James L. Masini, President P.O. Box 273 Goldfield, NV 89013
Foote Minerals Co.	Silver Peak Lithium Mine & Mill	S14,T2S,R39E	lithium	OS,ML	pumping brine	59	Jeffrey Seaman, Operations Manager Silverpeak, NV 89047
Grefco, Inc.	Basalt Mine & Mill	S29,T2N,R34E	diatomite	OP,ML	air separation grinding	11	Robert Poelvoorde, Plant Manager P.O. Box 288 Mina, NV 89422
Kinkaid Exploration & Mining Co.	McLean Mine	S15,T4N,R38E	gold silver	OP,ML, HL	single bench	16	William Paulter, Manager P.O. Box 1531 Tonopah, NV 89049
Placer Management Group Ltd.	Goldfield Operations	S26,35,T2S,R42E	gold silver	OP,ML, HL	single bench	36	Eric Anderson, Manager P.O. Box 475 Goldfield, NV 89013
Vaughan Construction Co., *Contractor*	Goldfield Operations	S26,35,T2S,R42E		OP,ML	multiple bench crushing screening	26	Otis L. Vaughan, Owner P.O. Box 679 Fernley, NV 89403
Sunshine Mining Co.	Silver Peak Mill	S23,T1N,R39E	silver gold	ML		37	Donald F. Earnest, Resident Manager P.O. Box 97 Silverpeak, NV 89047

DIRECTORY OF MINING OPERATIONS (continued)

Operator	Mine name	Location	Commodity	Type	Process/ activity	Employees	Address
ESMERALDA COUNTY (continued)							
Sunshine Mining Co.	Weepah Project	S23,T1N,R39E	silver gold	OP,HL	cyanidation	19	Donald F. Earnest, Resident Manager P.O. Box 97 Silverpeak, NV 89047
Vanderbilt Minerals Corp.	Blanco #3	S22,T1N,R37E	aluminum silicates clay	OP	grinding	4	J. W. Lease P.O. Box 399 Beatty, NV 89003
EUREKA COUNTY							
American Barrick Resources Corp.	Gold Strike Mine	S30,T36N,R50E	gold	OP,ML, HL	multiple bench cyanidation	112	John T. McDonough, Mine Manager P.O. Box 29 Elko, NV 89801
Crest-Line *Subcontractor*	Gold Strike Mine	S30,T36N,R50E		OP	construction	12	Thomas M. Foti, Supervisor P.O. Box 9382 Salt Lake City, UT 84109
R. C. Layne Construction, *Contractor*	Gold Strike Mine	S30,T36N,R50E		OP	construction	20	Bob Couch, Owner 459 - 4th Street, Suite #202 Elko, NV 89801
Atlas Gold Mining, Inc.	Gold Bar Mine	S26,27,T22N,R49E	gold	OP,ML, HL	multiple bench crushing grinding	92	David M. Rubio, Operations Manager P.O. Box 282 Eureka, NV 89316
Cominco American, Inc.	Buckhorn Mine	S30,31,T26N,R45E	gold silver	OP,ML, HL	cyanidation	69	Art Schweizer, General Manager P.O. Box 976 Carlin, NV 89822
Cortez Gold Mines	Horse Canyon Mine	S33,T27N,R48E	gold	OP		106	A. L. Walsh, Mine Manager Cortez, NV 89821
N. L. Industries, Baroid Division	Dunphy Mill	S26,T33N,R48E	barite	ML	gravity concentration	22	B. C. Baldwin, Manager P.O. Box 430 Battle Mountain, NV 89820
Nevada Barth Corp.	Nevada Barth Iron Mine & Mill	S7,8,T31N,R51E	magnetite iron ore	OP,ML	crushing screening	2	Celso Yraguen, Mine Manager P.O. Box 425 Carlin, NV 89822
Newmont Gold Mining Co.	Newmont Operations	T33-36N,R50E,51E	gold	OP,ML, HL	multiple bench cyanidation	1180	Robert L. Zerga, Executive Vice President P.O. Box 669 Carlin, NV 89822-0669
Bechtel, Inc., *Contractor*	Maggie Creek Gold Mine	S29,35,T34N,R51E		ML	construction	900	Ron Jenkins, Project Manager P.O. Box 621 Carlin, NV 89822
Kilborn International, Ltd., *Contractor*	Newmont Operations	S4,8,29,35, T33-36N,R50E,51E		OP	construction	130	Bruno Hildebrant, Construction Manager 742 D Street Elko, NV 89801
Norse Windfall Mines, Inc.	Windfall Mine	S2,22,T18N,R53E	gold silver	OP,ML, HL	multiple bench cyanidation	31	Jeffrey D. King, Mine Manager P.O. Box 326 Eureka, NV 89316
W. E. Vining Co., *Contractor*	Windfall Mine	S2,T18N,R53E		OP	rotary drilling	20	W. E. Vining, President P.O. Box 88 Manhattan, NV 89022
Tonkin Springs Gold Mining Co.	Tonkin Springs Project	S2,3,T23N,R49E	gold silver	OP,ML, HL	single bench cyanidation	16	Joe Young, Vice President, Operations P.O. Box 671 Elko, NV 89801
Target Construction, Inc., *Contractor*	Tonkin Springs Gold Mine	S2,3,T23N,R49E		OP	multiple bench	11	Jeff Fegert, President 333 Holcomb Avenue Reno, NV 89502
HUMBOLDT COUNTY							
Church, Dallas	Alabama Mine & Mill	S5,T39N,R36E	silver gold	OP,ML	gravity concentration	2	Dallas Church, Operator P.O. Box 1353 Winnemucca, NV 89445
Curtis Machinery, Inc.	Dun Glen Mine	S28,T35N,R38E	limestone	OP	single bench	2	Walter Curtis, Jr., Owner P.O. Box 1231 Winnemucca, NV 89445
Eddie, Charles	Lorrie Lee Mine	S5,T45N,R26E	opals	OP		2	Charles Eddie, Owner P.O. Box 1072 Sunland, CA 91040

continued

DIRECTORY OF MINING OPERATIONS (continued)

