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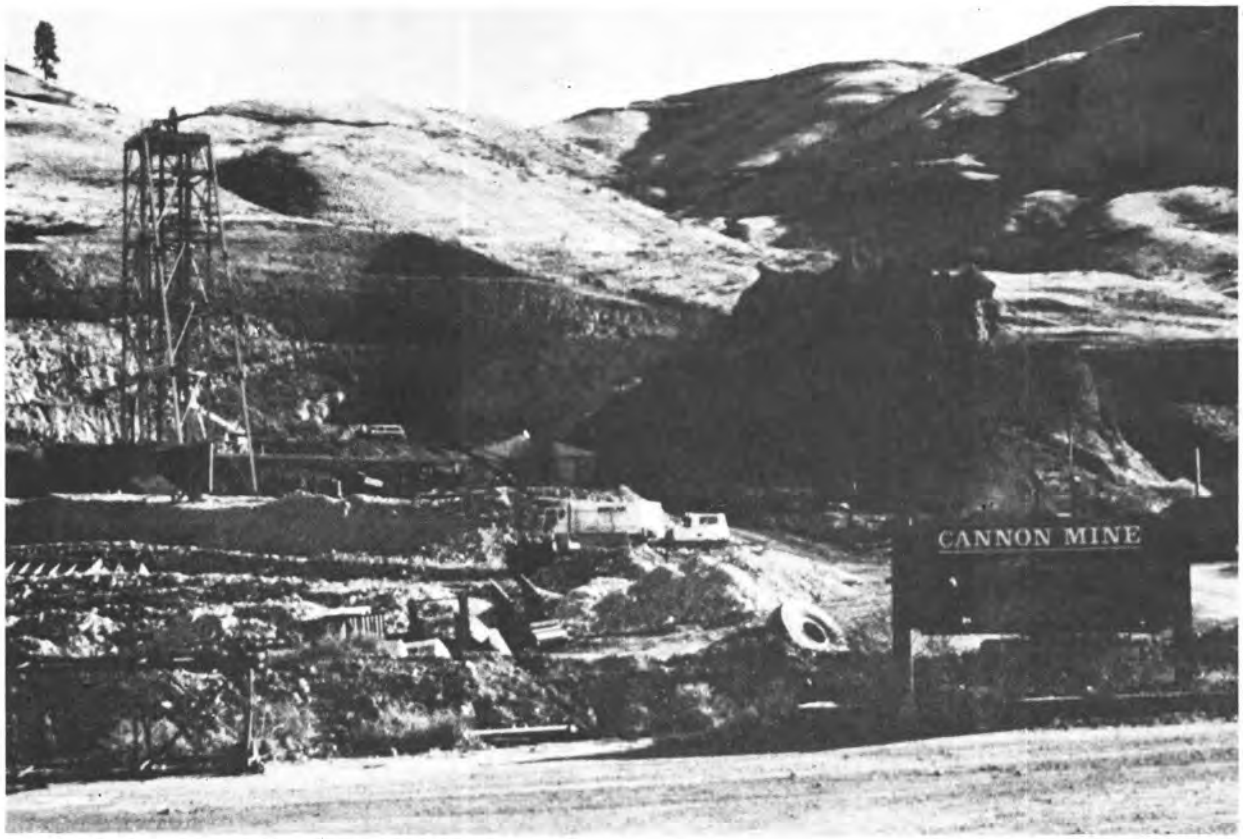

Site of the new Cannon mine and mill operated by Asamera Minerals, Inc. and Breakwater Resources, Ltd. in Wenatchee. Production is scheduled for mid-1985.

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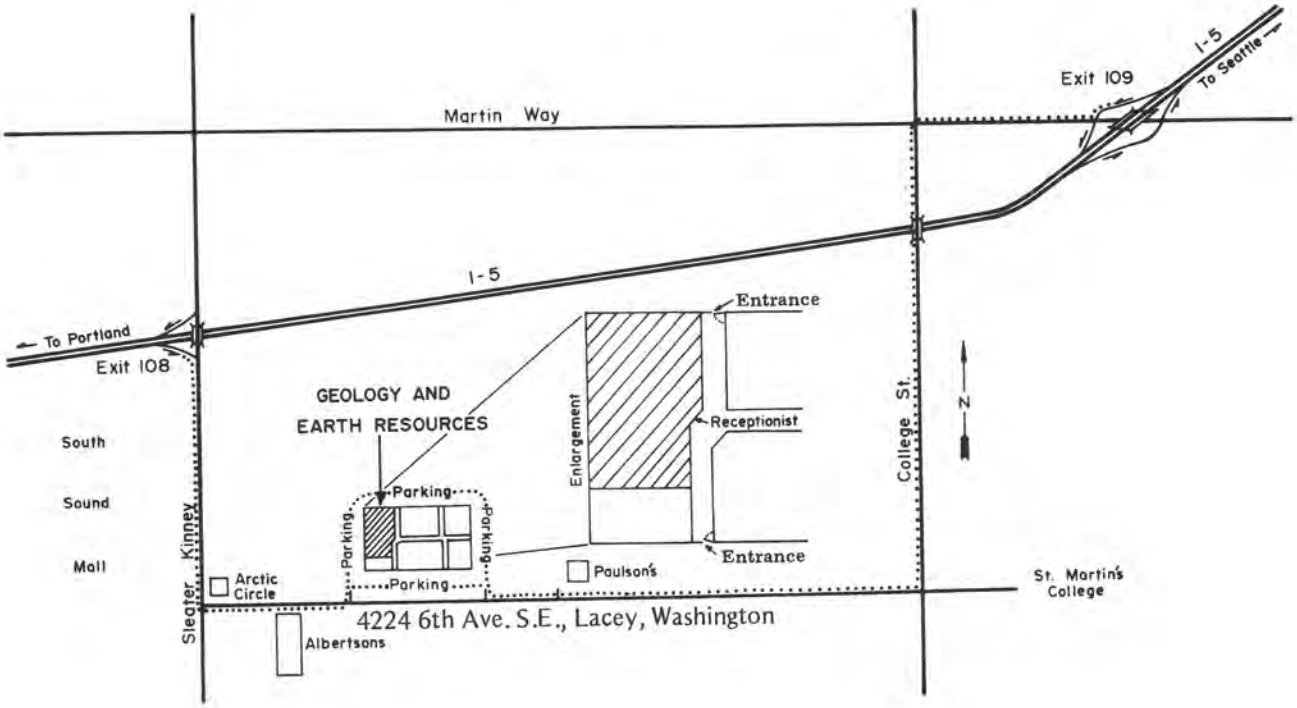

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NEW DEVELOPMENTS IN MINING AND MINERAL EXPLORATION IN WASHINGTON, 1984

by Bonnie B. Bunning *

The 1984 report on mining and mineral exploration in Washington was summarized from company data supplied voluntarily by questionnaire; as such, it is incomplete. The survey is restricted to metallic and industrial mineral commodities and does not include data on crushed rock or sand and gravel for which there are nearly 1,000 permitted sites within the state.

According to the U.S. Bureau of Mines, the estimated value of non-fuel mineral production in 1984 was $195 million, up 4 percent from 1983. The total reported investment in exploration and development of Washington's metallic mineral resources this year was nearly $33 million – more than double the 1983 total of $13,664,000. Pre-production development of the Cannon mine in Wenatchee by Asamera Minerals (U.S.) Inc. and Breakwater Resources Ltd. contributed $28.5 million to that total. Reported expenditures for other exploration increased over the 1983 figure of $3.6 million to almost $4½ million in 1984. Nearly 75 percent of that total was dedicated to exploration for gold and silver. More than 95 companies sought metals throughout the state this past year.

Reported expenditures for industrial commodities dropped to approximately $386,000 from more than $1 million a year ago, and only 26 firms reported their activities. The specific reasons for the decline have not been determined.

The total income from mining, prospecting, and quarrying on state lands reached a 5-year high of more than $870,000 (fig. 1). Rentals and royalties from mining and prospecting were also the highest in 5 years, totaling $283,015. The number of mining contracts and prospecting permits increased by 16 to 1,174 in 1984, maintaining the high level of activity established in 1983.

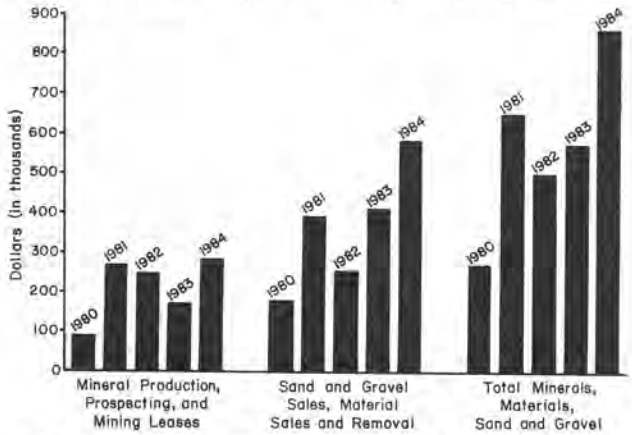

Figure 1. — Income from minerals and materials on state lands (1980-1984).

* Geologist for Division of Geology and Earth Resources field office in Spokane.

