Division Releases
"Selected Papers on the Geology of Washington" and Three Open-File Reports

The Division of Geology and Earth Resources announces the publication of its Bulletin 77, "Selected Papers on the Geology of Washington". J. Eric Schuster is editor of this volume. The 406-page book is a collection of technical papers derived from a symposium presented at the Cordilleran Section meeting of the Geological Society of America in 1982. Not all talks given at the symposium are represented in the volume, and several papers on related topics have been added to those from the symposium. Virtually all papers have been updated within the last year. The 19 papers cover topics ranging from geochronology to tectonics and from the Priest River metamorphic complex to the Columbia River basalts to recent deposits at Mount St. Helens.

The publication is available from the Division's Olympia office; its address is given on page 2 of this newsletter. The price is $14.84 + 1.16 tax (Washington residents) = $16.00. Please add $1 to each order for postage and handling.

Connie Manson, Division librarian, has compiled literature about landslides in western Washington. Open File Report 88-1, which is 58 pages long, is titled "Landslides of western Washington—A preliminary bibliography and index". The index is arranged primarily by county or geographic area.

A second bibliography, also compiled by Connie Manson, covers literature for Ferry County. Open File Report 88-2, "Bibliography of the geology and mineral resources of Ferry County, Washington, 1900-1987" is 58 pages long. It contains a subject index, and the bibliographic entries are also listed by geologic age of the described materials.

Open File Report 87-17 is a series of geologic maps of the Twisp River-Chelan Divide region of the North Cascades of Washington. The author of this report is Robert B. Miller of San José State University. A summary map is at 1:100,000-scale, and 11 component maps are at 1:24,000.

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Mineral Collecting Opportunities in Washington
by Raymond Lasnmaa, State Geologist

This issue of the Division newsletter features an article by Nancy Joseph on the status of Washington's mineral industry during 1987. Minerals provide one of the foundations for an industrialized society, as well as an important source of revenue for Washington.

In addition to their economic role, minerals, as well as fossils and other geologic materials, also provide enjoyment to a significant portion of Washington's population. Whether the activities involve field collection, the faceting of a gemstone, or the study of crystals, all are a means of learning about our Earth.

As with virtually everything else these days, we are becoming more specialized at work and play. So it is with "rockhounding." Depending on one's interest, there is an organization to match and foster it. With the advent of sport and opportunities to visit collecting sites, we offer some information for those wishing to get involved in mineral collecting. Among the groups active in Washington are the following:

Northwest Federation of Mineralogical Societies

The northwest region covers Alaska, Idaho, Montana, Oregon, Utah, and Washington. The federation's individual member clubs are involved in all aspects of rockhounding, with emphasis on lapidary arts, but many members are basically collectors. The Northwest Federation has an annual exhibition. The membership directory lists, for example, 40 clubs for Washington and their memberships. The directory costs $3 and is available from:

Hermena Koloki, Directory Chair
Northwest Federation of Mineralogical Societies
208 Fairview 2 East
Great Falls, Montana 59404

Davies, E.; Curie, R.; Sawyer, B.; compilers, 1987,


OTHER REPORTS OF INTEREST

Association of State Floodplain Managers, 1987, Realistic approaches to better floodplain management; proceedings of the 11th annual conference: University of Colorado Natural Hazards Information Center Special Publication 18, 322 p.


Geological Society of America Committee for the Magnetic Anomaly Map of North America, 1987, Magnetic anomaly map of North America: Geological Society of America Data NAG Continental-scale Map 003, 4 sheets, scale 1:5,000,000.

King County Parks, Planning and Resources Department, 1987, Sensitive areas map folio, King County, Washington: King County Parks, Planning and Resources Department, 1 v.


Petersen, Donald; Cordill, Allen; Jeffries, Alleen; Melby, Lynn; Ziegler, Gordon, 1987, Special investigation report by the Department of Social and Health Services Iodine-129 Task Force: Washington Department of Social and Health Services, 59 p.


Selected Additions to the
Division of Geology and Earth Resources
Library
January-February, 1988

THESES

U.S. GEOLOGICAL SURVEY REPORTS


GEological Survey of Canada REPORTS

by
Nancy L. Joseph

According to information obtained by the Division of Geology and Earth Resources, 23 metal and industrial mineral operations (excluding sand and gravel) produced gold, silver, limestone, dolomite, silica, olivine, diatomite, and clay in 1987 (Table 1). Three portland cement plants and seven plants producing lime, calcium chloride, precipitated calcium carbonate, or ground limestone were also in operation (Table 2).

Nonfuel mineral production in Washington in 1987 was valued at $402 million, according to preliminary figures compiled by the U.S. Bureau of Mines. This represents a 7 percent increase over the 1986 value of $376 million. The 1986 figure, which is considerably greater than the preliminary $254 million figure previously reported (Joseph, 1987), includes adjustments to the preliminary figures and reporting by the Bureau of Mines, for the first time, of the value of magnesium metal production by Northwest Alloys, Inc.

In 1987 Washington ranked 20th in the nation in nonfuel mineral production, according to the Bureau of Mines. Precious metal production increased significantly because of increased output at both the Canron mine and the Republic Unit. Increases in production and value of gold and silver, increased production of sand and gravel, and the steady, near-capacity output of magnesium metal were more than sufficient to offset a 25 percent decrease in the production of portland cement, which was caused, in part, by the shut-down of Columbia Northwest Cement Corp.

Total revenue from prospecting, mining, and quarrying, including sand and gravel production, on state lands was $506,069 for the fiscal year ending June 30, 1987 (Fig. 1). This represents a nearly 12 percent increase in revenues over the previous fiscal year. Revenues for the present fiscal year should exceed those of 1987 because of reform of the mineral lease...
Table 1—Mineral exploration and development in Washington, 1987. Locations given where available. See Figures 2a and 2b for property locations.

<table>
<thead>
<tr>
<th>Loc. no.</th>
<th>County</th>
<th>Operator(s)</th>
<th>Property or area</th>
<th>Location</th>
<th>Commodity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chelan</td>
<td>Asamena Minerals Inc./Breakwater Resources Ltd.</td>
<td>Cannon mine sec. 16</td>
<td>T.22N., R.20E.</td>
<td>Au, Ag</td>
<td>Mining and milling</td>
</tr>
<tr>
<td>2</td>
<td>Chelan</td>
<td>Asamena Minerals Inc./Orange Gold Inc., Teck Resources (U.S.), Inc.</td>
<td>Lovitt mine sec. 22</td>
<td>T.22N., R.20E.</td>
<td>Au</td>
<td>Drilling and sampling</td>
</tr>
<tr>
<td>3</td>
<td>Chelan</td>
<td>Welcome Nugget Mines</td>
<td>Welcome Nugget #1</td>
<td>T.26N., R.18E.</td>
<td>Au, Ag</td>
<td>Exploration</td>
</tr>
<tr>
<td>4</td>
<td>Clallam</td>
<td>Ideal Basic Industries, Inc.</td>
<td>Twin River secs. 22-23</td>
<td>T.3N., R.18W.</td>
<td>Clay</td>
<td>Mining</td>
</tr>
<tr>
<td>5</td>
<td>Ferry</td>
<td>Chemgold, Inc./Crown Resource Corp.</td>
<td>South Penn secs. 27-28</td>
<td>T.37N., R.33E.</td>
<td>Au, Ag</td>
<td>Mining, heap-leach</td>
</tr>
<tr>
<td>6</td>
<td>Ferry</td>
<td>Cyprus Gold Exploration Corp.</td>
<td>Lone Ranch Creek secs. 11-12</td>
<td>T.40N., R.35E.</td>
<td></td>
<td>Drilling</td>
</tr>
<tr>
<td>7</td>
<td>Ferry</td>
<td>N.A. Degersstrom, Inc./Inland Gold and Silver Corp.</td>
<td>Leland property secs. 10-15</td>
<td>T.3N., R.33E.</td>
<td>Au, Ag</td>
<td>Reconnaissance</td>
</tr>
<tr>
<td>9</td>
<td>Ferry</td>
<td>Echo Bay Mines Ltd./Crown Resource Corp., Gold Texas Resource, Ltd.</td>
<td>Key, Overlook secs. 7-8</td>
<td>T.37N., R.34E.</td>
<td>Au</td>
<td>Pre-development surface drilling at Overlook deposit</td>
</tr>
<tr>
<td>10</td>
<td>Ferry</td>
<td>Hecla Mining Co.</td>
<td>Republic Unit, Golden Promise shaft</td>
<td>T.37N., R.32E.</td>
<td>Au, Ag</td>
<td>Mining and milling, exploration</td>
</tr>
<tr>
<td>11</td>
<td>Ferry</td>
<td>High Country Mining and Exploration</td>
<td>Valley mine</td>
<td>T.37N., R.33E.</td>
<td></td>
<td>Mining and milling</td>
</tr>
<tr>
<td>12</td>
<td>Ferry</td>
<td>Hendrick Mining Co.</td>
<td>Morning Star</td>
<td>T.40N., R.34E.</td>
<td>Au, Ag, Cu</td>
<td>Mapping and sampling</td>
</tr>
<tr>
<td>13</td>
<td>Ferry</td>
<td>Kettle River Resources Ltd., Curlew Lake Resources Inc.</td>
<td>Empire Creek</td>
<td>T.38N., R.33E.</td>
<td>Au</td>
<td>Drilling and sampling</td>
</tr>
</tbody>
</table>