Operator	Mine name	Location	Commodity	Type	Process/ activity	Employees	Address
HUMBOLDT COUNTY (continued)							
FRM Minerals, Inc.	Getchell Mine	S3,4,32,33,34, T38N,39N,R42E	gold	OP,HL	cyanidation	30	Cecil Alvarez, Vice President P.O. Box 220 Golconda, NV 89414
Brown & Root U.S.A., Inc., *Contractor*	Getchell Mine	S3,4,32,33,34, T38N,39N,R42E		OP	single bench	15	Larry Kuhlman, Project Manager P.O. Box 1560 Winnemucca, NV 89445
Gold Fields Mining Co.	Chimney Creek Mine	S6,7,T39N,R43E	gold silver	OP,ML, HL	grinding cyanidation	138	Jim H. Gourdie, Manager P.O. Box 69 Golconda, NV 89414
Davey McKee, *Contractor*	Chimney Creek Mine	S32,T40N,R43E		OP,ML	construction	15	Robert Shaw, Project Superintendent P.O. Box 1710 Winnemucca, NV 89445
Emko Corp., *Contractor*	Chimney Creek Mine	S32,T40N,R43E		OP,ML	construction	10	Joe Conklin, Project Manager P.O. Box 2077 Winnemucca, NV 89445
Engineered Structures, Inc., *Contractor*	Chimney Creek Mine	S32,T40N,R43E		ML	construction	34	Marshal Gray, Project Manager P.O. Box 1608 Winnemucca, NV 89445
Lang Exploratory Drilling, *Contractor*	Chimney Creek Mine	S5,T39N,R43E		EX	rotary drilling	4	Alan Lang, Zone Manager 2286 West 1500 South Salt Lake City, UT 84104
The Industrial Co., *Contractor*	Chimney Creek Mine	S5,T39N,R43E		OP,ML	construction	114	Doug Green, Project Superintendent P.O. Box 366 Winnemucca, NV 89445
Western Central Concrete, Inc. *Subcontractor*	Chimney Creek Mine	S5,T39N,R43E		ML	construction	5	Del Cornella, Owner P.O. Box 2528 Hawthorne, NV 89415
Gravcon, Inc., *Contractor for:* Hydromet, Inc.	Furies III Mine	S25,26,30,31,36, T37N,R31E	gold silver	OP,ML	single bench gravity concentration	3	Don W. Ross, General Manager P.O. Box 1885 Winnemucca, NV 89445
Hewitt, C. George	Cecilie Anne Mine	S8,9,T45N,R26E	opals	OP	single bench	1	C. George Hewitt, Owner P.O. Box 33 Denio, NV 89404
	Daisy "M"s	S24,25,T45N,R26E	opals	OP	single bench	1	C. George Hewitt, Owner P.O. Box 33 Denio, NV 89404
	Kelley Mine	S30,T45N,R26E	opals	OP	single bench	1	C. George Hewitt, Owner P.O. Box 33 Denio, NV 89404
Hodson, G. Keith	Bonanza Opal Mine	S13,T45N,R25E	opals	OP	single bench	1	G. Keith Hodson, Owner P.O. Box 97 Denio, NV 89404
	Rainbow Ridge Mine	S34,T45N,R26E	opals	OP	single bench	1	G. Keith Hodson, Owner P.O. Box 97 Denio, NV 89404
Hycroft Resources & Development, Inc.	Lewis Mine	S24,T35N,R29E	gold silver	OP,ML, HL	cyanidation	48	Ed Rose Drawer M Winnemucca, NV 89455
King, E. B.	Jumbo Mine	S33,36,T40N,R35E	gold silver	OP,UG, ML,HL	cyanidation	5	E. B. King, Owner P.O. Box 1171 Winnemucca, NV 89445
Elquist Mining Company, Inc., *Contractor*	Austin Jumbo Mine	S33,36,T40N,R35E		OP,ML	single bench screening	5	Jim Elquist & Larry Elquist, Owners P.O. Box 488 Battle Mountain, NV 89820
K. W. Snyder Co.	Gold Button Mine	S5,T39N,R36E	gold	UG,OP, HL	multiple bench	5	K. W. Snyder, Owner P.O. Box 1007 Winnemucca, NV 89445
Min-Ad, Inc.	Min-Ad Mill	S26,T36N,R37E	limestone	ML	grinding	4	Charles J. Evans, Mill Superintendent 4210 Jungo Road Winnemucca, NV 89445
Nevada Gold Mining, Inc.	Sleeper Mine	S16,17,20,21, T40N,R35E	gold silver	OP,ML, HL	cyanide gravity grinding	155	Lawrence Hansen, General Manager P.O. Box 1820 Winnemucca, NV 89445
Miller Construction, *Contractor*	Sleeper Mine	S16,17,20,21, T40N,R35E		OP,ML	construction	4	Paul Miller, Owner 211 Maple Avenue Winnemucca, NV 89445

DIRECTORY OF MINING OPERATIONS (continued)