METALS

Mining

Eleven metal mining projects were under production or in advanced development in 1984 (table 1). Nine of these were primarily gold and silver operations. Secondary recovery of copper, lead, or zinc was reported at the Deer Trail mine in Stevens County and, in King County, at the Apex, Damon, and Cleopatra group of mines and the Coney Basin mine. At two properties – the Gold Dike mine in Ferry County and the Minnie mine in Okanogan County – gold is recovered by heap leaching. The Sherwood mine produced 327,793 pounds of uranium until it was shut down in August. Joy Mining Co. mined and stockpiled their uranium ore in anticipation of production in 1985. Approximately 18,700 oz of gold and 7,355 oz of silver were produced from Washington State ores during 1984.

The most intensive mining acitivity was centered on the B-Reef orebodies of Asamera Minerals (U.S.) Inc. and Breakwater Resources Ltd., where an 18-ft diameter, 620-ft-deep shaft, approximately 6,000 ft of decline, and three production access drifts into the orebody have been completed in preparation for mine production in March of 1985. The headframe is in place, a site for the concentrator has been cleared, the underground crushing station site has been excavated, and construction of the tailings impoundment dam is underway. The mine contains reserves of 6 million tons of ore grading 0.22 oz/ton gold.

According to the June 1984 Wallace Miner, the Cannon mine is expected to produce 182,000 oz of gold annually.

Exploration

Sixty-two companies responded to our questionnaire on their metallic mineral exploration in 1984. Published reports on mining and exploration contributed 34 companies to that list. These 96 firms explored a total of 102 projects (figs. 2 and 3; tables 2 and 3). Most were interested in gold and(or) silver. About a dozen sought lead and zinc or copper. Four companies explored for uranium. Two companies looked at tungsten, and individual interest was expressed in tin and gallium.

Most of the 1984 activity was concentrated in the Okanogan Highlands of Stevens, Ferry, Pend Oreille, and Okanogan Counties. Chelan County got the most attention of any individual county for gold exploration,

Table 1. — *Active metal mines in Washington, 1984*

County	Mine	Company	Commodity	Production and Development Data
Chelan	Cannon Mine	Asamera Minerals (U.S.) Inc. and Breakwater Resources Ltd.	Au,Ag	620-foot shaft in place; 6000-foot decline with three production-access drifts complete; millsite and tailings dam under construction; full-scale production anticipated for mid-1985
Ferry	Gold Dike Mine	Vulcan Mountain, Inc.	Au,Ag	Leaching continues on 50,000 tons of ore; exploration and development drilling in 1984 successful
	Knob Hill Mine	Hecla Mining Company	Au,Ag	Produced 63,000 tons of ore grading 0.25-oz/ton gold
	Seattle Mine	Crown Resource Corporation, Sutton Resources, Inc., and Gold Capital Corporation	Au,Ag	Estimated annual production of 500 tons per month grading 0.50-oz/ton gold
King	Coney Basin Mine	Terra Alta Mining Company	Au,Ag,Cu, Pb,Zn	Produced 7.875-oz gold, 155.4-oz silver, 693-lbs lead
	Damon Mine, Apex Mine, Cleopatra Mine	CSS Management Corporation	Au,Ag,Cu	Produced 600 tons of ore grading 0.04-oz/ton gold, 12-oz/ton silver, 10-percent copper
Okanogan	Minnie Mine	Cordilleran Development, Inc.	Au,Ag	10,000 tons of ore mined and prepared for heap leaching; projected recoverable grade of 0.14-oz/ton gold. 3.5-oz/ton silver
Stevens	Deer Trail Mine	Madre Mining Ltd.	Ag,Cu,Pb, Zn	In late 1983, shipped 240 tons of concentrate containing 44,000-oz silver, 129,600-lbs zinc, 100,800-lbs lead
	Flodelle Creek Mine	Joy Mining Company (WashTex)	U_3O_8	Ore mined and stockpiled; mill circuit tested; full production estimated for 1985
	Sherwood Mine	Western Nuclear, Inc.	U_3O_8	Produced 225,225 tons grading 0.073-percent U_3O_8 or 327,793-lbs U_3O_8

and activity in the area extended beyond Wenatchee to Douglas and Kittitas Counties. Scattered efforts were put forth along the length of the Cascades and in the Olympic Mountains.

Chelan County

Asamera Minerals (U.S.) Inc. and Breakwater Resources Ltd. expanded exploration efforts beyond the Cannon mine site this year. The joint venture explored the Goldwell property and the Compton, Jugla, and Volkman properties located on the southeast side of Squilchuck Canyon, 1½ miles from the B-Reef deposits. The May 10, 1984, Northern Miner reported that drilling in that area intercepted 65 ft of 0.274 oz/ton gold in one hole at 680 ft and a 60- to 80-ft section that carried visible gold in a second hole. Asamera and Breakwater have also acquired a 47 percent interest in the Lovitt Mining Co., which netted a 30 percent interest in approximately 500 acres of mineral leases in Squilchuck Canyon. The partners now control more than 4,000 acres in the Wenatchee area with the option of acquiring a majority interest in several properties controlled by Ican Resources, Lincoln Resources, Seagold Ltd., and Goldbelt Mines.

In mid-1984, United Mining Corp., which controlled the old Lovitt mine and a 9-acre parcel within the B-Reef zone, merged with Silver Strike Resources Ltd., based in Vancouver B.C. At the same time, United Mining Corp. reached an option agreement with Tenneco Inc. to explore

Polished slab of high grade ore with visible gold from the Cannon mine in Wenatchee.

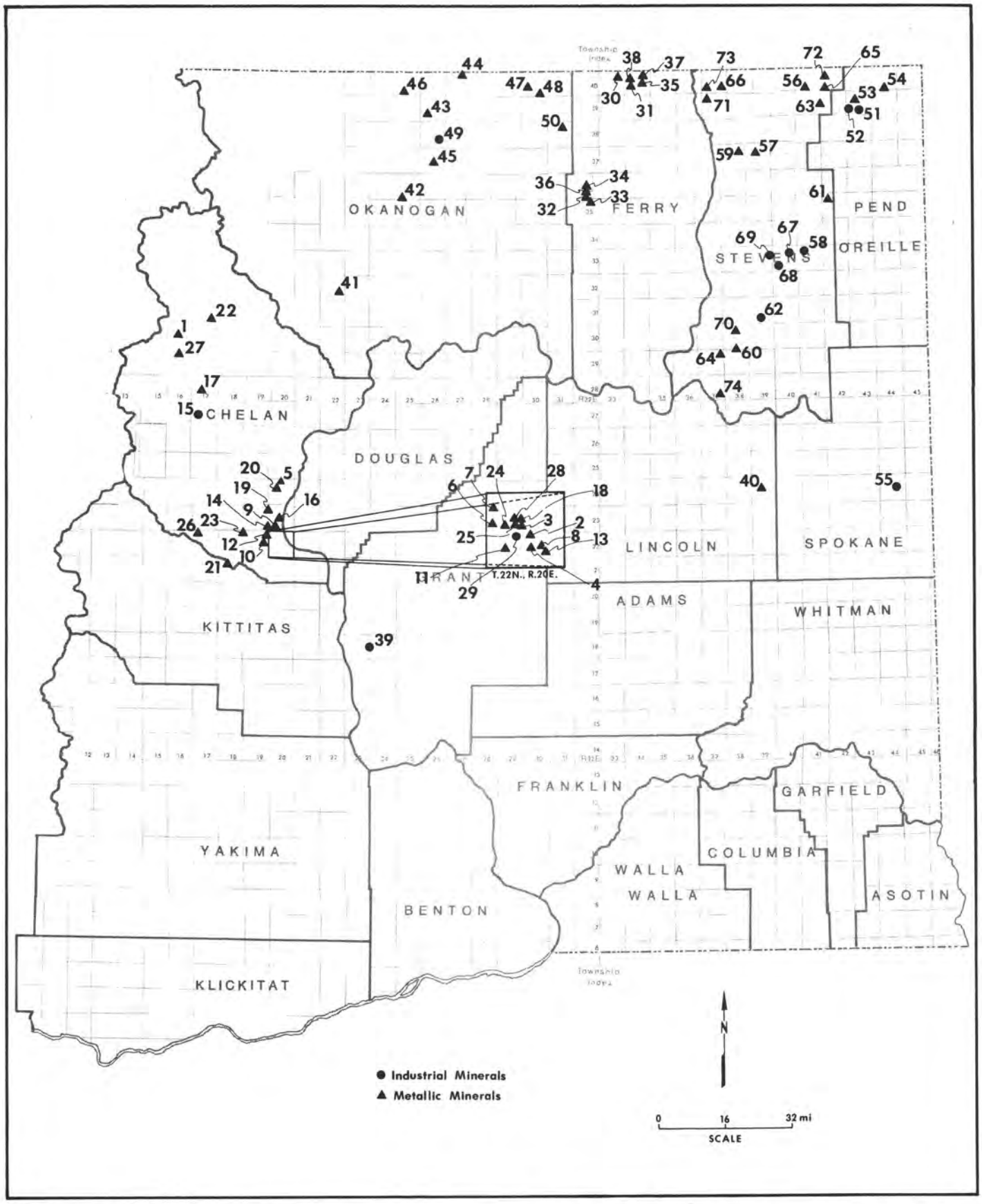

Figure 2. — Exploration and development in eastern Washington, 1984. (Note: Prospect numbers are keyed to table 2.)