Mineral Collecting Opportunities in Washington (continued from p. 2)

Washington State Mineral Council

This is an umbrella organization for all rockhound clubs in the state of Washington. Their most noted activity is the establishment of recreational rockhound sites for the enjoyment of the public and club members. Walker Valley (Skagit County) and Hansen Creek (King County) are examples of such sites. For further information about the council, contact:

Earl Barnhart, President Washington State Mineral Council 5103 Desmet Spokane, WA 99202

Friends of Mineralogy, Pacific Northwest Chapter

This chapter has members in British Columbia, Idaho, Oregon, and Washington. Members are primarily interested in mineral collection and the science of mineralogy. The group hosts an annual symposium in Tacoma during September. For information, contact:

Richard O'Donnell, President Friends of Mineralogy 4605 E. 18th St., Apt. #57 Vancouver, WA 98661

Society of Paleo loggers

This is an international organization drawing most of its members from the Pacific Northwest and having its headquarters in the state of Washington. Members' interests lie in collecting, display, and study of petrified wood. For membership information, contact:

L. Steve Edmonds, Secretary Society of Paleo loggers 6202 - 42th Ave. East Tacoma, WA 98443

Mining Awareness Week

The United States Senate has proclaimed April 24-30, 1988, as "Mining Awareness Week". A similar House resolution was being sponsored by Representative Jim Wright of Texas and others. Following is the test of Senate Resolution 296.

Whereas, the ability of the domestic mining industry to survive and prosper at home and in the international market is vital to the economic well-being and world leadership position of this nation; Now, therefore, be it

Resolved, That the Senate of the United States hereby proclaims April 24-30, 1988, Mining Awareness Week, in recognition of the domestic mining industry, which created, established and maintained our Nation's industrial cornerstone resulting in benefits to the entire world.

Summer Course Offered: Geology of the Cascade Range

Portland State University is offering a summer session geology course, Aug. 1-19, 1988. This course covers the main features of the Cascade Range between Lassen Volcanic National Park, California, and Snoqualmie Pass, Washington. Participants travel by private vehicle and camp out. One prior geology course at an accredited institution is a prerequisite; no textbook is required, but background reading is recommended.

A written report, due Aug. 26, completes requirements for a grade; 6 graduate credits can be earned. The course is tailored for geology teachers (high school, community college), geology students, and professional geologists. Cost: $310 undergraduate, $490 graduate; no additional charge for out-of-state participants; supplies: $20. Course charges payable at registration. Trip costs will include sharing transportation costs, camping fees, food, photocopying.

For further information write or call the Associate Professor Paul E. Hammond Geology Department Portland State University Portland, OR 97207 telephone (503) 464-3022.
Sources of Information about Earthquake Preparedness
(continued from p. 23)

From the American Red Cross (local chapters):
- "Family Disaster Plan and Personal Survival Guide"
- "27 Things to Help You Survive an Earthquake"
- "Safety and Survival in an Earthquake"

DGER to Contribute to Timber, Fish and Wildlife Research and Monitoring Program

by Robert (Josh) Logan

The Washington Department of Natural Resources (DNR) manages its own timelands and regulates all non-federal timelands within the state. With the help of funding from the Timber, Fish and Wildlife (TFW) Committee on Research and Monitoring, the Division of Geology and Earth Resources (DGER) can now initiate a preventive approach to landslide hazards. An engineering geologist is currently being sought by DGER to complete a TFW pilot program for mapping landslide hazards on forested lands. Slope processes and landslide inventory maps will be completed for a test area to be selected by the project geologist. The map information will be compared in a series of manually prepared or computer-generated overlays to develop hazard zonation maps that may be used by field personnel to identify landslide hazards.

The pilot project will also be useful in determining the applicability of computerized geographic information systems to slope stability problems. Both DNR and the U.S. Geological Survey (USGS) have such systems available. The USGS has completed several landslide hazard maps for California. However, Washington has different terrain, geology, and forest cover than California; these differences may limit the utility of current computer programs in this type of project in Washington.

Meetings

American Mining Congress MINExpo International
April 24-28, 1988
McCormick Place, Chicago, IL
For further information, write:
AMC MINExpo International '88
1920 N Street NW
Suite 300
Washington, DC 20036

Pacific Northwest Metals and Minerals Conference
AIME Columbia Section, "Gold Quest"
May 4-6, 1988
Sheraton Hotel
Spokane, WA
For further information, write:
PNMNC (AIME)
c/o NWMA
414 Peyton Blvd.
Spokane, WA 99201
(509) 624-1150

Table 1—Mineral exploration and development, 1987 (continued)

<table>
<thead>
<tr>
<th>Loc. no.</th>
<th>County</th>
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<th>Location</th>
<th>Commodity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td></td>
<td>Sundance Mining-Development, Inc.</td>
<td>Gold Hill</td>
<td>Danville district</td>
<td>Au, Ag, Cu</td>
<td>Leased property to United States Borax and Chemical Corp.</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>United States Borax and Chemical Corp.</td>
<td>Gold Dike</td>
<td>secs. 7-8, 17-18, T.40N., R.34E.</td>
<td>Au</td>
<td>Signed option agreement, drilling, geological mapping</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>Vulcan Mountain, Inc.</td>
<td>Gold Dike</td>
<td>secs. 7-8, 17-18, T.40N., R.34E.</td>
<td>Au, Ag, Cu</td>
<td>Mining</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>Asarco Inc.</td>
<td>Several areas</td>
<td>Au, Ag</td>
<td>Geological mapping, sampling</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>Crown Resource Corp.</td>
<td>Several areas</td>
<td>Au, Ag</td>
<td>Exploration</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>Newmont Gold</td>
<td>West of Danville</td>
<td>Au</td>
<td>Exploration</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>Stuart Jackson</td>
<td>Northwestern part of county</td>
<td>Au, Ag</td>
<td>Acquired state leases</td>
<td></td>
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<tr>
<td>21</td>
<td></td>
<td>Basic Resources Co.</td>
<td>Rock Top</td>
<td>sec. 20, T.22N., R.26E.</td>
<td>Clay</td>
<td>Access road completed</td>
</tr>
<tr>
<td>22</td>
<td></td>
<td>Wilco Corp.</td>
<td>Grant County pits</td>
<td>sec. 17, T.19N., R.23E.</td>
<td>Diatomite</td>
<td>Mining and milling</td>
</tr>
<tr>
<td>23</td>
<td></td>
<td>Wilco Corp.</td>
<td>Grant County pits</td>
<td>sec. 1, T.18N., R.24E.</td>
<td>Diatomite</td>
<td>Mining and milling</td>
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<tr>
<td>24</td>
<td></td>
<td>Ash Grove Cement West, Inc.</td>
<td>Superior quarry</td>
<td>sec. 1, T.19N., R.7E.</td>
<td>Silica</td>
<td>Mining</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>Kennebec Exploration</td>
<td>White River</td>
<td>sec. 6, T.19N., R.8E.</td>
<td>Au</td>
<td>Sampling</td>
</tr>
<tr>
<td>26</td>
<td></td>
<td>L-Bar Products, Inc.</td>
<td>Ravensdale</td>
<td>sec. 1, T.21N., R.6E.</td>
<td>Silica</td>
<td>Mining and screening</td>
</tr>
<tr>
<td>27</td>
<td></td>
<td>Mutual Materials Co.</td>
<td>Cougar Mountain pit</td>
<td>sec. 1, T.21N., R.6E.</td>
<td>Clay</td>
<td>mined 170,000 cubic yards</td>
</tr>
</tbody>
</table>
Table 1—Mineral exploration and development, 1987 (continued)