Operator	Mine name	Location	Commodity	Type	Process/ activity	Employees	Address
HUMBOLDT COUNTY (continued)							
Rackley Co., Inc. *Subcontractor*	Sleeper Mine	S16,17,20,21, T40N,R35E		OP,ML	construction	5	Bill Rackley, Owner Route 1, Box 1621 Orland, CA 95963
Ruby Dome, Inc., *Contractor*	Sleeper Mine	S16,17,20,21, T40N,R35E		OP	single bench	56	Robert Dorsa, President P.O. Box 1820 Winnemucca, NV 89445
The Industrial Co. of Steamboat Spgs., *Contractor*	Sleeper Mine	S16,17,20,21, T40N,R35E		ML	construction	30	Ray Dix, Project Manager P.O. Box 366 Winnemucca, NV 89445
Numot, Inc.	Rattler Mine	S5,T41N,R28E	gold silver	OP,HL		2	Thomas A. Breen, President 3105 South Desert Gem Road Winnemucca, NV 89445
Nutritional Additives Corp.	Sexton Mill	S20,T36N,R38E	limestone	ML	crushing screening	5	Glen Sexton, General Manager P.O. Box 802 Winnemucca, NV 89445
Paradise Valley Mining, Inc.	Paradise Valley Mine	S17,T38N,R40E	gold	OP,ML	gravity concentration	5	Merlin Fish, President HCR 12, Dutch Flat Road Winnemucca, NV 89445
Dirt Merchant Construction, *Contractor*	Paradise Valley Mine	S17,T38N,R40E		OP	single bench	4	Brian Wells, Owner HCR 12, Dutch Flat Road Winnemucca, NV 89445
Pinson Mining Co.	Pinson Mine & Mill	S28,T38N,R42E	gold	OP,ML, HL	cyanidation	137	H. Dan Harper, General Manager P.O. Box 192 Winnemucca, NV 89445
	Preble Mine	S11,T36N,R40E	gold	OP,HL		12	H. Dan Harper, General Manager P.O. Box 192 Winnemucca, NV 89445
Placer-Dome U.S.A.	McDermitt Mine Joint Venture	S33,T47N,R37E	mercury	OP,ML	flotation distillation	23	Randy Powell, Mine Manager P.O. Box 497 McDermitt, NV 89421
Rembrandt Gold, Inc.	Brown Betty Mine	S28,T46N,R39E	gold	UG	drifting	2	Jedd Van Kamper P.O. Box 1802 Winnemucca, NV 89445
Royal Peacock Opal Mine, Inc.	Royal Peacock #2 Opal Mine	S18,19,20, T45N,R26E	opals	OP	single bench	2	Harry Wilson, President P.O. Box 36 Denio, NV 89404
Silver Hills Mining Corp.	Silver Hills Mine	S26,T35N,R40E	gold silver	OP,ML	single bench cyanidation	6	Raymond C. McArthur, President P.O. Box 113 Golconda, NV 89414
Catear Exploration, *Contractor*	Silver Hills Mine	S26,T35N,R40E		OP		6	Bernard Westby & Jim Thomas, Owners P.O. Box 113 Golconda NV 89414
Thompson, Marion H.	Gold Run Mine	S28,T34N,R40E	gold	OP	gravity concentration	5	Marion H. Thompson, Owner/Operator 1930 Mizpah Winnemucca, NV 89445
LANDER COUNTY							
Battle Mountain Gold Co.	Fortitude Mine	S21,T31N,R43E	gold silver copper	OP	multiple bench	188	Richard Sumin, Vice President P.O. Box 1627 Battle Mountain, NV 89820
Battle Mountain Gold Co.	Fortitude Mill	S23,24,T31N,R43E	gold silver copper	ML	cyanidation flotation grinding gravity	185	Richard Sumin, Vice President P.O. Box 1627 Battle Mountain, NV 89820
Coral Resources, Inc.	Robertson Project	S8,T28N,R47E	gold silver	OP,HL	multiple bench cyanidation	7	Louis Wolfin, President Box 8 Crescent Valley, NV 89821
Cortez Gold Mine	Cortez Gold Mine & Mill	S24,T27N,R47E	gold silver	OP,ML, HL	cyanidation	135	A. L. Crandell, General Manager Cortez, NV 89821

continued

DIRECTORY OF MINING OPERATIONS (continued)

Operator	Mine name	Location	Commodity	Type	Process/ activity	Employees	Address
LANDER COUNTY (continued)							
Echo Bay Minerals Co.	McCoy Mine	S2,11,T28N,R42E	gold silver	OP,ML, HL	multiple bench cyanidation	123	David Naccarati, General Manager P.O. Box 1658 Battle Mountain, NV 89820
Becker Drills, Inc., *Contractor*	McCoy Mine	S36,T29N,R42E		EX,OP	rotary drilling	12	Harlan Fowler, Project Manager P.O. Box 18 Battle Mountain, NV 89820
Brown & Root U.S.A., Inc., *Contractor*	McCoy Mine	S2,T28N,R42E		OP		120	Harlan Fowler, Project Manager P.O. Box 1628 Battle Mountain, NV 89820
Clark-Bowler Management, *Contractor*	McCoy Mine	S2,T28N,R42E		OP,ML	construction	35	Garry Bunnah, Job Superintendent 715 Greg Street Sparks, NV 89431
Long Drilling Co., *Contractor*	McCoy Mine	S2,T28N,R42E		OP	rotary drilling	3	Jim Long, Owner P.O. Box 732 Carlin, NV 89822
National Structures, Inc., *Contractor*	McCoy Mine	S2,T28N,R42E		OP,ML	construction	79	Patrick L. Pettiette, Project Manager P.O. Box 457 Battle Mountain, NV 89820
Tonto Drilling Services, *Contractor*	McCoy Mine	S36,T29N,R42E		OP	rotary drilling	4	David Sigstad, Drilling Foreman 2701 West 900 South Salt Lake City, UT 84104
Harrison Mining	Independence Mine & Mill	S28,T31N,R43E	silver	UG,ML	open stoping cyanidation	7	Earl Harrison, Operator P.O. Box 186 Battle Mountain, NV 89820
Horizon Gold Shares, Inc. (Buffalo Valley Venture)	Buffalo Valley Mine	S33,34,T32N,R42E	gold	OP,ML, HL	cyanidation	62	John E. Watson, President P.O. Box 358 Valmy, NV 89438
Combined Metals Reduction Co., *Contractor*	Buffalo Valley Mine	S33,34,T32N,R42E		OP	crushing screening	3	Larry Atkinson, Owner Route 264, Fish Lake Valley via Tonopah, NV 89049
Ranstrom Construction, Inc., *Contractor*	Buffalo Valley Mine	S33,34,T32N,R42E		ML	crushing screening	3	B. J. Turk McMurtrey, Superintendent P.O. Box 15395 Boise, ID 83642
IMCO Services, Inc.	Battle Mountain Grinding Plant	S27,T32N,R45E	barite	ML	grinding	3	Ralph Gronning, Manager P.O. Box 861 Battle Mountain, NV 89820
Magcobar Minerals	Dresser Mill	S16,T32N,R45E	barite	ML	crushing screening	14	Garry Thielen, General Manager P.O. Box 370 Battle Mountain, NV 89820
Magcobar Minerals	Greystone Mine & Mill	S16,T28N,R46E	barite	OP,ML	multiple bench gravity concentration	12	Garry Thielen, General Manager P.O. Box 370 Battle Mountain, NV 89820
Milpark, Inc.	Bateman Canyon Mill	S5,T30N,R46E	barite	ML	gravity concentration	13	John Williams, Acting Superintendent P.O. Box 272 Battle Mountain, NV 89820
	Argenta Mine & Mill	S6,19,T32N,R47E	barite	OP,ML	multiple bench gravity concentration	30	Keith S. Olson, Manager P.O. Box 277 Battle Mountain, NV 89820
N. A. Degerstrom, Inc.	Saddle Deposit	S5,6,31,32, T25N,26N,R47E	gold silver	OP,ML, HL		59	Larry J. Simpson, Operations Manager P.O. Box 29 Crescent Valley, NV 89821
Nevada Goldfields, Inc.	Kingston Mine	S22,T16N,R43E	gold silver	UG	drifting	20	Jack Swanson, Mine Manager P.O. Box 119, Kingston Austin, NV 89310
American Mine Services, Inc., *Contractor*	Kingston Mine	S22,T16N,R43E		UG	drifting	14	Joe Kicher, Project Manager c/o Nevada Goldfields, Box 119 Kingston Village, Austin
Nevada Goldfields, Inc.	Kingston Mill	S5,T15N,R44E	gold silver	ML	cyanidation	50	Brian Micke, Operations Manager 47 Glen Carran Circle Sparks, NV 89431
Western Exploration & Mining Co., L.P.	Austin Gold Venture Mine & Mill	S27,36,T18N,R43E	gold	OP,ML	multiple bench flotation cyanidation	138	William E. Brooks, Project Manager P.O. Box 502 Austin, NV 89310