Table 2. — *Exploration and development in eastern Washington, 1984 (Note: Prospect numbers are keyed to fig. 2.)*

Prospect No.	Owner/Operator (Property)	Location	Commodity	Remarks
1	Artillery Resources (Red Mountain Mine)	Secs. 15, 22 T.30N., R.16E. Chelan County	Au,Ag	Sampling; drilling; clearing old workings
2	Asamera Minerals (U.S.) Inc. and Breakwater Resources Ltd. (Goldwell property)	Sec. 22 T.22N., R.20E. Chelan County	Au,Ag	Exploration drilling encountered 65 feet of 0.274-oz/ton gold mineralization
3	Asamera Minerals (U.S.) Inc. and Breakwater Resources Ltd. (Cannon Mine)	Sec. 16 T.22N., R.20E. Chelan County	Au,Ag	$24 million invested in mine and mill development for mid-1985 startup
4	Asamera Minerals (U.S.) Inc. and Wilbur Hallauer (Compton, Jugla, Volkman)	Sec. 27 T.22N., R.20E. Chelan County	Au	Exploration on lease
5	Bro Resources (Bro Resources property)	Secs. 31-36 T.23N., R.20E.; Secs. 1-12 T.24N., R.20E. Chelan County	Au,Ag	Joint exploration of gold soil anomalies with Cove Energy Corporation, Sporan Resources, Nalcus Resources
6	Continental Silver Corporation (Leman Gold prospect)	Sec. 18 T.22N., R.20E. Chelan County	Au,Ag	Geochemical and geophysical exploration; drilling planned
7	Control Energy Corporation (Meyers property)	Sec. 7 T.22N., R.20E. Chelan County	Au,Ag	Exploration
8	Cove Energy Corporation (H-4 property)	Sec. 26 T.22N., R.20E. Chelan County	Au,Ag	Drilling planned in joint venture with Asamera and Breakwater
9	Del Norte Chrome Corporation (Horse Lake)	Secs. 24, 25 T.23N., R.19E.; Sec. 36 T.23N., R.20E. Chelan County	Au,Ag	Exploration; drilling planned in joint venture with Silver Lake Resources
10	E & B Explorations (H-2 property)	Sec. 13 T.22N., R.19E. Chelan County	Au,Ag	Drilled 2,014 meters in four holes on an I.P. anomaly without success for Cove Energy Corporation
11	Hargor Resources Inc. (Wenatchee claims)	Sec. 29 T.22N., R.20E. Chelan County	Au,Ag	Encouraging results from geochemical program
12	ICAN Resources Ltd. (Wenatchee area)	Sec. 1 T.22N., R.19E. Chelan County	Au,Ag	Acquired 620 acres adjacent to joint venture of Asamera and Breakwater
13	Leader Resources Inc. (640 acres in Wenatchee area)	Sec. 26 T.22N., R.20E. Chelan County	Au,Ag	Soil sampling and geophysics in joint venture with Teck Corporation and Multinational Resources Inc.
14	Lincoln Resources (128 claims)	Sec. 36 T.23N., R.19E. Chelan County	Au,Ag	Exploration in joint venture with REA Petro Corporation
15	Matthews Scientific Foundation (Feldslite property)	Sec. 20 T.27N., R.17E. Chelan County	Au,Ag	Restaking claims; exploration
16	Monte Christo Resources (Wenatchee property)	Sec. 16 T.22N., R.20E. Chelan County	Au,Ag	Exploration
17	Prism Resources (EN prospect)	Secs. 21, 22 T.28N., R.17E. Chelan County	Au,Ag	Strong I.P. anomaly coincident with soil geochemical anomalies
18	Sea Gold Oil Corporation (Isenhart lease and other properties)	Sec. 16 T.22N., R.20E.; T.20N., R.17E.; T.21N., R.17E. Chelan County	Au,Ag	Gold reported in drilling results; drilling on gold and geophysical anomaly
19	Silver Lake Resources Inc. (Horse Lake property)	Sec. 30 T.23N., R.20E. Secs. 24, 25 T.23N., R.19E. Chelan County	Au,Ag	I.P., geochemistry, drilling planned

Table 2. — *Exploration and development in eastern Washington, 1984* — **Continued**

Prospect No.	Owner/Operator (Property)	Location	Commodity	Remarks
20	Snobird Resources Ltd. (Snobird and TBH claims)	Secs. 1-18 T.24N., R.20E. Chelan County	Au,Ag	Exploration drilling in joint venture with TBH Minerals, Bighorn Energy Group, Atkinson-Rice Corporation
21	St. Joe American Corporation (Star claims)	T.21N., R.18E. Chelan and Kittitas Counties	Au,Ag	Mapping; sampling
22	Sunshine Valley Resources (Holden Mine, ten other properties)	Secs. 17, 18 T.31N., R.17E. Chelan County	Au,Cu	Sampling
23	Teck Resources (U.S.) 1983, Inc. (Properties in Wenatchee area)	Townships 22, 23, 24 Ranges 18, 19, 20 Chelan County	Au,Ag	Exploration; drilling
24	Templar Mining (Wenatchee property)	Sec. 17 T.22N., R.20E. Chelan County	Au,Ag	Drilling; gold values as high as 10 feet of 0.307-oz/ton intersected
25	Tenneco Minerals Company (B-Reef and L-D Mine)	Sec. 16 T.22N., R.20E. Chelan County	Au,Ag	Close-spaced drilling completed; mineralization intersected; joint project with United Mining Corporation
26	Tillicum Gold Mines Ltd. (Blewett Pass)	Sec. 6 T.22N., R.17E. Chelan County	Au,Ag	Sampling and prospecting
27	Two Rivers, Inc. (Trinity Mine, Red Mtn. Mine)	Secs. 15, 22 T.30N., R.16E. Chelan County	Au,Ag	Exploration
28	Weaco Resources Ltd. (Wenatchee property)	Sec. 16 T.22N., R.20E. Chelan County	Au,Ag	3,550 feet of drilling; results showed "little or no commercial value"
29	Wenatchee Silica Products (Wenatchee Silica Quarry)	Sec. 21 T.22N., R.20E. Chelan County	Au,Ag	Quarry bought by Asamera Minerals; production to continue
30	Azure Resources (Lone Star Mine)	Sec. 2 T.40N., R.33E. Ferry County	Au,Cu	Exploration drilling planned for northwest copper zone and gold zone
31	Canorex International, Inc. (Various properties)	Secs. 28, 29 T.40N., R.34E. Ferry County	Au,Ag,Cu, Pb,Zn	Exploration
32	Crown Resource Corporation, Sutton Resources, Inc., and Gold Capital Corporation (Seattle Mine)	Sec. 31 T.37N., R.32E. Ferry County	Au,Ag	Production and development in joint venture with Sutton Resources, Inc. and Gold Capital Corporation
33	Crown Resource Corporation (Flag Hill Mine)	Secs. 1, 2 T.36N., R.32E. Ferry County	Au,Ag	Exploration and development
34	Crown Resource Corporation (South Penn)	Sec. 22 T.37N., R.32E. Ferry County	Au,Ag	Heap-leach test
35	Crown Resource Corporation (Granny)	Near Curlew Ferry County	Au,Ag	Exploration drilling
36	Hecla Mining Company (Knob Hill Mine)	Sec. 27 T.37N., R.32E. Ferry County	Au,Ag	Mine life extended two years with new reserves; continued production
37	Sundance Mining & Development (Gold Hill property)	North of Curlew Ferry County	Au,Ag	Drilled five successful holes
38	Vulcan Mtn. Mining Company (Gold Dike Mine)	Secs. 7, 8 T.40N., R.34E. Ferry County	Au,Ag	Heap leaching (50,000 tons) in progress; exploration drilling successful
39	Witco Chemical Corporation (Grant County Pits)	T.18N., R.23E. T.17N., R.24E. Grant County	Diatomite	Mined 60,000 tons
40	Rexcon, Inc. (Junction Reef)	Sec. 16 T.24N., R.39E. Lincoln County	Au,Ag	Geophysical exploration; shallow drilling in joint venture with Veronex Resources Ltd.

Table 2. — *Exploration and development in eastern Washington, 1984* — **Continued**