<table>
<thead>
<tr>
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<th>Remarks</th>
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<tbody>
<tr>
<td>26</td>
<td>Okanogan</td>
<td>L.F. Baum Associates</td>
<td>Turtle Lake</td>
<td>secs. 9-10 T.38N., R.26E.</td>
<td>Au, Ag, Cu</td>
<td>Exploration</td>
</tr>
<tr>
<td>27</td>
<td>Okanogan</td>
<td>CM Silver Mines, Inc.</td>
<td>Reed Limestone</td>
<td>sec. 35 T.39N., R.26N.</td>
<td>Limestone</td>
<td>Drilling</td>
</tr>
<tr>
<td>28</td>
<td>Okanogan</td>
<td>Columbia River Carbonates</td>
<td>Waconda quarry</td>
<td>sec. 24 T.38N., R.30E.</td>
<td>Limestone</td>
<td>Geologic study</td>
</tr>
<tr>
<td>29</td>
<td>Okanogan</td>
<td>Herdick Mining Co.</td>
<td>Ida</td>
<td>secs. 21, 28 T.39N., R.31E.</td>
<td>Au</td>
<td>Sampling and mapping</td>
</tr>
<tr>
<td>31</td>
<td>Okanogan</td>
<td>Keystone Gold, Inc.</td>
<td>Crystal Eagle</td>
<td>secs. 16, 25-26 T.40N., R.30E.</td>
<td>Au, Ag</td>
<td>Geologic reconnaissance</td>
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<td>32</td>
<td>Okanogan</td>
<td>Omak Minerals, Inc.</td>
<td>Hameberle Ranch</td>
<td>North of Riverside</td>
<td>Au, Mo</td>
<td>Drilling</td>
</tr>
<tr>
<td>33</td>
<td>Okanogan</td>
<td>Pacific Calcium Corp.</td>
<td>Whitestone quarry</td>
<td>sec. 14 T.38N., R.26E.</td>
<td>Limestone, Dolomite</td>
<td>Quarrying and milling</td>
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<td>34</td>
<td>Okanogan</td>
<td>Quintana Minerals Corp.</td>
<td>Mazama</td>
<td></td>
<td>Au</td>
<td>Sampling</td>
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<tr>
<td>35</td>
<td>Okanogan</td>
<td>Newhawk Gold Mines Ltd.</td>
<td>Smith Canyon</td>
<td>T.32-33N., R.21E.</td>
<td>Au</td>
<td>Drilling</td>
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<tr>
<td>36</td>
<td>Okanogan</td>
<td>Silver Bell, Inc.</td>
<td>Silver Bell mine</td>
<td>sec. 25 T.38N., R.31E.</td>
<td>Au, Ag</td>
<td>Sampling</td>
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<tr>
<td>38</td>
<td>Okanogan</td>
<td>Weston Mining Inc./Crown Resource Corp.</td>
<td>Bodie</td>
<td>sec. 34 T.38N., R.31E.</td>
<td>Au, Ag, Cu, Mo</td>
<td>Exploring and sampling</td>
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<tr>
<td>39</td>
<td>Pend Oreille</td>
<td>Pend Oreille Construction Inc.</td>
<td>Easy Street Claims</td>
<td>secs. 26-27 T.39N., R.44E.</td>
<td>Au, Ag, Cu,</td>
<td>Mining</td>
</tr>
<tr>
<td>40</td>
<td>Pend Oreille</td>
<td>Leighton Portland Cement Co.</td>
<td>Champane placer</td>
<td>sec. 27 T.39N., R.43E.</td>
<td>Limestone</td>
<td>Mining</td>
</tr>
<tr>
<td>41</td>
<td>Pend Oreille</td>
<td>Lewis and Clark Mines</td>
<td>Lewis and Clark 1-7</td>
<td>sec. 17 T.38N., R.44E.</td>
<td>Ag, Mo, Pb,</td>
<td>Drilling</td>
</tr>
</tbody>
</table>

Washington Geologic Newsletter, Vol. 16, No. 2

Earthquake Awareness Week:
Planning and Preparation Can Reduce Losses

Because the threat of catastrophic earthquakes in Washington does not go away or diminish with time, Governor Booth Gardner has again set aside a full week for reminding citizens to prepare themselves. In this month, Washington has suffered the damaging effects of ten earthquakes, three in the month of April. The most recent occurred in Seattle on April 29, 1965; seven people were killed, and damages totaled more than $50 million (1984 dollars).

To reduce damages of this magnitude in the future, Governor Gardner has proclaimed April 10 through 16 Earthquake Awareness Week. Throughout the week, state and local emergency managers will be offering safety tips and information through educational programs, displays, and brochures.

"Citizens of Washington State must be made aware of the potential threat of earthquakes," Gardner stated. "They also need to know what can be done before, during, and after a quake to save lives and minimize injury and property damage." While it has been 23 years since the last damaging earthquake, another earthquake could happen at any time.

Earthquakes are caused by the shifting of the various plates that make up the Earth's crust. Vibrations of the ground accompanying the plate motions may sever phone, electric, sewer, and gas lines; destroy freeways and overpasses; topple buildings; and dump tons of rubble on busy streets and sidewalks.

The Division of Emergency Management and several local emergency management agencies have prepared educational programs, brochures, and displays to help people to protect themselves from damage or injury. These will be available to the public during Earthquake Awareness Week. For more information, contact your local emergency management agency.

From text supplied by the Department of Community Development

Note: The March 1982 issue of Sunset Magazine offered an article titled "Getting ready for a big quake." This article is many useful tips on preparing for a residential earthquake and some basic advice about general earthquake preparedness.

The Division of Geology and Earth Resources has several technical publications about the locations and effects of earthquakes in Washington. Contact the Division for more information.

Sources of Information about Earthquake Preparedness

From the Federal Emergency Management Agency (FEMA)

The following are representative titles; many other related publications are available from this agency. The FEMA publication number is given in parentheses. All these publications are free.

- "Earthquake Public Information Materials—An Annotated Bibliography" (67)
- "Earthquake Preparedness Information for People with Disabilities" (70)
- "Reducing the Risks of Nonstructural Earthquake Damage—A Practical Guide" (74)
- "An Action Plan for Reducing Earthquake Hazards of Existing Buildings" (91)
- "Improving Seismic Safety of New Buildings—A Non-Technical Explanation of NEHRP Provisions" (99)
- "Marketing Earthquake Preparedness—Community Campaigns that Get Results" (112)

From the Washington State Division of Emergency Management

- "Washington State Seismic Safety Report" Washington State Division of Emergency Management Department of Community Development 4220 E. Martin Way Olympia, WA 98504

From the U.S. Geological Survey

- "The Interior of the Earth" (free)
- "Safety and Survival in an Earthquake" (free)
- "The Severity of an Earthquake" (free)
- "Earthquake" (free)
- "Seismicity Map of the World" ($3.10 each)

U.S. Geological Survey Public Inquiries Office Room 687, U.S. Courthouse West 920 Riverside Ave. Spokane, WA 99201 (continued on p. 24)
WHEREAS, earthquakes are among the most devastating of natural disasters; and

WHEREAS, earthquakes have caused death and damage in Washington state in the past, and may do so again; and

WHEREAS, a damaging earthquake could occur anywhere in the state without warning; and

WHEREAS, the citizens of Washington state must by made aware of the potential threat of earthquakes and of the measures that can be taken before, during and after a quake to save lives, protect property and mitigate damages and injuries;

NOW, THEREFORE, I, Booth Gardner, Governor of the State of Washington, do hereby proclaim April 10-16, 1988, as

EARTHQUAKE AWARENESS WEEK

in the State of Washington, and I urge all citizens to take advantage of opportunities to learn about this natural hazard.