DIRECTORY OF MINING OPERATIONS (continued)

Operator	Mine name	Location	Commodity	Type	Process/ activity	Employees	Address
LANDER COUNTY (continued)							
Morrison-Knudsen Company, Inc., *Contractor*	Austin Gold Venture Mine & Mill	S36,T18N,R43E		OP	multiple bench construction	29	Duane E. Eubanks, Mine Manager P.O. Box 503 Austin, NV 89310
LINCOLN COUNTY							
Bobcat Properties, Inc.	Atlanta Mine & Mill	S14,T7N,R68E	gold silver	OP,ML, HL	cyanidation	1	Tom Wilkirk, Superintendent Star Route HCR 10 Pioche, NV 89043
Deleperlite Partnership Lease	Mackie Perlite Mine	S11,T5S,R62E	perlite	UG	room pillar	3	Joe Wilkin, Owner P.O. Box 472 Panaca, NV 89042
Hollingshead Mining Contracting	Pioche Mill	S23,T1N,R67E	scheelite	ML	flotation gravity concentration	2	LaVar Hollingshead, Owner Panaca, NV 89042
Wilkin Mining & Trucking Co.	Delamar Perlite	S7,T4S,R67E	perlite	ML	crushing screening	7	Joe Wilkin, Owner P.O. Box 472 Panaca, NV 89042
LYON COUNTY							
Allen, David L.	Old Hall Claims	S17,T13N,R24E	gold	PL	placer	3	John Bialaski, Owner 17 Smith Lane Yerington, NV 89447
Art Wilson Co.	Adams Claims	S25,T16N,R20E	gypsum	OP,ML	crushing screening	12	Art Wilson, Owner/Operator P.O. Box 1160 Carson City, NV 89702
B & B Casler, Living Trust	Wabuska Plant	S21,T15N,R25E	montmorillonite	ML	shaker screening bagging	1	Bill Casler, President P.O. Box 733 Yerington, NV 89447
Blazer Exploration, Inc.	Weed Heights Mine	S8,T25N,R13E	gold	EX,HL		4	Gary Messingill, President 130 Oregon, Apt. #2 Yerington, NV 89447
Canyon Resources Corp.	Santiago-Haywood Mine	S18,T16N,R21E	gold silver	ML,HL	cyanidation	9	Allen P. Vogel, Plant Supervisor 13 Affonso Drive, #J-15 Carson City, NV 89701-7721
Carl Brownell & Tom Redican	Trio Mine	S21,T16N,R21E	gold	OP	placer washing	2	Robert Craig, Owner 892 East William Carson City, NV 89701
Cyprus Corp.	Fernley Mill	S11,T20N,R24E	diatomite	ML	grinding dressing separating	3	Henry Turnbaugh, Superintendent 100 Front Street Fernley, NV 89408
Eagle-Picher Industries, Inc.	Hazen Pit	S9,T18N,R25E	diatomite	OP	single bench	2	Roger Malone, President P.O. Box 10480 Reno, NV 89510
Eglington Oil & Gas Corp.	South Comstock Mine & Mill	S21,T16N,R21E	gold silver	OP,ML	flotation	3	Colin Burton, Mine Manager 21309 Highway 50 East Carson City, NV 89701
Nevada Cement Co.	Nevada Cement Plant	S10,T20N,R24E	cement	ML	grinding calcining	150	David L. Dalton, President P.O. Box 840 Fernley, NV 89408
Nevada Cement Co.	Limestone Mine	S4,T19N,R25E	limestone	OP	multiple bench	3	David Dalton, President P.O. Box 840 Fernley, NV 89408
Tuttle's Golden Minerals	Tuttle Mine	S20,21,29, T7N,R27E	montmorillonite	OP	screening	2	James B. Tuttle, Owner P.O. Box 519 Hawthorne, NV 89415
Dream Land Mining Co.	Dream Land Mill (Aden Mill)	S7,T6N,R35E	gold silver	ML	remodeling	2	Merl E. Richard, Vice President P.O. Box 648 Mina, NV 89422
Echo Bay Minerals, Inc.	Borealis Mine	S16,17,T6N,R29E	gold silver	OP,ML, HL	crushing screening	51	Greg Earle, Site Manager P.O. Box 2310 Hawthorne, NV 89415

continued

DIRECTORY OF MINING OPERATIONS (continued)