Prospect No.	Owner/Operator (Property)	Location	Commodity	Remarks
41	Cordilleran Development, Inc. (Minnie Mine)	Sec. 23 T.32N., R.22E. Okanogan County	Au,Ag	Heap leaching and mine development
42	Crown Resource Corporation (Key)	Sec. 31 T.36N., R.25E. Okanogan County	Au,Ag	Exploration drilling on gold-bearing magnetite prospect
43	Wilbur Hallauer (Copper World Extension)	Sec. 20 T.39N., R.26E. Okanogan County	Au,Cu	Drilling
44	Wilbur Hallauer (Kelsey property)	Secs. 5-8 T.40N., R.27E. Okanogan County	Au,Cu	Drilling; sampling
45	Wilbur Hallauer (Starr Moly)	Sec. 16 T.37N., R.26E. Okanogan County	Mo,W	Drilling; sampling
46	Kaaba Resources Inc. (Ruby Silver Mine)	Sec. 28 T.40N., R.25E. Okanogan County	Ag,Au	Rehabilitation of old workings; exploration
47	Keystone Gold Inc. (Crystal Butte)	Sec. 35 T.40N., R.30E. Okanogan County	Au,Ag	Exploration
48	Keystone Gold Inc. (Grey Eagle)	Sec. 16 T.40N., R.30E. Okanogan County	Au,Ag	Exploration
49	Lucky Three Mining Company (Limestone deposit)	Sec. 25 T.38N., R.26E. Okanogan County	Limestone	Acquired limestone deposit through acquisition of CM Silver Mines Inc.
50	Western Land & Resources (Bodie Mine)	Sec. 3 T.38N., R.31E. Okanogan County	Au,Ag	Exploration in joint venture with Crown Resource Corporation
51	Lehigh Portland Cement Company (Champane Placer)	Sec. 27 T.39N., R.43E. Pend Oreille County	Limestone	Mining (238,195 tons)
52	Lehigh Portland Cement Company (Troyer)	Sec. 20 T.39N., R.43E. Pend Oreille County	Silica	Mining (23,804 tons)
53	Pintlar Corporation (Pend Oreille Mine)	T.39N., R.43E. Pend Oreille County	Pb,Zn	Exploration; drilling; mine maintenance; flood prevention
54	Terra Alta Mining Company (LaSota Prospect)	Sec. 22 T.40N., R.44E. Pend Oreille County	Au,Ag,Pb	Exploration
55	Interpace Corporation (Mica plant and mine)	Secs. 14, 23 T.24N., R.44E. Spokane County	Clay	Drilling; development; mining
56	Arbor Resources, Inc. (Melrose Mine)	Sec. 28 T.40N., R.41E. Stevens County	Ag	Trenching; soil sampling
57	Canorex International, Inc. (Various properties)	Sec. 9 T.37N., R.39E. Stevens County	Au,Ag,W, Pb,Zn	Exploration; drilling; option to explore Grandview Mines, Inc. properties
58	Chewelah-Eagle Mining Company and Nanome Aggregates, Inc. (Blue Star Mine)	Sec. 5 T.33N., R.41E.; Sec. 32 T.32N., R.41E. Stevens County	Dolomite	Mining by Nanome Aggregates, Inc. for roof chips, terrazzo
59	Getty Mining Company (Bonanza Mine)	Secs. 2, 11 T.37N., R.38E. Stevens County	Ag,Cu,Pb, Zn	Exploration and drilling
60	Huckleberry Mtn. Ltd. (Huckleberry Mtn.)	T.29N., R.38E.; T.30N., R.38E. Stevens County	Au,Ag,Cu, Mo,U	Exploration
61	Joy Mining Company (WashTex) (Flodelle Creek Mine)	Sec. 5 T.35N., R.42E. Stevens County	U_3O_8	Mining and stockpiling; mill circuit testing; production expected in 1985

Table 2. — *Exploration and development in eastern Washington, 1984* — **Continued**

Prospect No.	Owner/Operator (Property)	Location	Commodity	Remarks
62	Lane Mtn. Silica Company (Lane Mountain claims)	Sec. 22 T.31N., R.39E.; Sec. 34 T.31N., R.39E. Stevens County	Silica	Drilling; mining; milling
63	Leadpoint Consolidated Mines Company (Leadpoint Consolidated properties)	Secs. 12, 13, 23 T.39N., R.41E.; Secs. 7, 12, 13, 17, 20 T.39N., R.42E. Stevens County	Ag,Pb,Zn	Exploration; mapping
64	Madre Mining Ltd. (Deer Trail Mine)	Secs. 1, 12 T.29N., R.37E. Stevens County	Ag,Cu,Pb Zn	Operations suspended in mid-June after reported location of new ore reserves
65	Mines Management, Inc. (Iroquois and Advance properties)	Secs. 19, 20, 29, 30 T.40N., R.42E.; Sec. 18 T.39N., R.41E. Stevens County	Pb,Zn	Trenching, timbering, drilling in joint venture with Bitterroot Resources Ltd.
66	Mines Management, Inc. (Big Iron property)	Sec. 24 T.40N., R.37E. Stevens County	Au	Trenching, timbering, drilling in joint venture with Bitterroot Resources Ltd.
67	Nanome Aggregates, Inc. (15 properties in county)	Near Valley Stevens County	Dolomite, marble	Exploration; drilling; mining; milling
68	Northwest Alloys Inc. (Blue Creek Quarry)	Sec. 29 T.33N., R.40E. Stevens County	Silica	Mining; milling
69	Northwest Alloys Inc. (West Dolomite Pit)	Sec. 12 T.33N., R.39E. Stevens County	Dolomite	Mining; milling
70	Northwest Minerals Development (Becky B. [Cleveland])	Secs. 3, 4, 9, 10 T.30N., R.38E. Stevens County	Ag,Pb,Zn	Exploration
71	Shell Mining Company (First Thought Mine)	Secs. 7, 18 T.39N., R.37E. Stevens County	Au	Drilling; optioned by Rochester Minerals Inc.
72	Terra Alta Mining Company (Lakeview Mine)	Sec. 7 T.40N., R.42E. Stevens County	Au,Ag,Pb	Exploration
73	Vanhorn & Watson Mining Company (Copper Penny, Gold Nugget)	Secs. 19, 20 T.40N., R.37E. Stevens County	Au,Ag,Cu, Pb,Zn	Exploration
74	Western Nuclear Inc. (Sherwood Mine)	Sec. 36 T.28N., R.37E. Stevens County	U_3O_8	Mining; milling

the Wenatchee area properties. Subsequent drilling by Tenneco in the B-Reef area intersected mineralization with intercepts grading as high as 1.349 oz/ton gold over 51 ft. Several holes in the prospect area were reported to carry visible gold.

Templar Mining Co. announced encouraging results from drilling their Wenatchee property. Hole No. 84-13 reportedly contained 15 ft of 0.173 oz/ton gold with a 5-ft section grading 0.442 oz/ton gold. Hole No. 84-2 intersected 20 ft of 0.124 oz/ton gold, 150 ft to the southeast. The 554 acre property adjoins the Asamera-Breakwater ground on the west and north.

Seagold Ltd. drilled several properties in the Wenatchee area. Drilling on the Isenhart lease was targeted on favorable gold geochemistry coincident with an induced polarization and resistivity anomaly. Mining Magazine (October, 1984) reports that gold was found and drilling is continuing. Favorable geochemistry and induced polarization anomalies were also slated for detailed exploration on the Noyd and Magee leases.

Prism Resources Co. reports silt sample results from their EN prospect of up to 1.02 oz/ton gold. An induced polarization and resistivity survey revealed a strong geophysical anomaly not far from the geochemical "highs." The property is located more than 20 miles north of the Cannon mine.

Del Norte Chrome Corp., in joint venture with Silver Lake Resources Inc., explored the Horse Lake property with geophysical and geochemical surveys this year. Plans call for drilling the property in the near future.

Figure 3. — Exploration and development in western Washington, 1984. (Note: Prospect numbers are keyed to table 3.)

Table 3. — *Exploration and development in western Washington, 1984 (Note: Prospect numbers are keyed to fig. 3.)*

Prospect No.	Owner/Operator (Property)	Location	Commodity	Remarks
1	Ideal Basic Industries, Inc. (Twin Rivers Quarry)	Secs. 23, 26 T.31N., R.10W. Clallam County	Clay	Mined 120,000 tons
2	Hidden Brick Company (Hidden Brick Quarry)	T.2N., R.1E. Clark County	Clay	Mined 248 tons
3	Ocean Farms, Inc. (Grays Harbor property)	Sec. 13 T.18N., R.12E. Grays Harbor County	Peat moss	Mined 200,000 tons
4	CSS Management Corporation (Damon Mine, Apex Mine, Cleopatra Mine)	Secs. 33, 34 T.26N., R.10E. King County	Au,Ag,Cu, Pb,Zn	Mining; milling; development; produced 600 tons ore, grading 0.04-oz/ton gold and 12-oz/ton silver
5	Industrial Mineral Products Inc. (Ravensdale Silica Sand Mine)	Sec. 36 T.22N., R.26E. King County	Silica	Mining; milling; 111,196 tons produced
6	Mutual Materials Company (Elk Pit)	Sec. 34 T.22N., R.7E. King County	Clay	Mining
7	Mutual Materials Company (Cougar Mtn.)	Sec. 31 T.24N., R.6E. King County	Clay	Mining
8	Terra Alta Mining Company (Coney Basin Mine)	Sec. 13 T.25N., R.10E. King County	Au,Ag,Cu, Pb,Zn	Exploration; small-scale mining
9	United Cascade Mining Corporation (United Cascade, Gilbreath properties)	Sec. 24 T.24N., R.11E. King County	Au,Ag,Cu, Mo,Pb, Zn	Exploration; drilling
10	Mutual Materials Co. (Clay City Pit)	Sec. 25 T.17N., R.4E. Pierce County	Clay	Mining
11	IMC Olivine (Twin Sisters Quarry, Hamilton Plant)	Sec. 3 T.36N., R.7E. Skagit County	Olivine	Produced 23,000 tons from inventory; mine development
12	Duval Corporation (Margaret property)	Secs. 8, 17, 18 T.10N., R.6E. Skamania County	Cu	Relinquished claims to Mt. St. Helens National Volcanic Monument
13	Cominco American Inc. (Menzel Lake property)	T.30N., R.7E. Snohomish County	Au	Geochemical exploration
14	Olivine Corporation (Swen Larsen Quarry)	Sec. 34 T.38N., R.6E. Whatcom County	Olivine	Mining; milling
15	Seattle - St. Louis Mining Company (Minnesota Mine)	Sec. 2 T.37N., R.16E. Whatcom County	Au,Ag	Exploration; trenching; sampling
16	Western Gold Mining Inc. (Newlight Mine)	Sec. 27 T.38N., R.17E. Whatcom County	Au,Ag	Exploration

Weaco Resources Ltd. drilled five holes on their lease north of the Cannon mine without success.