Signed, this 22nd day of March, 1988

Governor Booth Gardner

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Table 1.- Mineral exploration and development, 1987 (continued)

<table>
<thead>
<tr>
<th>Loc. no.</th>
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<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>Pend Oreille</td>
<td>United Catalysts, Inc./FRM Minerals, Inc.</td>
<td>Talc Totem</td>
<td>secs. 23, 14</td>
<td>T39N., R.44E.</td>
<td>Talc</td>
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<td>43</td>
<td>Pend Oreille</td>
<td>Union Pacific Resources</td>
<td></td>
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<tr>
<td>44</td>
<td>Skagit</td>
<td>Applied Industrial Materials Corp. (AIMCOR)</td>
<td>Olivefield</td>
<td>secs. 3-4, 8-9, 16-17</td>
<td>T36N., R.7E.</td>
<td>Olive</td>
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<tr>
<td>45</td>
<td>Skamania</td>
<td>Flexus Resources Corp.</td>
<td>Silver Star</td>
<td>sec. 4</td>
<td>T3N., R.5E.</td>
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<tr>
<td>46</td>
<td>Spokane</td>
<td>Interpace Industries Inc.</td>
<td>Mica mine and plant</td>
<td>sec. 14</td>
<td>T24N., R.4E.</td>
<td></td>
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<td>47</td>
<td>Stevens</td>
<td>Boise Cascade Minerals, Pathfinder Gold Corp./Million Minerals</td>
<td>First Thought mine area</td>
<td></td>
<td></td>
<td></td>
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<td>48</td>
<td>Stevens</td>
<td>Art Bolt</td>
<td>near Flagstaff Mountain</td>
<td>secs. 1-5, 16</td>
<td>T39N., R.39E.</td>
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<tr>
<td>49</td>
<td>Stevens</td>
<td>Champion Gold and Silver, Inc.</td>
<td>First Thought mine</td>
<td>secs. 7, 18</td>
<td>T39N., R.37E.</td>
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<td>50</td>
<td>Stevens</td>
<td>Chevelah Eagle Co.</td>
<td>Chevelah Eagle quarry</td>
<td>sec. 5, T32N.; sec. 3E, T33N., R.41E.</td>
<td></td>
<td>Dolomite</td>
</tr>
<tr>
<td>51</td>
<td>Stevens</td>
<td>Cortez International Ltd. (Oregon Leo Minerals and Timber)</td>
<td>Turk mine area</td>
<td>sec. 36</td>
<td>T30N., R.37E.</td>
<td></td>
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<td>52</td>
<td>Stevens</td>
<td>Hemphill Brothers, Inc.</td>
<td>Northport Limestone</td>
<td>sec. 8</td>
<td>T39N., R.40E.</td>
<td></td>
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<tr>
<td>53</td>
<td>Stevens</td>
<td>Lane Mountain Silica Co. (subsidiary of Hemphill Brothers)</td>
<td>Lane Mountain Silica</td>
<td>sec. 27</td>
<td>T3N., R.39E.</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Stevens</td>
<td>Lead Point Consolidated Mines Co.</td>
<td>Lead Point Consolidated mines</td>
<td>secs. 2-13, 23</td>
<td>T39N., R.41E.</td>
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Table 1.- Mineral exploration and development, 1987 (continued)

<table>
<thead>
<tr>
<th>Loc. no.</th>
<th>County</th>
<th>Operator and/or Owner(s)</th>
<th>Property or area</th>
<th>Location</th>
<th>Commodity</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>55</td>
<td>Stevens</td>
<td>Naname Aggregates, Inc.</td>
<td>Several quarries</td>
<td></td>
<td>Dolomite</td>
<td>Mining and milling</td>
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<tr>
<td>56</td>
<td>Stevens</td>
<td>Northwest Alloys, Inc.</td>
<td>Ady dolomite quarry</td>
<td>secs. 13-14</td>
<td>T.13N., R.39W.</td>
<td>Dolomite</td>
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<tr>
<td>57</td>
<td>Stevens</td>
<td>Northwest Marble Products Co.</td>
<td>White quarry</td>
<td>sec. 10</td>
<td>T.13N., R.38E.</td>
<td>Dolomite</td>
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<tr>
<td>58</td>
<td>Stevens</td>
<td>Westmont Mining Inc./International Curator Resources Ltd.</td>
<td>Twilight Canyon</td>
<td>sec. 9</td>
<td>T.13N., R.38E.</td>
<td>In, P, Ag</td>
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<tr>
<td></td>
<td>Stevens</td>
<td>Crown Resource Corp.</td>
<td></td>
<td>County</td>
<td></td>
<td>Au, Ag</td>
</tr>
<tr>
<td></td>
<td>Stevens</td>
<td>Union Pacific Resources</td>
<td></td>
<td>County</td>
<td></td>
<td>U</td>
</tr>
<tr>
<td>59</td>
<td>Whatcom</td>
<td>Clausen Lime Company</td>
<td>Near Maple Falls</td>
<td>secs. 7, 18</td>
<td>T.40N., R.6E.</td>
<td>Limestone</td>
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<tr>
<td>60</td>
<td>Whatcom</td>
<td>Columbia Northwest Cement Corp.</td>
<td>Kendall quarry</td>
<td>secs. 14-16</td>
<td>T.39N., R.5E.</td>
<td>Limestone</td>
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<tr>
<td>61</td>
<td>Whatcom</td>
<td>Olivine Corp.</td>
<td>Swen Larsen quarry</td>
<td>sec. 34</td>
<td>T.39N., R.6E.</td>
<td>Olivine</td>
</tr>
<tr>
<td>62</td>
<td>Whatcom</td>
<td>Seattle-St. Louis Mining Co.</td>
<td>Minnesota mine</td>
<td>sec. 2</td>
<td>T.39N., R.16E.</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>Whatcom</td>
<td>Steelhead Resources, Ltd.</td>
<td>Excelsior property</td>
<td>secs. 5-6</td>
<td>T.39N., R.8E.</td>
<td></td>
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<tr>
<td>64</td>
<td>Whatcom</td>
<td>Western Gold Mining, Inc.</td>
<td>New Light mine</td>
<td>sec. 27</td>
<td>T.39N., R.17E.</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>Yakima</td>
<td>Arctic Exploration and Development, Ltd.</td>
<td>Morse Creek</td>
<td>sec. 31</td>
<td>T.17N., R.11E.</td>
<td></td>
</tr>
</tbody>
</table>

ing system, which includes higher lease payments, and because of renewed exploration interest in Washington. No uranium was produced in Washington in 1987. The most recent uranium production in the state was in 1984, when two properties were being mined.

The information in this report is summarized from voluntary replies to a questionnaire sent to companies and individuals active in mineral exploration and development in the state, as well as from published information. The questionnaire is limited in scope, and therefore, details of activities on individual properties are not always available. Not all questionnaires were returned, and some information requested, particularly regarding expenditures and production, is considered confidential by many of those questioned and

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Staff Notes

Gerald (Jerry) W. Thorsen retired from the Division at the end of February, after 30 years with the State and the Division's various predecessor agencies. Jerry came to the Division from Washington State University, The Bunker Hill Company, and Climax Molybdenum. In recent years he divided his time between on-site inspection of landslides and geologic hazards and representing the Department of Natural Resources as an expert witness in navigability, forest practices, geohydrology, seismic hazards, land-use conflicts, and other issues relating to environmental geology. Jerry looks forward to time on his boat and a relaxed pace, but we expect to see him on the "outcrop" in his capacity as consultant on geologic hazards for the Northwest Region of the Department of Natural Resources.

Bonnie Bunning

Bonnie Bunning, Geologist IV in the Olympia office, left the Division March 11 for a 2-year post as Chief Management Analyst for the Department of Natural Resources. In that capacity, Bonnie will examine and analyze a broad range of natural resource and management issues facing the Department and provide recommendations to the Department's executive management. The new position offers an opportunity to work with the diverse functions of the Department, from timber harvesting to natural heritage preservation and aquatic land management. Bonnie expects her background in economic geology to enable her to bring an added perspective to natural resource management in the agency.
Chinasaurus: The Dinosaurs of Sichuan Come to the Burke Museum

Figure 1—Huagongosaurus taibaili, on display at the Burke Museum. This species resembles the well-known American Stegosaurus in having a double row of plates along its back. Photo by Virgil Fassio.