Operator	Mine name	Location	Commodity	Type	Process/ activity	Employees	Address
LYON COUNTY (continued)							
Lost Dutchman Construction, Inc., *Contractor for:* Echo Bay Minerals, Inc.	Borealis Mine	S16,17,T6N,R29E		OP	multiple bench	25	J. R. Barkley, President P.O. Box 1538 Hawthorne, NV 89415
H. E. Hunewill Construction Co., Inc.	Wassuk Gypsum Mine	S6,T12N,R27E	gypsum	OP	crushing screening	5	Harvey E. Hunewill, President 10 Artist View Wellington, NV 89444
L. S. M., Inc.	Rattlesnake Claims & Mill	S7,T8N,R28E	gold	UG	cyanidation	3	Leslie A. Boyd, President P.O. Box 136 Mina, NV 89422
N. A. Degerstrom, Inc.	Spot Deposit	S11,T7N,R36E	gold	OP		15	Daryle Peck P.O. Box 185 Mina, NV 89422
NERCO Metals, Inc.	Candelaria Mine	S33,34,T4N,R35E	silver gold	OP,ML, HL	crushing screening	195	Ralph L. Van Arsdale, General Manager P.O. Box 1240 Hawthorne, NV 89415
Nevada Goldfields, Inc.	Prospectus Mine	S18,T5N,R28E	gold	OP,UG	multiple bench drifting	31	Joe Kircher, Project Manager P.O. Box 3070 Hawthorne, NV 89415
Western General Construction, Inc., *Contractor*	Prospectus Mill	S18,T5N,R28E	gold	ML	construction	8	Bill Frieberg, Project Superintendent 420 'H' Street, Apt. 31 Hawthorne, NV 89415
Nevada Minerals Processing	Nevada Minerals Processing Mill	S7,T6N,R35E	gold silver	ML	construction	10	Kurt Hoyer, Owner P.O. Box 167 Mina, NV 89422
Regent Mining & Exploration, Ltd.	Gold Cuff Hercules Mine & Mill	S9,15,16,22, T4N,5N,R33E	gold	OP,ML	oxidation	3	W. James Stevens, President P.O. Box 7614 Reno, NV 89510
Sodaville Research Facility	Sodaville Mill	S29,T6N,R35E	gold silver	ML	gravity concentration	3	Jim Schaefer, Research Engineer P.O. Box 451 Mina, NV 89422
The Aurora Partnership	Aurora Mine	S17,T5N,R28E	gold silver	OP,HL	multiple bench	20	Doug Stelling, President P.O. Box 1628 Hawthorne, NV 89415
Deatly Co., *Contractor*	Aurora Mine	S17,T5N,R28E		ML	crushing screening	10	John Hjaltalin, Manager 3665 Snake River Avenue P.O. Box 2354 Lewiston, ID 83501
Target Construction, Inc., *Contractor*	Aurora Mine	S17,T5N,R28E		OP	multiple bench	14	Earl Fegert, General Manager 333 Holcomb Avenue, #100 Reno, NV 89502
NYE COUNTY							
Angst Corp.	Gold Bar Mine & Mill	S36,T11S,R45E	gold	OP,ML, HL	multiple bench	48	Joe Zaccaria, Manager P.O. Box 1030 Beatty, NV 89003
C-E Basic	Nevada Works Mill	S34,T12N,R36E	magnesium oxide	OP,ML	calcining flotation	107	Don Pressey, Manager P.O. Box 177 Gabbs, NV 89409
C-E Basic	Nevada Works Pit	S34,T12N,R36E	magnesite	OP	multiple bench	13	Patrick A. Dunne, Works Manager P.O. Box 177 Gabbs, NV 89409
Cind-R-Lite Block Co.	Cinder Cone Mine	S28,T14S,R49E	pumice	OP	multiple bench	2	E. L. Selman, Vice President 3333 Cinder Lane Las Vegas, NV 89103
Cuervo Gold, Inc.	Sullivan Mine	S29,32,T11N,R36E	gold silver	OP,ML, HL		16	Pat Doherty, Project Manager P.O. Box 146 Gabbs, NV 89409
T. G. Sheppard Construction Co., Inc., *Contractor*	Sullivan Mine	S29,32,T11N,R36E		ML	crushing	4	T. G. Sheppard, Owner 605 West Haskell Street Winnemucca, NV 89445

DIRECTORY OF MINING OPERATIONS (continued)