Cove Energy Corp. was joined by Asamera Minerals and Breakwater Resources in drilling the H-4 and H-2 properties in the Wenatchee area. Initial drilling on the H-2 prospect reportedly did not intersect economic mineralization. Exploration is continuing.

Teck Resources (U.S.) Inc. reports exploration and drilling on several properties near Wenatchee. Monte Christo Resources Ltd. and Hargor Resources Inc. also explored land in the area.

Control Energy Corp. explored their Myers property for gold.

Wenatchee Resources Ltd. reports exploration on the Jack property.

Numerous mining trade journals carried accounts of exploration and drilling plans on properties in the Wenatchee area by Leader Resources, Inc., Nalcus Resources Ltd., Sporan Enterprises, Bro Resources, Ltd., Multinational Resources, Inc., Continental Silver Corp., and Cove Energy Corp.

The Red Mountain mine in northern Chelan County was explored by Artillery Resources, which leased the property from Two Rivers Inc. E & B Exploration of

Vancouver, B.C., was contracted to conduct underground drilling.

Not far from Red Mountain, the Feldslite property was again studied by Matthews Scientific Foundation. The property, long known for its feldspar resources, is being examined for silver and gallium carried in large veins of biotite.

A sizeable group of claims staked by Snobird Resources, Ltd. and TBH Minerals Inc. is being evaluated and drill-tested in the Entiat area. Atkinson-Rice and Bighorn Energy Group are backing the project.

Sunshine Valley Minerals, of Manson, Washington, reports gold and copper exploration at the Holden mine in northern Chelan County, as well as exploration on several gold properties in the Entiat area.

Tillicum Gold Mines Ltd. carried out geochemical sampling and prospecting on their gold property near Blewett Pass.

Two companies, Nord Resources Corp. and Exploration Ventures Co., reported exploration in Chelan County at unspecified locations.

Ferry County

Shortly after announcing plans to close the Knob Hill mine because reserves were exhausted, Hecla Mining Co. extended mine life at least 2 more years on the strength of additional ore zones found by exploration. Hecla produced 63,000 tons of ore grading 0.25 oz/ton gold during 1984.

Hecla also milled ores from the nearby Seattle mine, operated by Crown Resource Corp. in joint venture with Sutton Resources, Inc. and Gold Capital Corp. Early estimates of Seattle mine output peg production at roughly 500 tons per month, grading approximately 0.5 oz/ton gold. Crown continued exploration at both the Seattle mine and the Granny property located near Curlew, Washington. Drilling at the Granny targeted bulk tonnage, high-grade gold zones. Crown also carried out a heap leach test on ore from the South Penn mine in the Republic district.

Leaching is continuing at Vulcan Mtn. Inc.'s Gold Dike mine, near Danville. Fifty thousand tons of ore is being leached year-round, with ultimate recovery predicted to be 80 percent of the contained gold. Silver and copper will also be recovered. More than 5 years of reserves are in hand, with excellent potential for additional reserves to be located. Exploration drilling to confirm and expand reserves was reported to be successful.

According to the California Mining Journal (January, 1985) Sundance Mining-Development, Inc. successfully drilled their Gold Hill property, 5 miles north of Curlew. Twelve 100-ft holes, outlined approximately 80,000 to 90,000 tons of minable ore in two orebodies

Heap leaching operation recovers gold from the Gold Dike mine, owned and operated by Vulcan Mtn. Inc.

grading about 0.07 oz/ton gold with added values in silver. Production is expected to begin in 1985.

Azure Resources, Ltd. reopened some of the old Lone Star mine workings near the Canadian border and drilled and sampled the gold and copper ore zones. The property is leased from Wilbur Hallauer, of Oroville.

Several properties in Ferry County were explored by Canorex International Inc., of Denver, Colorado.

General reconnaissance was reported by Callahan Mining Corp., Freeport Exploration Co., and Goldfields Mining Corp.

King County

Minor production of gold, silver, lead, and copper were reported by two firms in King County this year. CSS Management Corp. reports mining a total of 600 tons of ore grading 0.04 oz/ton gold and 12 oz/ton silver with 10 percent copper from the Apex, Damon, and Cleopatra mines located near Skykomish, Washington. The ores are processed in a pressure leaching plant designed to recover metals from complex sulfide ores. The plant, installed with help from the U.S. Bureau of Mines Reno Research Center, will be tested through 1985. Nearby, at the Coney Basin mine, Terra Alta Mining Co. sent a 10½-ton bulk sample of gold-silver-lead ore to the Cominco smelter in Trail, B.C. Ore grades were reported at 0.75 oz/ton gold, 14.8 oz/ton silver, and 3.3 percent lead. That property has since been optioned to a Canadian firm.

Elsewhere in King County, United Cascade Mining Co. reports assessment work only at their gold, silver, copper, molybdenum, lead, and zinc properties along the Middle Fork of the Snoqualmie River.

Rexcon, Inc. sampled the White Cap property for gold and silver.

Kittitas County

St. Joe American Corp. reports geologic and geochemical exploration for gold on their Star claims located in Chelan and Kittitas counties. According to the January 1984 Engineering and Mining Journal, St. Joe also leased some property in the Liberty area from Gold Placers Inc. for gold exploration. However, an article in the November 12, 1984, Wenatchee World states that St. Joe has withdrawn its interest in the area. The same article mentions increased activity in the Liberty and Swauk areas by Schaaf & Associates, of Delta, Colorado, and Pederson Northwest Mining Services, of Wenatchee.

Two other companies, Nord Resources Corp. and Goldfields Mining Corp., carried out reconnaissance exploration in Kittitas County this year.

Lincoln County

The sole operator reporting from Lincoln County this year was Rexcon, Inc., which explored its Junction Reef gold prospect with shallow drilling and electromagnetic, magnetic, and resistivity surveys.

Okanogan County

Late in October, heap leaching began on 10,000 tons of gold-silver ore mined from the Minnie mine near Twisp. The July 25, 1984, Mining Record quotes owner-operator, Cordilleran Development, Inc., as reporting proven and probable reserves of 30,000 tons of ore with recoverable metal grades of 0.14 oz/ton gold and 3.5 oz/ton silver. The November 1, 1984, Wallace Miner reports the project is partly financed by Carson Oil and Exploration, Inc.

Crown Resource Corp. drilled the Key property for precious metals in gold-bearing magnetite ores. They also explored the Bodie mine area, which was reported in the January 1984 Engineering and Mining Journal to be a joint project with Western Land and Resources, Inc.

Kaaba Resources, Inc. rehabilitated some of the old Ruby Silver mine workings and carried out general exploration there as well.

Exploration drilling was reported by Wilbur Hallauer, of Oroville, Washington, on three properties in Okanogan County: The Starr Molybdenum property was examined for tungsten; the Kelsey property on the Canadian border was drilled and resampled to check precious metal potential of the copper-bearing ores; and the Copper World Extension property on Palmer Mountain was drilled and sampled as a follow-up to 1983 precious metal exploration.

Keystone Gold Inc. explored the Crystal Butte and Grey Eagle prospects with detailed geochemical and geological studies.

Reconnaissance work in Okanogan County was reported by Callahan Mining Co. and Goldfields Mining Corp.

Pend Oreille County

Pintlar Corp. kept the pumps running at the Pend Oreille mine in Metaline Falls, and reported exploration drilling and mine development work there in 1984.

Terra Alta Mining Co. explored the La Sota lead-zinc property.

Canorex International, Inc. worked on several properties in Pend Oreille County this year.

Callahan Mining Co. and Exploration Ventures Co. report reconnaissance level exploration in the area.

Skamania County

Youngquist Mine Development, Inc. reports mine development and mining for gold, silver, and silica at the Wind River mine.

Stevens County

Western Nuclear Inc. operated the Sherwood mine and mill until August 1st this year, when unfavorable market conditions forced its temporary closure. A total of 327,793 pounds of U_3O_8 was produced from ore grading 0.073 percent U_3O_8.

The Deer Trail mine and mill, a victim of low silver prices and economic difficulties in 1984, suspended operations in mid-June. Just prior to closing down operation, Madre Mining Ltd. had announced the discovery of enough ore to run the mill on a 24-hour basis.

While the bugs are being worked out of the mill circuit, Joy Mining Co. continues to mine and stockpile uranium ore from the Flodelle Creek bog. Plans call for full-scale production sometime in 1985.

Shell Mining Co. drilled the First Thought mine near Orient, Washington, during 1984. The company has since leased its extensive holdings around the mine to Rochester Minerals, Inc.

Drilling was also reported by Mines Management, Inc. on the Big Iron property held for potential values in gold. The project is a joint venture effort with Bitterroot Resources Ltd., of British Columbia. Mines Management also did backhoe trenching on the Advance property and re-timbering of underground workings on the Iroquois.

Elsewhere in Stevens County, drilling was reported by Getty Mining Co. at the Bonanza mine, and Canorex International Inc. explored for gold, silver, copper, lead, and zinc on several properties in the county. According to the September 1984 Engineering and Mining Journal, Canorex International Inc. optioned the Stevens County properties held by Grandview Mines of Spokane.

Huckleberry Mountain Ltd. studied their extensive holdings in central Stevens County with geological mapping and geochemical sampling. Metals sought were gold, silver, copper, molybdenum, and uranium.

Not far from Huckleberry Mountain, Northwest Minerals Development Corp. explored the Becky B. mine (formerly known as the Cleveland) for gold, silver, lead, and zinc.

Vanhorn and Watson Mining Co. of Colville, reports exploration on their Copper Penny and Gold Nugget claims.