The first North American viewing of dinosaur discoveries from Sichuan Province in the People's Republic of China are being presented by the Burke Museum. The exhibit, "Chinasaurus—The Dinosaurs of Sichuan", is a product of collaboration between the Chongqing Natural History Museum and the Burke Museum and is sponsored by The Seattle Post-Intelligencer and United Airlines. Eight Chinese scientists and curators have accompanied the fossils to the United States.

The core of the exhibit is three full dinosaur skeletons: *Omeirosaurus juxiensis*, a 45-foot-long plant eater with a long tail and neck; *Huagongosaurus taubaili*, a "stegosaurus" type of dinosaur (Fig. 1); and *Yangchuanosaurus shuangqiaoensis*, a massive erect meat-eater whose skull is one of the largest found in China. Ninety-eight other fossils are on view, including one of the largest nests of dinosaur eggs yet found in China, shells of extinct turtles, and dinosaur footprints.

The fossils on display are between 140 million and 160 million years old. They were recovered from an ancient lake bed, which has also yielded numerous other new forms. In fact, China's dinosaurs are unmatched in diversity and abundance. Hundreds of specimens representing 22 species have been found throughout the Sichuan Basin. While one species of stegosaurus has been found in the United States, Chinese paleontologists have uncovered six species.

The dinosaurs will be on view through September 18, 1988. In conjunction with the exhibit, the museum is offering a series of lectures whose topics range from the Chinese material to the museum's efforts to expand its collection.

Admission to the exhibit costs $3.50 for adults, $2.50 for students and senior citizens, and $1 for children under 12. Group tours can be arranged by calling (206) 543-5591. More information about the exhibit and lectures is available from (206) 543-5590.

Table 2: Selected producers of processed carbonate products, 1987. Refer to Table 1 and Figures 2a and 2b for locations

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Owner and/or operator</th>
<th>County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland cement</td>
<td>Columbia Northwest Cement Corp.</td>
<td>Whatcom</td>
</tr>
<tr>
<td>Portland cement</td>
<td>Ideal Basic Industries, Inc.</td>
<td>King</td>
</tr>
<tr>
<td>Portland cement</td>
<td>Lehigh Portland Cement Co.</td>
<td>Pend Oreille</td>
</tr>
<tr>
<td>Lime</td>
<td>Tacoma Lime, a division of</td>
<td>Pierce</td>
</tr>
<tr>
<td></td>
<td>Continental Lime, Inc.</td>
<td></td>
</tr>
<tr>
<td>Lime</td>
<td>Northwest Alloys, Inc.</td>
<td>Stevens</td>
</tr>
<tr>
<td>Precipitated calcium carbonate</td>
<td>Tacoma Lime, a division of Continental Lime, Inc.</td>
<td>Pierce</td>
</tr>
<tr>
<td>Calcium chloride</td>
<td>Tahoma Chemical Co.</td>
<td>Pierce</td>
</tr>
<tr>
<td>Calcium chloride</td>
<td>Occidental Chemical Corp.</td>
<td>Pierce</td>
</tr>
<tr>
<td>Ground limestone</td>
<td>J.A. Jack and Sons, Inc.</td>
<td>King</td>
</tr>
<tr>
<td>Ground limestone</td>
<td>Columbia River Carbonates</td>
<td>Cowlitz</td>
</tr>
<tr>
<td>Ground dolomite</td>
<td>Nanome Aggregates, Inc.</td>
<td>Stevens</td>
</tr>
<tr>
<td>Ground dolomite and limestone</td>
<td>Pacific Calcium, Inc.</td>
<td>Okanogan</td>
</tr>
<tr>
<td>Crushed dolomite</td>
<td>Northwest Marble Products Co.</td>
<td>Stevens</td>
</tr>
</tbody>
</table>

is not reported. Therefore, while this summary is a reliable indication of the mineral activity in the state, it is incomplete and general in nature.

The locations of the properties mentioned in this article are shown in Figures 2a and 2b (p. 10, 11), which cover western and eastern Washington, respectively.

**METALS**

**Development**

Gold and silver were the primary metallic minerals produced from the five active metal mines in Washington (Table 3). A record of more than 210,000 ounces of gold (Fig. 3) and 350,000 ounces of silver, having a combined value of more than $95 million, was produced from the mines located in Chelan County and Ferry County. The Bureau of Mines ranks Washington 6th in the nation for gold production and 10th for silver production.

**Chelan County**

The Cannon mine is the largest gold mine in the state and was the 11th largest gold producer in the

Figure 3—Estimated gold production in Washington. Production increased dramatically beginning in 1985 as a result of the opening of the Cannon mine and increased production at the Republic Unit.
460 workers in 1986 and continues as the largest employer in Stevens County (TEAM WASHINGTON, 1986).

Crushed dolomite was produced by several companies. Nanome Aggregates, Inc., continues to produce dolomite from several quarries, including one leased from Chewelah Eagle Mining Company at which approximately 5,000 tons of dolomite was mined. The white and colored stone is used for architectural aggregate, filler, and agricultural lime. Northwest Marble Products Co. continued to mine white dolomite from their quarry northeast of Kelly Hill. The stone is used in the manufacture of ceramics.

Hempill Brothers, Inc., continued to operate two quarries in Stevens County. Silica from a friable area of the Addy Quarztite is mined at their Lane Mountain silica quarry. The rock is crushed, floated, dried, screened, and run through a magnetic separator to produce several grain sizes of high-purity silica. Limestone from the Cambrian Malakwa Formation is mined by the Northport Limestone Division.

L-Bar Products Inc. continues to produce fertilizer and de-icer from magnesium sludge from the Northwest Alloys plant.

Cortez International Ltd. acquired a state lease in the Turf mine area. The company plans to investigate the renewed potential for magnesite from the former producer.

**Whatcom County**

Columbia Northwest Cement Corp. mined approximately 300,000 tons of limestone from the Kendall quarry, before the company was purchased in September by Tilbury Cement Co. of Delta, B.C., Canada. The kilns have been shut down, and imported clinker is now being ground at the plant. A large staff reduction followed the takeover. The company had been the largest producer of portland cement in the state to mine limestone in Washington.

Olivo Corp. produced 100,000 tons of clivine from their Swed Larsen quarry. Clason Lime Company continues to mine limestone from their quarry near Maple Falls. The limestone is thought to be of Pennsylvanian age (Danner, 1966).

**Statewide Exploration**

Meridian Mineral Company explored for and developed clay, diatomite, limestone, marble, and sources suitable for crushed stone at several places across the state.

**REFERENCES CITED**


was produced by two companies, making Washington one of only two states to produce this refractory mineral.

Locations of properties discussed in this section are shown in Figures 2a and 2b. Table 2 lists producers of processed carbonate products.

Clallam County

Ideal Basic Industries, Inc. continues to mine clay from the Twin River quarry. The company produced 100,000 tons of clay, which is banded to their plant in Seattle where it is used in the manufacture of portland cement. The clay is mined from weathered mudstones of the Twin River Group of Oligocene age.

Grant County

Wiaco Corp. is the sole producer of diatomite in the state. A net production of 60,000 tons was mined from two pits; this is a reduction of 30 percent from 1986. The diatomite was mined from former lake beds interbedded with flows of the Miocene Columbia River Basalt Group. The diatomite is utilized for filter in paints and as filters.

Basic Resources Co. completed the access road to their Rock Top clay property, where exploration drilling was undertaken. The deposit consists of non-swelling bentonite that is present in sedimentary layers interbedded with the Columbia River basalt. The clay is reported to be suitable for many uses, including absorbents, oil and gas drilling mud, and filters.

King County

L-Bar Products Inc. continues to mine silica sand at the Ravensdale mine and plant. Approximately 120,000 tons of sand were mined, washed, screened, and dried to produce silica for colored bottles and cement. The sand is mined from the Eocene Puget Group.

Ash Grove Cement West, Inc., entered the silica market with the start-up production at the Superior quarry. Approximately 40,000 tons of cement-grade silica were mined there in 1987.