Operator	Mine name	Location	Commodity	Type	Process/ activity	Employees	Address
NYE COUNTY (continued)							
East West Minerals, Inc.	Zeolite Mine	S1,T18S,R51E	zeolite	OP	single bench	4	Gordon Presley, Vice President Star Route 15, Box 7006 Armagosa, NV 89020
Echo Bay Minerals Co.	Manhattan Mill	S19,20,29,30, T8N,R44E	gold	ML	gravity concentration flotation cyanidation	120	Clare A. Moore, Resident Manager P.O. Box 56 Manhattan, NV 89022
Presidential Welding Co., *Contractor*	Manhattan Mill	S20,T8N,R44E		ML		2	David Wise, Owner 18 Palomino Drive Yerington, NV 89447
Echo Bay Minerals Co.	Old Sullivan Mine	S19,T8N,R44E	gold	OP,HL		4	Butch Warr, Manager P.O. Box 1282 Tonopah, NV 89049
FMC Corp.	Paradise Peak Mine	S3,4,9,10, T10N,R36E	gold silver	OP,ML, HL	cyanidation	201	David J. Collins, General Manager P.O. Box 1237 Hawthorne, NV 89415
Fury Exploration of Nevada, Inc.	Grantsville Mine	S2,3,11, T11N,R39E	gold silver	OP,ML, HL		10	Bill Caughlin, Project Manager P.O. Box 2367 Fallon, NV 89406
Gilbert Western Corp., *Contractor*	Grantsville Mine	S2,3,T11N,R39E		OP	multiple bench crushing	12	Ken Hopkins, Job Sponsor P.O. Box 62 Gabbs, NV 89409
Industrial Mineral Ventures, Inc.	Armagosa Pit & Mill	S29,T17S,R49E	clay	OP,ML	crushing drying bagging	43	Forrest Hansen, Resident Manager RFD Box 549 Amargosa, NV 89020
J. Irving Crowell, Jr. & Son	Crowell Fluorspar Mine	S23,T12S,R47E	fluorspar	UG	open & stulled stopes	3	Jack Crowell, Owner P.O. Box 96 Beatty, NV 89003
Marshall Earth Resources, Inc.	Catherine Mine	S1,T12N,R39E	gold silver	UG	drifting	4	Hugh R. Marshall, President Route 1, Box 29A Ione, NV 89310
	Ione Placer, Primary Plan Plant	S28,T13N,R39E	gold	ML	screening washing	6	Hugh R. Marshall, President Route 1, Box 29A Ione, NV 89310
	Phonograph Mine	S2,T12N,R39E	gold silver	UG	drifting	2	Hugh R. Marshall, President Route 1, Box 29A Ione, NV 89310
	Shamrock Tunnel #2	S3,T12N,R39E	gold silver	UG		2	Hugh R. Marshall, President Route 1, Box 29A Ione, NV 89310
	Sky Claims Secondary Mill	S34,T13N,R39E	gold silver	ML	remodeling	4	Hugh R. Marshall, President Route 1, Box 29A Ione, NV 89310
	Stonewall Mine	S2,T12N,R39E	gold silver	UG,ML	drifting	26	Hugh R. Marshall, President Route 1, Box 29A Ione, NV 89310
	Top of the Mountain Mine	S14,T13N,R39E	gold	UG		4	Charles Dela Vega, Mine Superintendent 720 Willow Street Reno, NV 89502
Mid Continent Mining & Exploration, Inc.	White Caps Mill	S19,T12S,R46E	gold silver	ML	construction	5	Bill Foster, President P.O. Box 3308 Tonopah, NV 89049
Round Mountain Gold Corp.	Round Mountain Mine	S19,20,29,30, T10N,R44E	gold silver	OP,ML, HL	multiple bench cyanidation	469	Andre Douchane, General Manager P.O. Box 480 Round Mountain, NV 89045
Utah Construction & Development, *Contractor*	Round Mountain Mine	S19,T10N,R44E		ML	construction	6	John Kopp, Construction Superintendent P.O. Box 230 Round Mountain, NV 89045
Sterling Mine Joint Venture	Sterling Mine	S6,T13S,R48E	gold silver	UG,ML, HL	drifting	21	Greg Austin, President (Saga Exploration Co.) P.O. Box 187 Beatty, NV 89003

continued

DIRECTORY OF MINING OPERATIONS (continued)

Operator	Mine name	Location	Commodity	Type	Process/ activity	Employees	Address
NYE COUNTY (continued)							
Vanderbilt Minerals Co.	White Caps Mine & Mill	S19,T12S,R46E	bentonite	UG,ML	crushing screening square-set stoping	6	Jerry Lease, Manager P.O. Box 399 Beatty, NV 89003
W. E. Vining Co. *Contractor for:* Echo Bay Minerals Co.	Manhattan Mine	S20,T8N,R44E		OP	multiple bench	21	W. E. Vining, Contractor P.O. Box 2499 Carson City, NV 89702
Western States Minerals Corp.	Northumberland Mine	S18,19,T13N,R46E	gold	OP,ML, HL	cyanidation	83	Larry Simpson, Manager Route 2, Box 8A Austin, NV 89310
PERSHING COUNTY							
A & G Mining Co.	Pershing Mine	S9,T26N,R34E	gold	OP,HL	single bench	2	Phillip Geertson, Owner Route 2, Box 29 Adrian, OR 97901
American Antimony	American Antimony Mine	S28,T26N,R34E	antimony	ML	gravity concentration	2	Frank Caldon & Roy Jones, Owners P.O. Box 1148 Lovelock, NV 89419
Anderson Farms Corp.	Fortune Cookie Mine	S17,T33N,R36E	gold	OP,ML	gravity concentration	6	Lawson Brooks, Mine Foreman Star Route, Box 12 Imlay, NV 89418
Banickie, Michael	Saundra Lee & Phase II Mines	S18,T32N,R32E	gold silver	OP,ML	gravity concentration	1	Michael Banickie, Owner/Operator 5444 Woods Drive Sparks, NV 89431
Coeur-Rochester, Inc.	Rochester Mine	S15,16,T28N,R34E	silver gold	OP	single bench	72	Mike Carter, Project Manager P.O. Box 1057 Lovelock, NV 89419
Morrison-Knudsen Co., Inc., *Contractor*	Rochester Mine	S15,16,T28N,R34E		OP	multiple bench	188	Larry Baker, Mine Manager P.O. Box H Lovelock, NV 89419
The Argee Corp., *Contractor*	Rochester Mine	S15,16,T28N,R34E		OP	crushing screening	30	Doug Luna, Project Manager P.O. Box 1108 Lovelock, NV 89419
Consolidated Gold, Ltd.	Marietta Mine	S2,T34N,R34E	gold	UG	drifting	4	Charles A. Dela Vega, Vice President P.O. Box 354 Imlay, NV 89418
Dusty Mining Co.	Dusty Mine	S20,T32N,R32E	gold	OP,ML	gravity concentration	2	Ed Speir, Owner P.O. Box 1149 Lovelock, NV 89419
Eagle-Picher Industries, Inc.	Colado Mine & Shop	S8,T28N,R29E	diatomite	OP	multiple bench	22	M. M. Moezzi, Mine Manager P.O. Box 959 Lovelock, NV 89419
	Colado Plant	S6,T27N,R32E	diatomite	ML	calcining crushing drying	101	Robert N. Maher, Plant Manager Drawer A Lovelock, NV 89419
Ferno Dubrey	Spring Valley Placer	S35,T29N,R34E	gold	OP,ML	single bench gravity concentration	2	Ferno Dubrey, Lessee/Operator P.O. Box 1275 Winnemucca, NV 89445
Karl E. Kuehn & John Ala	Barrel Springs	S31,T34N,R29E	gold	OP,ML	single bench gravity concentration	2	Karl E. Kuehn & John Ala, Partners 1231 Second Street Elko, NV 89801
M. B. A. Gold Tech, Inc.	Majuba Site Test	S19,T32N,R32E	gold	OP,ML	single bench gravity concentration	3	Bill Mockwitz, President P.O. Box 26395 Las Vegas, NV 89126
McCullough Construction Co.	Oreana Stockpile Plant	S3,T28N,R33E	gold silver	ML	screening	5	Maurice L. McCullough, President 47 South 10th West Salt Lake City, UT 84104
Nutritional Additives Co.	Sexton Mine	S5,8,T34N,R38E	limestone	OP	single bench grinding	4	Glen W. Sexton, General Manager P.O. Box 802 Winnemucca, NV 89445