Leadpoint Consolidated Mines Co., also a Colville-based company, explored for silver, lead, and zinc on their properties. Geological mapping was done for them by Brady-Knowlton and Associates of Davis, California.

Arbor Resources Inc. sought silver by soil sampling and trenching at the Melrose mine near Northport.

Terra Alta Mining Co. explored the Lakeview mine in the same area. The Lakeview is developed on a 4-inch vein carrying silver, lead, zinc, and gold.

Rocky Mountain Energy maintained an interest in uranium this year with reconnaissance exploration on both the Colville and Spokane Indian Reservations.

General reconnaissance exploration in Stevens County is reported by Callahan Mining Co., Boise Cascade Corp., Coca Mines Inc., Exploration Ventures Co., and Freeport Exploration Co.

Whatcom County

Western Gold Mining, Inc. of Colville reports that underground sampling was carried out on the Western Gold (Newlight) property by R & B Resources Ltd. this past season.

Workings at the Minnesota mine were reopened and trenches dug and sampled by Seattle-St. Louis Mining Co. on the continuation of a small-scale exploration program initiated several years ago.

NONMETALS

Twenty-six companies produced or explored for industrial commodities in 1984, a drop of six over 1983 (table 4). The total dollars invested in exploration also declined from $1 million in 1983 to $386,000 this year. While activity in general was down, 1984 output increased substantially for producers of clay and silica. At the same time, barite activity was all but eliminated. Competition from Asian suppliers and reduced oil and gas drilling are cited as the primary causes of the decline in the barite industry. Dolomite quarrying for terrazzo and white rock increased this year, while dolomite mining for magnesium production declined. Overall, fewer operators produced and explored for industrial commodities in the state this year, but most of those in production saw much improved conditions over 1983.

Chelan County

According to a report in the September 2, 1984, Wenatchee World, Asamera Minerals (U.S.) Inc. bought the Wenatchee Silica Products, Inc. operation in Dry Gulch. The quarry will continue to operate as a wholly owned subsidiary and Asamera will use some of the silica sands in constructing their nearby tailings dam.

W. R. Matthews of Matthews Scientific Foundation reports continued research related to the quartz-mica-feldspar potential of the Feldslite property near Lake Wenatchee. One ton of material was quarried in 1984.

Clallam County

One hundred and twenty thousand tons of clay was produced from the Twin Rivers quarry on the Olympic Peninsula. The quarry is operated by Ideal Basic Industries, Inc. of Seattle. Exploration was also reported by the company.

Clark County

Hidden Brick Co. again produced a small amount of clay (248 tons) from their clay pits in the city limits of Vancouver, Washington. The shallow resource has reportedly been worked for over 100 years.

Grant County

Diatomite production from Witco Chemical Corp.'s Grant County pits declined by 5,000 tons from last year to 60,000 tons of diatomite. Washington continues to be one of only four states producing diatomite in the United States.

Grays Harbor County

Two hundred thousand tons of peat moss were taken from the Grays Harbor property by Ocean Farms, Inc., a Hoquiam firm with logging and lumber interests.

King County

Industrial Mineral Products increased silica production at their Ravensdale Silica Sand mine this year, netting 111,196 tons of silica.

Mutual Materials Co. upped their production in King County as well, taking a total of 120,000 cubic yards of clay from their Cougar Mountain and Elk pits this year.

Pend Oreille County

Lehigh Portland Cement reports production of 23,804 net tons of silica from the Troyer property and 238,195 net tons of limestone from the Champane Placer in Metaline Falls. Both commodities are used onsite to manufacture portland cement.

Table 4. — *Industrial mineral production in Washington, 1984*

County	Mine	Company	Commodity	Production and Development Data
Chelan	Feldslite property	Matthews Scientific Foundation	Quartz, mica, feldspar	1 ton
Clallam	Twin Rivers Quarry	Ideal Basic Industries, Inc.	Clay	120,000 tons
Clark	Hidden Brick Quarry	Hidden Brick Company	Clay	248 tons
Grant	Grant County Pits	Witco Chemical Corporation	Diatomite, silica	60,000 tons (net)
Grays Harbor	Grays Harbor property	Ocean Farms, Inc.	Peat moss	200,000 tons
King	Cougar Mtn.	Mutual Materials Company	Clay	100,000 yd^3
	Elk Pit	Mutual Materials Company	Clay	20,000 yd^3
	Ravensdale Silica Sand Mine	Industrial Mineral Products Inc.	Silica	111,196 tons
Pend Oreille	Champane Placer	Lehigh Portland Cement Company	Limestone	238,195 tons (net)
	Troyer	Lehigh Portland Cement Company	Silica	23,804 tons (net)
Pierce	Clay City Pit	Mutual Materials Company	Clay	30,000 yd^3
Skagit	Twin Sisters Quarry, Hamilton Plant	IMC Olivine	Olivine	23,000 tons (from inventory)
Spokane	Mica Plant and Mine	Interpace Corporation	Clay	10,000 tons
Stevens	Blue Creek Quarry	Northwest Alloys Inc.	Silica	40,328 tons
	Blue Star Mine	Chewelah-Eagle Mining Company and Nanome Aggregates, Inc.	Dolomite	500 tons
	Lane Mountain claims	Lane Mtn. Silica Company	Silica	200,000 tons (net)
	West Dolomite Pit	Northwest Alloys Inc.	Dolomite	315,096 tons
	Miscellaneous (15 properties in county)	Nanome Aggregates, Inc.	Dolomite, marble, crushed rock	18,000 tons
Whatcom	Swen Larsen Quarry	Olivine Corporation	Olivine	25,000 tons

Pierce County

The Clay City pits of Mutual Materials Co. produced 30,000 cubic yards of clay in 1984.

Skagit County

IMC Olivine Corp., of Hamilton, produced 23,000 tons of olivine from inventory this year.

Spokane County

Interpace Corp. produced 10,000 tons of clay from its operations at Mica. This represents an improvement over 1983, when only exploration and development activities were reported.

Stevens County

Stevens County continues to be the leader in number of industrial mineral operations for the state.

Northwest Alloys quarried a total of 40,328 tons of silica from the Blue Creek quarry, and 315,096 tons of dolomite from the West Dolomite pit this year. Production was down considerably from the 1983 figures.

Lane Mountain Silica Co. had a good year, outstripping the 1983 output by 54,000 tons, for a total of 200,000 tons in 1984.

Nanome Aggregates, Inc. also increased production of dolomite for terrazzo chips and decorative stone this year. Nanome reports taking a total of 18,000 tons from various quarries in Stevens County, including the Blue Star mine owned by Chewelah Eagle Mining Co.

Boise Cascade prospected for barite on their lands in Stevens and Ferry Counties.

Canorex International, Inc. also sought barite in the northeastern Washington counties this year.

Statewide Reconnaissance

General reconnaissance was reported by Meridian Minerals Co. for diatomite and limestone, and by Cominco American, Inc. for industrial minerals.

COAL ACTIVITY IN WASHINGTON, 1984

by Henry W. Schasse *

Coal activity in terms of exploration in Washington during 1984 was noticeably less than during each of the previous 3 years. This resulted from a combination of a depressed coal market, corporate reorganizations, and mergers.

Most activity in terms of actual exploration came from exploratory drilling by Royal Land Co. (formerly Kennecott Minerals Co.), in western Lewis County. Royal Land Co. is a subsidiary of Old Ben Coal Co., whose parent company is SOHIO. Royal Land continued drilling its lease holdings along the Curtis-Vader belt. Their environmental baseline studies, which were begun last year, have been put on hold. They conducted a baseline hydrological study during 1984. According to Royal Land representatives, the Vader project has been funded for 1985.

Meridian Minerals Co. (formerly called Meridian Land and Mineral Co.) reduced its 1984 exploration efforts considerably over those of the previous year. During 1984, Meridian drilled five exploratory holes on its holdings in the Green River coal district in southern King County. The company plans to continue exploratory drilling at a modest scale in 1985.

Washington Irrigation and Development Company (WIDCO) continues its mining operation at Centralia where 3,863,000 tons of coal was produced in 1984 for the Centralia Steam Plant. The 1984 production, slightly less than last year but significantly less than its average of 4.5 million tons during the previous 10 years, reflects a combination of energy conservation efforts, a plentiful water supply for hydro-power, and the shutdown of several large consumers of electrical power such as aluminum plants. The company also continued confirmation drilling of its mineral holdings in the Centralia area.

WIDCO is continuing the underground coal gasification (UCG) research it started in 1980. The UCG efforts are now being handled by a subsidiary, Empire Energy Co., which maintains its office in Chehalis. Plans continue for a 90-day commercial-scale test involving two simultaneous UCG modules growing together. The Gas Research Institute will manage the experiment planned for late 1986. WIDCO will donate the test site for the experiment. Sponsors of the project also include the Gas Research Institute, Washington State Energy Office, Amoco Production Co., and the Weyerhaeuser Co. Results of the CRIP UCG test performed in 1983 were published in February, 1984.

Old King Coal Co. terminated its secondary coal operation at Centralia where, since 1979, it had salvaged coal from material rejected by the larger scale beneficiation process at the WIDCO wash plant. The installation of an upgraded beneficiation process by WIDCO accounted for the termination. Old King Coal Co. is currently supplying customers from its stockpile, which will probably by depleted by mid-1985. Coal sales by Old King Coal Co. during 1984 amounted to approximately 14,200 tons.