Mutual Materials Co. mined 170,000 cubic yards of clay for use in the manufacture of structural brick from their Cougar Mountain pit. The company also has clay pits in Pierce, Thurston, Cowlitz, and Chelan counties.

Okanogan County

Columbia River Carbonates completed detailed geological mapping and modeling of the Wauconda quarry, but no new rock was mined. Production of fine-ground high-brightness calcium carbonate continued from stockpiles at the plant near Woodland in Cowellz County.

Pacific Calcium Inc. continued quarrying of limestone and dolomite from their Whitestone property near Spectacle Lake, 13 miles northwest of Tonasket.

CM Silver Mines, Inc. a wholly owned subsidiary of Lucky Three Mining Co., conducted geologic reconnaissance and core drilling at their limestone deposit near White Rock Mountain. The company is evaluating the potential of their high-calcium limestone deposit for use in cement and for agricultural lime.

Pend Oreille County

Lehigh Portland Cement Co. produced slightly more than 240,000 tons of limestone from the Champane Placer. The limestone from the Cambrian Metalline Formation is used in the production of portland cement. Lehigh is presently the only company in the state to produce portland cement from limestone mined in Washington.

Bockman Construction Inc. produced 15,000 tons of silica from an alluvial deposit derived from Addy Quartzite. Rock from the Easy Street claims is trucked to Lehigh Portland Cement Co. for use in the manufacture of portland cement.

United Catalysts, Inc., in joint venture with FRM Minerals, Inc., continued to explore their Totem Talc property.

Skagit County

Applied Industrial Materials Corp. produced olivine products after screening and milling olivine from the plant stockpile. Quarry development and exploration were also undertaken.

Spokane County

Interspace Industries Inc. mined 30,000 tons of clay at their Mica mine and plant. The company has been approved by the Washington State Community Economic Revitalization Board to participate in bonds issued by the board. The funds will enable the company to expand their brick factory by 7 million bricks per year. The company employs 80 workers (Journal of Business, Nov. 25, 1987).

Stevens County

Northwest Alloys, Inc., a wholly owned subsidiary of Aluminum Co. of America, mined more than 500,000 tons of dolomite from the Addy dolomite quarry. Northwest Alloys' mine and plant is the highest value mineral operation in the state because of the value added to the dolomite by the production of magnesium metal at the plant. The company is one of only three producers of magnesium metal in the United States and the only one to utilize the silicothermic process (whereby magnesia in calcined dolomite is reduced by silicon). The company employed more than

Figure 2b.—Location of selected mines (metallic and industrial minerals) and prospects in eastern Washington. Location numbers are keyed to Table 1.
Table 3.-Properties producing base and precious metals, 1987

<table>
<thead>
<tr>
<th>Property</th>
<th>Owner and/ or operator</th>
<th>County</th>
<th>Production and development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannon mine</td>
<td>Asamaera Minerals (U.S.), Inc.; Breakwater Resources, Ltd.</td>
<td>Chelan</td>
<td>Produced 136,913 oz of gold and 184,660 oz of silver</td>
</tr>
<tr>
<td>South Penn</td>
<td>Chengold, Inc.; Crown Resource Corp.</td>
<td>Ferry</td>
<td>Mined 33,000 tons of rock for heap-leach operation</td>
</tr>
<tr>
<td>Republic Unit</td>
<td>Hecla Mining Co.</td>
<td>Ferry</td>
<td>Produced 70,095 oz of gold</td>
</tr>
<tr>
<td>Valley mine</td>
<td>High Country Mining Exploration</td>
<td>Ferry</td>
<td>Mining and milling</td>
</tr>
<tr>
<td>Gold Dike mine</td>
<td>Vulcan Mountain, Inc.</td>
<td>Ferry</td>
<td>Renewed mining, heap-leach operation</td>
</tr>
</tbody>
</table>

United States during the year October 1986 through September 1987. The mine produced a record of 136,913 ounces of gold and 184,660 ounces of silver in 1987. The operation mined 487,065 tons with an average grade of 0.308 oz/ton gold; the average daily production was 1,600 tons.

The underground, backless mine is operated by Asamaera Minerals Inc. (51%) in joint venture with Breakwater Resources Ltd. (49%). In July, stock was issued in a public offering for Asamaera Minerals Inc., with Asamaera Inc. as the majority stockholder holding 90 percent of the stock (Asamaera Inc. third quarter report, 1987).

The Cannon mine employs approximately 189 workers and had a 1987 payroll of about $5.5 million (Wenatchee World, Oct. 23, 1987). In September the mine went to a 7-day work schedule, up from the previous 5-day work week.

In April, Asamaera announced the discovery of the new B-4 ore zone which was first drilled in 1986. The zone extends north and west of the B-north body that is currently being mined. The new discovery, as of December 1986, adds to the mine’s proven and probable reserves about 465,000 tons at a grade of 0.241 oz/ton gold, with a 0.1 oz/ton cut-off (Breakwater Resources Ltd., 1986 report). In addition, a new zone called the B-Tween has been identified (Asamaera Inc. third quarter report, 1987). Underground and some surface drilling continued in these two areas during 1987 to increase the reserve base.

Modifications made to the mill in 1986 have resulted in an increase in gold recovery from 86 percent to 91 percent. The concentrate is sent to smelters in Japan and Montana for further refining (Wenatchee World, October 23, 1987).

The ore body at the Cannon mine “consists of widely spaced veins of quartz, chalcedony, adularia, calcite, sulfides, and gold in a pervasively silicified and mineralized section of Eocene feldspathic sandstone and sandstone-siltstone about 40 m thick.” (Ott and others, 1986, p. 425).

Ferry County

Three mines are presently active in the Republic Mining District, which has produced nearly 2.5 million ounces of gold in its 91-year history. Locations of mines and properties in the Ferry County area are shown in Figure 4.

It was a banner year at the Republic Unit, which is owned by Hecla Mining Company. The company dedicated the 1,300-foot Golden Promise (GP) Shaft in January and produced a record of 70,095 ounces of gold from the mine. Gold grades that were higher than anticipated and increased production from the GP veins resulted in a 76 percent increase in gold production over 1986. The new shaft accesses the Golden Promise veins whose discovery was announced in 1985. The banded chaledony epithermal veins are in pyroclastic rocks in the upper part of the Eocene Sanpoil Volcanics.

Approximately 25,000 feet of diamond drilling, 3,500 feet of development drilling, and 300 feet of raises were developed during mining and exploration for the extension of the recently discovered ore systems. The Republic Unit mine and mill employed 116 workers in 1987.

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Table 4.-Properties producing industrial minerals, 1987

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Property</th>
<th>Owner and/ or operator</th>
<th>County</th>
<th>Production and development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay</td>
<td>Twin River quarry</td>
<td>Ideal Basic Industries, Inc.; Clallam County</td>
<td>Clallam County</td>
<td>Mined 100,000 tons</td>
</tr>
<tr>
<td>Mica</td>
<td>mine</td>
<td>plant</td>
<td>Spokane County</td>
<td>Mined 30,000 tons</td>
</tr>
<tr>
<td>Cougar</td>
<td>Mountain</td>
<td>pit</td>
<td>King County</td>
<td>Mined 170,000 cubic yd</td>
</tr>
<tr>
<td>Dolomite</td>
<td>Chelewah Eagle</td>
<td>Mining Co.</td>
<td>Stevens County</td>
<td>Leased quarry to Nanaimo Aggregates, Inc.</td>
</tr>
<tr>
<td>Several</td>
<td>quarries</td>
<td></td>
<td>Nanaimo Aggregates, Inc.</td>
<td>Mined from several quarries</td>
</tr>
<tr>
<td>Addy dolomite quarry</td>
<td>Northwest Alloys, Inc.</td>
<td>Stevens County</td>
<td>Mined more than 500,000 tons</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>quarry</td>
<td></td>
<td>Stevens County</td>
<td>Mined white dolomite Products</td>
</tr>
<tr>
<td>Limestone</td>
<td>Quarry near Maple</td>
<td>Falls</td>
<td>Whatcom County</td>
<td>Mining</td>
</tr>
<tr>
<td>Kendall</td>
<td>quarry</td>
<td></td>
<td>Columbia Cement Corp.</td>
<td>Whatcom County</td>
</tr>
<tr>
<td>Northport</td>
<td>Limestone Division</td>
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<td>Hemphill Brothers, Inc.</td>
<td>Stevens County</td>
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<tr>
<td>Champane</td>
<td>Placer</td>
<td></td>
<td>Lehigh Portland Cement Co.</td>
<td>Pend Oreille</td>
</tr>
<tr>
<td>Whitestone</td>
<td>Quarry</td>
<td></td>
<td>Pacific Calcium, Inc.</td>
<td>Okanogan County</td>
</tr>
<tr>
<td>Olivine</td>
<td>Almcor Olivine</td>
<td>Applied Industrial Material Corp.</td>
<td>Skagit County</td>
<td>Mined 100,000 tons</td>
</tr>
<tr>
<td>Swen Larsen</td>
<td>quarry</td>
<td>Olivine Corp.</td>
<td>Whatcom County</td>
<td>Mined 100,000 tons</td>
</tr>
<tr>
<td>Diatomite</td>
<td>Great County pits</td>
<td></td>
<td>Witco Corp.</td>
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<td>Ash Grove Cement West, Inc.</td>
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</tr>
<tr>
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<td>claims</td>
<td></td>
<td>Buckman Construction Inc.</td>
<td>Pend Oreille</td>
</tr>
<tr>
<td>Lane Mountain</td>
<td>Silica</td>
<td></td>
<td>Hemphill Brothers, Inc.</td>
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<td>Ravensdale mine and plant</td>
<td>L-Bar Products, Inc.</td>
<td>King County</td>
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<td></td>
</tr>
</tbody>
</table>