DIRECTORY OF MINING OPERATIONS (continued)

Operator	Mine name	Location	Commodity	Type	Process/ activity	Employees	Address
PERSHING COUNTY (continued)							
Pegasus Gold Corp.	Relief Canyon Mine	S16,T27N,R34E	gold silver	OP,ML, HL	multiple bench	26	John Rice, General Manager P.O. Box 330 Imlay, NV 89418
Morrison-Knudsen Co., Inc. *Contractor*	Relief Canyon Mine	S16,T27N,R34E		OP	multiple bench	56	John O'Laughlin, Project Manager P.O. Box H Lovelock, NV 89419
N. A. Degerstrom, Inc. *Contractor*	Relief Canyon Mine	S16,T27N,R34E		ML	crushing	10	Robert Wallin, Area Manager P.O. Box 1150 Lovelock, NV 89419
Pegasus Gold Corp.	Florida Canyon Mine	S2,T31N,R33E	gold	OP,ML, HL	cyanidation	72	John Rice, General Manager P.O. Box 330 Imlay, NV 89418
N. A. Degerstrom, Inc. *Contractor*	Florida Canyon Mine	S2,T31N,R33E		OP	multiple bench	53	James J. Wolfe, Superintendent P.O. Box 1150 Lovelock, NV 89419
Rose Bud Mines	Rose Bud Mine	S24,T34N,R29E	gold	OP	cyanidation	30	Charles A. Dela Vega, Vice President P.O. Box 1931 Winnemucca, NV 89445
T & T Mining	Imlay Canyon Mine	S31,T32N,R34E	gold	OP,ML	gravity concentration	3	J. A. Thornhill and G. C. Thompson, Partners P.O. Box 111 Imlay, NV 89418
U.S. Borax & Chemical Corp.	Trinity Mine	S9,T29N,R30E	silver	OP,HL	cyanidation	58	Richard C. Jensen, Resident Manager Drawer L Lovelock, NV 89419
Iron King Assay, Inc. *Contractor*	Trinity Mine	S9,T29N,R30E		ML	crushing	4	Robert G. Crook, President Drawer L Lovelock, NV 89419
Lost Dutchman Construction *Contractor*	Trinity Mine	S9,T29N,R30E		OP,ML	single bench crushing screening	25	Greg Stach, Project Superintendent P.O. Box 158 Lovelock, NV 89419
U.S. Gypsum Co.	Empire Mine	S31,T31N,R24E	gypsum	OP	multiple bench	9	Michael D. Phillips, Works Manager P.O. Box 130 Empire, NV 89405
United Global Minerals, Inc.	Four Generations	S24,T29N,R31E	gold silver	OP		9	Dan Wright, President P.O. Box 363 Lovelock, NV 89419
STOREY COUNTY							
Asamera Minerals, Inc.	Gooseberry Mine & Mill	S25,T19N,R22E	gold silver	UG,ML	cyanidation	25	Rick Karlson, Acting Mine Manager 6121 Lakeside Drive, St. 130 Reno, NV 89511-8502
Eagle-Picher Industries, Inc.	Clark Mine	S28,T20N,R23E	diatomite	OP	multiple bench	9	Jack P. Richards, Clark Operations Manager P.O. Box 10480 Reno, NV 89510
	Clark Mill	S35,T20N,R22E	diatomite	ML	calcining screening drying	50	Jack P. Richards, Clark Operations Manager P.O. Box 10480 Reno, NV 89510
Marshall Earth Resources, Inc.	Meri's Con Virginia #1	S29,T17N,R21E	gold silver	UG	drifting	10	Hugh R. Marshall, President 720 Willow Reno, NV 89502
Naturalite Aggregate Corp; Division of Glass Mountain Block	Lower Naturalite Pit & Plant	S16,T17N,R22E	pumice	OS,ML	crushing screening	6	Dick Wideriksen, Vice President 355 Greg Street Sparks, NV 89431
Nevex Gold Co., Inc.	Lucerne Dump Project	S8,T16N,R21E	gold silver	OP	single bench	12	Jeff C. Smith, Plant Manager 13 Affonso Drive, No. J-15 Carson City, NV 89701
W. E. S. Construction Co. *Contractor*	Lucerne Dump Project	S8,T16N,R21E		OP	single bench	11	Roy Walker & Arnold Etcheverry, Owners P.O. Box 7157 Reno, NV 89510

continued

DIRECTORY OF MINING OPERATIONS (continued)