Terraspace Inc., of Rockville, Maryland, submitted its final report to the U.S. Bureau of Mines on a feasibility study of an underground hydraulic coal mine, near Wilkeson, Washington. Their mine plan was made for a 2-million(clean)-ton-per-year mine using two shafts to access the coal to a depth of 2,500 ft. The proposed mining method uses monitor jets to break coal by sublevel retreat mining and then brings it to the surface via flumes and pumps to a preparation plant.

Palmer Coking Coal Co. produced 8,900 tons of bituminous coal from its stripping operation on the McKay seam near Black Diamond, in King County. This exceeds their production for 1983 by approximately 1,400 tons.

Pacific Coast Coal Co. (PCCC), which announced plans to develop an open-pit mine (John Henry No. 1) northeast of Black Diamond in 1982, expects to receive its mining permit from the federal Office of Surface Mining (OSM) in early 1985. PCCC still must receive approval from King County, but expects that permit also to be forthcoming. Once the permits have been granted, PCCC will begin breaking ground on its mine (which it anticipates could occur about mid-1985). The mine has a planned capacity of 250,000 tons per year.

Utah International, Inc., of Salt Lake City, drilled a 2,000-ft coal exploratory hole southwest of Carbonado in Pierce County, in early 1984. The company also investigated coal potential in the Roslyn and Taneum-Manastash areas of Kittitas County.

The Council of Energy Resource Tribes, of Englewood, Colorado, completed drilling for the Muckleshoot Indian Tribe in southwestern King County. The drilling attempted to establish the existence of coal methane resources in the area. A report of their activities is still forthcoming.

Getty Oil Co., involved in a corporate takeover by Texaco in 1984, has terminated its coal exploration activities in Washington.

Amoco Production Co., Denver, drilled eight stratigraphic test holes (each less than 2,000 ft) in the Puget Lowland of King and Pierce Counties. Part of the testing included coal methane measurements. Amoco is one of the industry leaders in coalbed demethanization.

* Geologist with Division of Geology and Earth Resources.

Wilexco, Inc., of Denver, Colorado, has also shown strong interest in coalbed methane resources in Washington. Its efforts thus far have consisted of preliminary studies and library research.

Gulf Mineral Resources Co., of Denver, showed some interest early in 1984 in possible UCG sites in Washington, particulary in the Centralia-Chehalis coal district and in the Pierce County coalfields. Gulf has been involved in UCG testing of steeply dipping coal seams.

OIL AND GAS ACTIVITY IN WASHINGTON, 1984

by Carl McFarland *

Shell Oil Co. completed drilling their BN 1-9 well in sec. 9, T. 15 N., R. 25 E., in Grant County, to a total depth of 17,518 feet, making it the deepest well ever drilled in the state. They plugged the well on 10-13-84, almost 2 years after spudding it. The well had some very good gas shows but was not considered commercial.

Amoco Production Co. is still testing the Weyerhaeuser No. 1-29, located in sec. 29, T. 19 N., R. 8 W., in Grays Harbor County. Amoco has reached a total depth of 12,293 feet.

Amoco also drilled eight stratigraphic test (less than 2,000 ft) holes in King and Pierce Counties this past year. All the holes have been plugged.

Shell and Arco have done considerable seismic work east of the Cascades, and Arco and Amoco conducted seismic work west of the Cascades during 1984.

DIVISION REPORTS WIN AWARDS

Two Division of Geology and Earth Resources publications recently won awards in the 1984-1985 Pacific Northwest Technical Publications competition sponsored by the Puget Sound Chapter of the Society for Technical Communication. A "Distinguished" award (first place) in the technical reports category was given to "Geology of the Grande Ronde Lignite Field, Asotin County, Washington" (Report of Investigations 27). Keith Stoffel, author and geologist, began research on the area's geologic evolution and the distribution, thickness, and quality of coal reserves in 1980. The report was edited by Laura Bray and the design and cartographic work was done by Keith Ikerd and Donald Hiller. The publication will now be submitted to the Society's International Technical Publications competition.

A "Merit" award (third place), also in the technical reports category, was given to "Availability of Federal Land for Mineral Exploration and Development in the State of Washington" (Geologic Map GM-30), authored by D'Arcy P. Banister, Donald J. Barnes, and Warren D. Longwill of the U.S. Bureau of Mines. Theodore R. Brandt, cartographer with the U.S. Bureau of Mines, designed and produced the maps and diagrams. Donald Hiller and Keith Ikerd designed the publication's layout and provided cartographic assistance. Laura Bray provided editorial support.

Entries for the competition came from both private and governmental agencies, many with larger budgets and staffs than our division. We are gratified to be recognized in such a field of competitors.

GEOLOGIC REPORT RELEASED ON COLVILLE INDIAN RESERVATION

The Colville Confederated Tribes has released the "Revised Geology and Mineral Potential of the Colville Indian Reservation, Washington, 1984," a report on the 5-year exploration program conducted by the Colville Tribal Geology Department.

The two-volume hard-bound set includes 81 pages of text and 13 oversize color plates. The set sells for $100 and is available from the Colville Confederated Tribes, PO Box 150, Nespelem, Washington 99155.

RECENT U.S. GEOLOGICAL SURVEY OPEN-FILE REPORTS ADDED TO OUR DIVISION LIBRARY

The following U.S. Geological Survey Open-File Reports are now available for inspection in our Division library. However, if you wish to purchase any of these reports, please write or call:

Open-File Services Section
Western Distribution Branch
U.S. Geological Survey
Box 25425, Federal Center
Denver, CO 80225
(303) 236-7476

Prepayment is required. Open-file reports are announced, with price, in the monthly list, "New Publications of the Geological Survey." A free subscription to the list may be obtained on application to: Mailing List Unit, U.S. Geological Survey, 329 National Center, Reston, VA 22092.

Evarts, R. C.; Ashley, R. P., 1984, Preliminary geologic map of the Spirit Lake quadrangle, Washington: U.S. Geological Survey Open-File Report 84-480, 1 sheet, scale 1:48,000.

Frizzell, V. A., Jr.; Tabor, R. W.; Booth, D. B.; Ort, K. M.; Waitt, R. B., Jr., 1984, Preliminary geologic map of the Snoqualmie Pass 1:100,000 quadrangle, Washington: U.S. Geological Survey Open-File Report 84-693, 43 p., 1 plate, scale 1:100,000.

* Geologist for Division of Geology and Earth Resources.

THESES ADDED TO OUR DIVISION LIBRARY

We have recently acquired the following theses in our Division of Geology and Earth Resources library where they are now available for reference work.

Adekoya, A. A., 1983, Conodont analysis of a limestone lense in the black shale belt of northeast Washington: Washington State University Master of Science thesis, 65 p.

Cleveland, S. R., 1982, Deposition and diagenesis of the middle member of the Metaline Formation, Clugston Creek, Stevens County, Washington: University of Idaho Master of Science thesis, 98 p.

Cushman, C. D., 1984, Geology and sedimentary petrology of the Taneum/Manastash Creeks area, Kittitas County, Washington: Eastern Washington University Master of Science thesis, 132 p., 2 plates.

Mancuso, T. K., 1983, The origin of stratiform barite in Stevens County, Washington: University of Idaho Master of Science thesis, 115 p.

Moye, F. J., 1984, Geology and petrochemistry of Tertiary igneous rocks in the western half of the Seventeenmile Mountain 15 minute quadrangle, Ferry County, Washington: University of Idaho Doctor of Philosophy thesis, 242 p., 2 plates.

Polivka, D. R., 1984, Quaternary volcanology of the West Crater-Soda Peaks area, southern Washington Cascade Range: Portland State University Master of Science thesis, 78 p., 1 plate, scale 1:24,000.

Roland, J. L., 1983, A paleomagnetic age investigation of pre-Salmon Springs Drift Pleistocene deposits in the southern Puget Lowland, Washington: Western Washington University Master of Science thesis, 93 p.

Sisson, T. W., 1982, Sedimentary characteristics of the airfall deposit produced by the major pyroclastic surge of May 18, 1980 at Mount St. Helens, Washington: University of California, Santa Barbara Master of Arts thesis, 145 p., 2 plates.

Thompson, M. E., 1984, Solidification in magmas; Part one — The magmatic history of the Tatoosh volcanic-plutonic complex, Mount Rainier National Park; Part two — Numerical simulation of heat and mass transfer in solidifying magmas: University of Oregon Master of Science thesis, 227 p.

GEOLOGIST 2 EMPLOYMENT OPPORTUNITY

Geologist 2, Washington Department of Natural Resources, Division of Geology and Earth Resources. Requires B.S. in Geology or closely allied field and 2 years professional experience in minerals and(or) economic geology. M.S. in minerals or economic geology may substitute for experience. Must be available to Spokane, Washington. Starting salary: $24,180 per year. For recruiting announcement and application forms, call or write Wendi Jolly, DNR Personnel Section, 1102 S. Quince St., Olympia, WA 98504, (206) 753-5310, by February 27, 1985. Equal Opportunity Employer.

RECENTLY PUBLISHED REPORT BY THE DIVISION OF GEOLOGY AND EARTH RESOURCES NOW AVAILABLE

Coal Publication Updated

Bulletin 47 — Coal reserves of Washington, by H. M. Beikman, H. D. Gower, and T. A. M. Dana. 1961. 115 p. Reprinted with 15 page addendum, by H. W. Schasse, T. J. Walsh, and W. M. Phillips in 1984. Price $3.25 plus 25 cents tax.