17 Washington Geologic Newsletter, Vol. 16, No. 2
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Steelhead Resources, Ltd., through its wholly owned subsidiary, Nooksack Mines, Inc., completed 61 rotary reverse circulation holes for a total of 25,000 ft at the Excelsior property. Previous core drilling by U.S. Borax resulted in drill-indicated reserves of 4 million tons of 0.03% copper and 3.16 oz/ton silver. According to the company, the mineralized zone has a minimum north-south strike length of 1,000 ft and an east-west width of 500 ft. Mineralization is hosted by the Wells Formation, a Jurassic volcanic and sedimentary sequence.

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Yakima County

Arctic Exploration and Development Ltd. continued exploration for bulk tonnage gold and silver in a Tertiary volcanic complex at the Morse Creek property in the Summit Creek District. Work at the property included drilling, geochemical sampling, and geology.

Statewide

Several companies explored for precious metals throughout the state. Asarco Inc. and Boise Cascade Minerals conducted exploration programs in the north-east part of the state. Exploration Ventures Co. employed geologic mapping and sampling in their search for precious and base metals. Property examinations were conducted by Ornava Resources Corp., Place U.S. Inc., and M.D. Regan and Associates. Both companies discovered precious metal epithermal deposits. Cominco American Resources Inc. continued exploration in the state. J.C. Foxoxo Mining explored for precious metals, platinum, and opal.

INDUSTRIAL MINERALS

Development and Exploration

Seventeen companies mined industrial minerals, producing clay, dolomite, diatomite, limestone, olivine, and silica (Table 4).

Clay was produced by three companies and was primarily used for fire brick and cement. Limestone was mined by four companies and used mainly for Portland cement. Silica was produced by four companies, largely for use in manufacturing container and float glass. All four dolomite operations were located in Stevens County. The production of magnesium by Northwest Alloys, Inc., was the largest use of the dolomite. One company produced diatomite. Olivine rock being mined is in the Sanpoil Volcanics near the contact with the Kondiak Mountain Formation.

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Exploration

A minimum of 55 companies and individuals explored for metals in Washington in 1987, according to replies to the questionnaire and other information. An overwhelming 92 percent of these companies explored for gold and silver. Copper, molybdenum, lead, zinc, platinum, and uranium were also sought by several companies.

Chelan County

Asamera, in joint venture with Grange Gold Inc., explored the potential of the old Lovitt mine, which was last active in 1967, and the area between this mine and the Cannon mine. Nineteen surface holes were drilled for a total of more than 10,000 feet, and an extensive surface and underground sampling program was undertaken. The Wenatchee (October 23, 1987) reported that a potential site for a small open pit operation was identified.

Tillicum Industries, which had drilled six holes in the Blewett District in 1986, dropped their claims in the area.

Welcome Nugget Mines explored their placer claims in the county.

Ferry County

Ferry county was the most active area in the state for precious metals exploration. More than 14 companies conducted exploration in the county, including several extending their operations.

Echo Bay Mines Ltd. announced in July that they would begin a $2.5-million feasibility study and expand exploration at the Kettle formally the Canyon, Key East, Key West, and Overlook deposits. Echo Bay, the operator of the properties, has been in a joint venture agreement with the owners. Crown Resource Corp. and Gold Texas Resource Ltd., since late 1985. The decision of whether to put the properties into production following the feasibility study will be made in mid-1988.

At the Kettle deposit, a 3,000-foot exploration decline was begun in October to allow more extensive exploration (15,000 feet). Mill development continues, with high-grade, low-angle, radial underground exploration holes.
began in December and continued during early 1988. An office building and core storage facilities were also constructed at the site.

Surface core drilling done earlier in 1987 extended the known mineralization at the Kettle deposit and has identified two vein systems, the Bruts and the Lucy. Crown Resource reported that the two best intercepts on the Lucy were 7.7 feet true width grading 0.67 oz/ton gold and 26 feet grading 0.35 oz/ton gold. Gold mineralization on the Bruts veins has been extended over a horizontal distance of 900 feet and a vertical distance of 600 feet; it is open down dip. The two best assay intervals for the Bruts vein were 25.5 feet grading 0.39 oz/ton and 41 feet grading 0.25 oz/ton gold (The Mining Record, October 21, 1987). The banded epithermal quartz veins at this mine are in the upper part of the Sanpoil Volcanics near the contact with the Klondike Mountain Formation.

Two rotary reverse circulation drill rigs were utilized at the Overlook deposit, which was discovered in 1986. Nearly 100 rotary reverse circulation holes were completed at the property; the average hole depth was 650 feet.

The gold mineralization near Cooke Mountain occurs as manto replacements of limestone by magnetite, pyrite, and pyrrhotite and as quartz stockwork veins ± pyrite, pyrrhotite, arsenopyrite, magnetite, and chalcopyrite. The mineralization occurs in Permian metasedimentary rocks, which are in contact with dikes of the Eocene Scatter Creek Rhyodacite. Previous mining in the Belcher District occurred in the early 1900s.

If put into production, the Kettle will be an underground mine, and the Key and Overlook properties could be accessed by underground and/or open-pit methods. One mill near the Key would serve both properties. The two operations would employ approximately 100 persons.

Hecla Mining Co. continued exploratory drilling on their properties, outside of the Golden Promise mine area, in the Republic Mining District.

Vulcan Mountain Inc. and Sundance Mining-Development Inc. signed exploration agreements with United States Borax and Chemical Corp. for the Gold Dike and Gold Hill properties, respectively. A drill program initiated by Borax in October included several angle and vertical core holes which averaged 200-300 feet deep; some deeper holes are planned. Geologic mapping and geochemoical sampling were also undertaken.

Kettle River Resources Ltd., in joint venture with Curlew Lake Resources, explored claims near the headwaters of Empire Creek. Six core holes totaling more than 2,500 feet were drilled at the gold and base metal property. An extensive surface geochemical sampling program was also undertaken. The deposit is in Permian and Triassic greenstone and metasedimentary rocks (Parker and Callins, 1964).

N. A. Degernstrom, Inc., in joint venture with Inland Gold and Silver Corp. acquired the Leland property, west of the Key prospects. Geochemical sampling and geologic mapping were conducted at the property.

Axcor Inc. conducted geological mapping and geochemical sampling throughout the county in their search for gold mineralization.

Cypress Gold Exploration Corp. drilled on claims on Lone Ranch Creek east of Danville. The company also acquired property in the area.

Several other companies explored in the county. Crown Resource Corp. explored for precious metals. Herdrick Mining Co. did geologic mapping and geochemoical sampling at the Morning Star property. Newmont Gold Co. conducted very limited exploration in the county. Numerous state mineral leases were acquired by Stuart Jackson.