Operator	Mine name	Location	Commodity	Type	Process/ activity	Employees	Address
WASHOE COUNTY							
Art Wilson Co.	Clay Mine & Shop	S13,T27N,R19E	clay	OP	single bench	4	Art Wilson, Owner/Operator P.O. Box 1160 Carson City, NV 89702
U.S. Gypsum Co.	Empire Mill	S11,T31N,R23E	gypsum	ML	crushing screening	110	Michael D. Phillips, Works Manager P.O. Box 130 Empire, NV 89405
Western Goldfields Co.	Hog Ranch Mine	S25,T38N,R22E	gold	OP,ML, HL	cyanidation	62	Dan Martin, President Mine Site Box 9 Gerlach, NV 89412
Gilbert Western Corp. *Contractor*	Hog Ranch Mine	S25,T38N,R22E		OP	single bench	40	Tait Johnson, President P.O. Box 130 Gerlach, NV 89412
WHITE PINE COUNTY							
B. P. Minerals, Inc.	Alligator Ridge Gold Mine	S23,T22N,R57E	gold	OP,ML, HL	cyanidation	130	Bob Martinez, General Manager P.O. Box 149 Ely, NV 89301
Idaho Iron, Inc. *Contractor*	Alligator Ridge Gold Mine	S23,T22N,R57E		ML	construction	10	Jerry Wellard, Superintendent P.O. Box 899 Ely, NV 89301
PBQ & D *Contractor*	Alligator Ridge Mine	S23,T22N,R57E		OP,HL		3	John J. Selters, Project Manager P.O. Box 899 Ely, NV 89801
The Industrial Co. *Contractor*	Alligator Ridge Gold Mine	S23,T22N,R57E		ML	construction	60	Robert Dusbabek 625 Spice Island Drive Sparks, NV 89431
Echo Bay Minerals Co.	Illipah Mine	S4,T18N,R58E	gold	OP		33	John Zigarlik, Jr., President 1139 Avenue F Ely, NV 89301
Country Construction *Contractor*	Illipah Mine	S4,T18N,R58E		OP,ML, HL	multiple bench	10	Mike Lemich, Owner 1200 Avenue B Ely, NV 89301
W. E. Vining Co. *Contractor*	Illipah Mine	S4,T18N,R58E		OP	multiple bench	20	W. E. Vining, President P.O. Box 2499 Carson City, NV 89702
Mt. Moriah Stone, Inc.	Mt. Moriah Stone Quarry	S15,T16N,R70E	building	OS	single bench	6	Richard K. Hatch, President No. 10 Hatch Rock Road, Gandy Route Garrison, UT 84728
New Dynasty Mines, Inc.	Little Bald Mountain Mine	S26,27,T24N,R57E	gold silver	OP,UG, ML,HL	cyanidation	10	Ronald D. Damele, Manager P.O. Box 314 Eureka, NV 89316
Dan Callaghan *contractor*	Little Bald Mountain Mine	S26,27,T24N,R57E		UG	development	11	Dan Callaghan, Mine Superintendent P.O. Box 636 Eureka, NV 89316
Ostlund, Robert	Osceola Mine & Mill	S2,T14N,R67E	gold	OP,ML	single bench gravity concentration	2	Robert Ostlund, Owner Baker Stage Route Ely, NV 89301
Placer-Dome U.S.A., Inc.	Bald Mountain Mine	S17,20,T24N,R57E	gold silver	OP,ML, HL	cyanidation	143	A. L. Walsh, Mine Manager P.O. Box 2706 Elko, NV 89801
Salisbury, Fred R.	Fred R. Salisbury Placer	S19,T14N,R67E	gold silver	OP,ML	gravity concentration	3	Fred R. Salisbury, Owner Star Route 5, Lot 24 Osceola, NV 89301
Silver King Mines, Inc.	East Robinson Project & Pine Tree Mill	S11,T16N,R62E	silver gold	OP,ML	single bench cyanidation	105	K. L. Stoker, President P.O. Box 324 East Ely, NV 89315

Digitized by Google

The Nevada Bureau of Mines and Geology (NBMG) is a research and public service organization in the Mackay School of Mines, University of Nevada-Reno. NBMG is charged by state law with the duty of investigating and reporting the geology and mineral resources of Nevada; it has no regulatory functions.

NBMG performs research, compiles information, and makes the information available through: 1) published maps and reports; 2) unpublished data files and collections; and 3) talks, correspondence, and personal contacts. NBMG also provides assaying and mineral identification services, and through its affiliation with the National Cartographic Information Center provides information and assistance on base maps and aerial photographs.

NBMG research includes all phases of Nevada's geology and mineral resources: 1) geologic mapping and laboratory studies; 2) geophysical and geochemical surveys; 3) engineering geology; 4) geologic considerations in urban and rural planning; 5) the preparation of educational guides and booklets; 6) statewide investigations of mineral commodities; 7) the geology of ore deposits; and 8) the exploration, development, mining, processing, utilization, and conservation of metal ores, industrial minerals, fossil and nuclear fuels, geothermal power, and water.

NBMG offices are located in the Mines Wing of the Scrugham Engineering-Mines Building on the University of Nevada-Reno campus; office hours are 8:00–4:30, Monday through Friday.

For information concerning the geology and mineral resources of Nevada, write to: Director/State Geologist, Nevada Bureau of Mines and Geology, University of Nevada-Reno, Reno, NV 89557-0088; or call (702) 784-6691. A publication list will be sent upon request.

For more information contact:
Nevada Bureau of Mines and Geology
Email: nbmg@unr.edu
Web: http://www.nbmg.unr.edu/

THE NEVADA MINERAL INDUSTRY 1987 Special Publication MI-1987

Digitized by Google