"Coal Reserves of Washington" was first printed in 1961, and by the early 1980's the report was about to go out of print. Because the original version contains much information that is still pertinent on the coal within the state, such as the location, thickness, extent of coal, rank of coal beds, all known commercial coal deposits, and estimates of coal reserves, the Washington Division of Geology and Earth Resources decided to reprint this section in its original form. Then, in order to bring the bulletin up-to-date, a 15-page addendum was included in the new printing.

The addendum consists of an update of coal production statistics since January 1, 1960, and changes in ASTM coal rank standards that reclassify 237 million tons of coal in King County from subbituminous to bituminous. Notable changes in stratigraphic nomenclature of coal-bearing formations are mentioned, along with significant exploration and mining activities that have occurred since 1960. Another significant event was the opening of a large surface mine at Centralia in Lewis County in 1971. The mine supplies a mine-mouth thermo-electric power plant which accounted for over 7 percent of all electricity generated in Washington in 1980. Information on this mine is included in the addendum.

The authors of the addendum, H. W. Schasse, T. J. Walsh, and W. M. Phillips, are geologists with the Washington Division of Geology and Earth Resources.

Copies of this publication may be obtained by writing to the Department of Natural Resources, Division of Geology and Earth Resources, Mail Stop PY-12, Olympia, WA 98504.

Please send $1 to cover our Handling and Distribution charge for your total publication order.

DIVISION OF GEOLOGY AND EARTH RESOURCES RELEASES OPEN-FILE REPORTS

The following open-file reports may be purchased from the Department of Natural Resources, Division of Geology and Earth Resources, Mail Stop PY-12, Olympia, WA 98504; they are also available for inspection in our Division library.

Please send $1 to cover our Handling and Distribution charge for your total publication order.

Manson, Connie J., compiler, 1985, Bibliography and index to U.S. Geological Survey open-file reports on the geology and mineral resources of Washington State: Washington Division of Geology and Earth Resources Open-File Report 84-7, 133 p. Price $3.94 plus 31 cents tax.

Wagner, Holly [U.S. Geological Survey], 1985, Preliminary geologic framework studies showing bathymetry, locations of geophysical tracklines and exploratory wells, sea floor geology and deeper geologic structures, magnetic contours, and inferred thickness of Tertiary rocks on the continental shelf and upper continental slope off southwestern Washington between latitudes 46° N. and 47°30' N. and from the Washington coast to 125°20' W.; prepared under cooperative agreement no. 14-12-0001-3115 between U.S. Minerals Management Service and American Association of State Geologists, administered by Texas Bureau of Economic Geology: Washington Division of Geology and Earth Resources Open-File Report 85-1, 6 p., 5 plates, scale 1:250,000. Price $3.94 plus 31 cents tax.

RECENT PERMITS FOR OIL AND GAS DRILLING

Operator	Permit no.	County	Well name	Location	Ground elevation (feet)	Estimated total depth (feet)	Spud date	Date permit issued
				Oil and Gas Exploratory Wells				
AMOCO Prod. Co.	354	King	Enumclaw Mill No. 1-34	1,430 ft FNL and 1,370 ft FWL sec. 34 (20-7E)[1]	1,447	2,500	5-16-83	5-16-83
AMOCO Prod. Co.	386	Grays Harbor	Amoco-Weyerhaeuser No. 1-29	2,601 ft FWL and 2,377 ft FSL sec. 29 (19-8W)	390	12,000[2]	6-26-84	5-31-84
Shell Western E & P Inc.	387	Grant	Maughan et al No. 1-5	1,398 ft FSL and 1,822 ft FEL sec. 5 (15-25E)	1,937	15,000	Canceled	7-11-84
Shell Western E & P Inc.	394	Grant	Maughan et al No. 1-29	221 ft FSL and 2,140 ft FEL sec. 12 (15-24E)	2,241	15,000	Canceled	8-2-84
				Oil and Gas Stratigraphic Tests				
AMOCO Prod. Co.	355	Pierce	WC-83-7	3,112 ft FSL, and 528 ft FWL sec. 25 (16-5E)	1,680	1,500		9-1-83
AMOCO Prod. Co.	356	Pierce	WC-83-1	1,990 ft FWL and 2,033 ft FSL sec. 11 (19-6E)	755	1,800		7-26-83
AMOCO Prod. Co.	362	King	WC-83-9	1,489 ft FNL and 1,297 ft FWL sec. 25 (24-7E)	842	1,500		7-26-83
AMOCO Prod. Co.	363	King	WC-83-8	1,779 ft FWL and 601 ft FSL sec. 19 (23-8E)	2,190	1,500		7-26-83
AMOCO Prod. Co.	364	Lewis	WC-83-4	2,005 ft FSL and 2,569 ft FEL sec. 23 (14-5E)	1,835	1,500		7-26-83
AMOCO Prod. Co.	365	Lewis	WC-83-12	488 ft FWL and 2,212 ft FSL sec. 7 (14-5E)	1,515	2,000	Canceled	12-15-83
AMOCO Prod. Co.	366	Pierce	WC-83-11	347 ft FSL and 330 ft FWL sec. 11 (19-6E)	752	2,000	Canceled	12-29-83
AMOCO Prod. Co.	367	Pierce	WC-83-13	964 ft FNL and 1,015 ft FWL sec. 10 (15-6E)	3,260	2,000	Canceled	12-29-83

RECENT PERMITS FOR OIL AND GAS DRILLING - Continued

Operator	Permit no.	County	Well name	Location	Ground elevation (feet)	Estimated total depth (feet)	Spud date	Date permit issued
				Oil and Gas Stratigraphic Tests - Continued				
AMOCO Prod. Co.	371	King	WC-83-31	114 ft FSL and 1,194 ft FEL sec. 15 (25-8E)	1,125	2,000	Canceled	2-2-84
AMOCO Prod. Co.	372	King	WC-83-32	739 ft FNL and 2,032 ft FEL sec. 26 (26-7E)	620	2,000	Canceled	2-2-84
AMOCO Prod. Co.	373	Pierce	WC-83-26	40 ft FSL and 609 ft FEL sec. 17 (16-4E)	725	2,000	Canceled	2-2-84
AMOCO Prod. Co.[3]	374	King	WC-83-17	847 ft FSL and 1,460 ft FWL sec. 13 (22-6E)	645	2,000	3-23-84	2-2-84
AMOCO Prod. Co.	375	King	WC-83-16	2,254 ft FNL and 562 ft FEL sec. 4 (20-7E)	1,246	2,000	Canceled	2-2-84
AMOCO Prod. Co.	377	King	WC-83-20	696 ft FSL and 123 ft FWL sec. 1 (24-6E)	435	2,000	Canceled	2-22-84
AMOCO Prod. Co.[4]	378	King	WC-83-21	216 ft FSL and 1,131 ft FEL sec. 33 (21-6E)	675	2,000	4-10-84	2-15-84
AMOCO Prod. Co.	379	Pierce	WC-83-23	1,073 ft FSL and 1,130 ft FEL sec. 24 (19-5E)	820	2,000	Canceled	2-15-84
AMOCO Prod. Co.	380	Lewis	WC-83-24	2,244 ft FSL and 2,356 ft FWL sec. 1 (14-4E)	1,635	2,000	Canceled	2-15-84
AMOCO Prod. Co.	381	Lewis	WC-83-25	1,023 ft FNL and 752 ft FEL sec. 29 (13-4E)	1,540	2,000	Canceled	2-15-84
AMOCO Prod. Co.	382	Pierce	WC-83-28	2,335 ft FNL and 661 ft FEL sec. 19 (19-6E)	520	2,000	Canceled	2-15-84
AMOCO Prod. Co.	384	Lewis	WC-83-33	1,107 ft FNL and 1,243 ft FEL sec. 33 (13-4E)	1,355	2,000	Canceled	2-15-84
AMOCO Prod. Co.	385	Pierce	WC-83-34	700 ft FNL and 2,346 ft FEL sec. 25 (16-3E)	725	2,000	Canceled	2-15-84
AMOCO Prod. Co.	388	Pierce	WC-83-35	1,255 ft FSL and 108 ft FEL sec. 36 (20-5E)	810	2,000	Canceled	8-2-84
AMOCO Prod. Co.	389	Pierce	WC-83-36	99 ft FSL and 2,287 ft FWL sec. 21 (19-5E)	810	2,000	Canceled	8-2-84
AMOCO Prod. Co.	390	King	WC-83-37	739 ft FSL and 2,838 ft FEL sec. 34 (22-7E)	4,097	2,000	Canceled	8-2-84
AMOCO Prod. Co.	391	King	WC-83-38	288 ft FSL and 538 ft FEL sec. 14 (21-7E)	1,306	2,000	Canceled	8-2-84
AMOCO Prod. Co.	392	Pierce	WC-83-39	2,005 ft FWL and 158 ft FNL sec. 16 (19-6E)	702	2,000	Canceled	8-2-84
AMOCO Prod. Co.	393	Pierce	WC-83-40	160 ft FWL and 2,226 ft FNL sec. 36 (18-6E)	1,540	2,000	Canceled	8-2-84

[1] Land description indicates that the location is 965 ft from the west line and 1,869 ft from the north line of sec. 9, township 15 north, range 25 east, Willamette meridian.

[2] Total depth 12,293 ft.

[3] Total depth 1,736 ft; converted to water well.

[4] Total depth 1,517 ft; converted to water well.

Department of Natural Resources
Division of Geology and Earth Resources
Olympia, WA 98504

BULK RATE
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Permit 263