King County

Kennecott Exploration sampled at the White River property. The prospect is hosted by Tertiary volcanic rocks.

Okanogan County

Westmont Mining Inc. signed a joint venture agreement with Crown Resource Corp. to explore the Bodie property, which was last mined in 1944 (Moen, 1980). Detailed geologic mapping and geochemoical sampling were conducted on the property. Sites were also prepared for future drilling. The northeast-striking banded epithermal vein and breccia are located in the Toroda Creek graben and hosted by Eocene volcanic rocks (Moen, 1980).

Several other companies explored properties in the Eocene volcanic sequence. Silver Bell Inc., continued geochemical sampling at the Silver Bell mine. Some mining was also done at the property. Hendrick Mining Co. conducted geologic mapping and sampling at the Nida mine, which was sold to Sundance Mining-Development.

In the Meyers Creek District, Kent-McGee Corp. continued exploration at their gold property near Cheshaw. Keystone Gold Inc. conducted geologic and geochemoical reconnaissance at Crystal Butte and Gray Eagle.

Omak Minerals, Inc. drilled two core holes and undertook geological mapping at their prospect northwest of Omak. The newly incorporated company is seeking gold, molybdenum, and other minerals on the property.

Newhawk Gold Mines Ltd. in joint venture with Reliant Resources Inc., drilled eight holes, for a total of 1,500 ft, on their prospect in Smith Canyon south of Twisp. The gold-copper property is under option from Nord Resources Corp. A large claim block staked in 1986 is part of the land package put together by the company in that area.

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**INDUSTRIAL MINERALS**

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Ferry county was the most active area in the state for precious metals exploration. More than 14 companies conducted exploration in the county, including several extensive drilling programs.

Echo Bay Mines Ltd. announced in July that they would begin a $2.5-million feasibility study and expansion of the Kettle (formally the Granny), Key East, Key West, and Overlook deposits. Echo Bay, the operator of the properties, has been in a joint venture agreement with the owners, Crown Resource Corp. and Gold Texas Resource Ltd., since late 1985. The decision of whether to put the properties into production following the feasibility study will be made in mid-1988.

At the Kettle deposit, a 3,000-foot exploration decline was begun in October to allow more extensive exploration (20,000 feet). Mineral exploration, consisting of low-angle, radial underground exploration holes.
Table 3.-Properties producing base and precious metals, 1987

<table>
<thead>
<tr>
<th>Property</th>
<th>Owner and/or operator</th>
<th>County</th>
<th>Production and development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannon mine</td>
<td>Asamaera Minerals (U.S.), Inc.; Breakwater Resources, Ltd.</td>
<td>Chelan</td>
<td>Produced 136,913 oz of gold and 184,660 oz of silver</td>
</tr>
<tr>
<td>South Penn</td>
<td>Chemgold, Inc.; Crown Resource Corp.</td>
<td>Ferry</td>
<td>Mined 33,000 tons of rock for heap-leach operation</td>
</tr>
<tr>
<td>Republic Unit</td>
<td>Hecla Mining Co.</td>
<td>Ferry</td>
<td>Produced 70,095 oz of gold</td>
</tr>
<tr>
<td>Valley mine</td>
<td>High Country Mining Exploration</td>
<td>Ferry</td>
<td>Mining and milling</td>
</tr>
<tr>
<td>Gold Dike mine</td>
<td>Vulcan Mountain, Inc.</td>
<td>Ferry</td>
<td>Renewed mining, heap-leach operation</td>
</tr>
</tbody>
</table>

United States during the year October 1986 through September 1987. The mine produced a record of 136,913 ounces of gold and 184,660 ounces of silver in 1987. The operation mined 487,065 tons with an average grade of 0.308 oz/ton gold; the average daily production was 1,600 tons.

The underground blockcave mine is owned by Asamaera Minerals Inc. (51%) in joint venture with Breakwater Resources Ltd. (49%). In July, stock was issued in a public offering for Asamaera Minerals Inc., with Asamaera Inc. as the majority stockholder holding 90 percent of the stock (Asamaera Inc. third quarter report, 1987).

The cannon mine employs approximately 189 workers and had a 1987 payroll of about $5.5 million (Wenatchee World, Oct. 23, 1987). In September the mine went to a 7-day work schedule, up from the previous 5-day work week.

In April, Asamaera announced the discovery of the new B-4 ore zone which was first drilled in 1986. The zone extends north and west of the B-north body that is currently being mined. The new discovery, as of December 1986, adds to the mine's proven and probable reserves about 465,000 tons at a grade of 0.241 oz/ton gold, with a 0.1 oz/ton cut-off (Breakwater Resources Ltd., 1986 year report). In addition, a new zone called the B-Tween has been identified (Asamaera Inc. third quarter report, 1987). Underground and some surface drilling continued in these two areas during 1987 to increase the reserve base.

Modifications made to the mill in 1986 have resulted in an increase in gold recovery from 86 percent to 91 percent. The concentrate is sent to smelters in Japan and Montana for further refining (Wenatchee World, October 23, 1987).

The ore body at the cannon mine "consists of widely spaced veins of quartz, chalcedony, adularia, calcite, sulfides, and gold in a pervasively silicified and mineralized section of Eocene feldspathic sandstone and sandy siltstone about 40m thick." (Utt and others, 1986, p. 425).

Ferry County

Three mines are presently active in the Republic Mining District, which has produced nearly 2.5 million ounces of gold in its 91-year history. Locations of mines and properties in the Ferry County area are shown in Figure 4.

It was a bumper year at the Republic Unit, which is owned by Hecla Mining Company. The company dedicated the 1,300-foot Golden Promise (GP) Shaft in January and produced a record of 70,095 ounces of gold from the mine. Gold grades that were higher than anticipated and increased production from the GP veins resulted in a 76 percent increase in gold production over 1986. The new shaft accesses the Golden Promise veins whose discovery was announced in 1985. The banded chalcedony-epithermal veins are in pyroclastic rocks in the upper part of the Eocene Sanpoil Volcanics.

Approximately 25,000 feet of diamond drilling, 3,500 feet of development drilling, and 300 feet of raises were developed during mining and exploration for the extensions of the recently discovered ore systems. The Republic Unit mine and mill employed 116 workers in 1987.

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Table 4.-Properties producing industrial minerals, 1987

<table>
<thead>
<tr>
<th>Commodity</th>
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<tr>
<td>Clay</td>
<td>Twin River quarry</td>
<td>Ideal Basic Industries, Clallam Inc.</td>
<td>Snoqualmie</td>
<td>Mined 100,000 tons</td>
</tr>
<tr>
<td>Mica</td>
<td>mine and plant</td>
<td>Intercap Industries Inc.</td>
<td>Spokane</td>
<td>Mined 30,000 tons</td>
</tr>
<tr>
<td>Dolomite</td>
<td>Chelan Eagle</td>
<td>Mutual Materials Co.</td>
<td>King</td>
<td>Mined 170,000 cubic yd</td>
</tr>
<tr>
<td>Limestone</td>
<td>Maple Falls</td>
<td>Lehigh Portland Cement Co.</td>
<td>Pend Oreille</td>
<td>Mined 240,049 tons</td>
</tr>
<tr>
<td>Olivine</td>
<td>Golden Cluster</td>
<td>Applied Industrial Material Corp.</td>
<td>Skagit</td>
<td>Milled 40,000 tons</td>
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<td>Great County pits</td>
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was produced by two companies, making Washington one of only two states to produce this refractory mineral.

Locations of properties discussed in this section are shown in Figures 2a and 2b. Table 2 lists producers of processed carbonate products.

**Clallam County**

Ideal Basic Industries, Inc. continues to mine clay from the Twin River quarry. The company produced 100,000 tons of clay, which is banded to their plant in Seattle where it is used in the manufacture of portland cement. The clay is mined from weathered mudstones of the Twin River Group of Oligocene age.

**Grant County**

Witco Corp. is the sole producer of diatomite in the state. A net production of 60,000 tons was mined from two pits; this is a reduction of 30 percent from 1996. The diatomite was mined from former lake beds interbedded with flows of the Miocene Columbia River Basalt Group. The diatomite is utilized for filter in paints and as filter aids.

Basic Resources Co. completed the access road to their Rock Top clay property, where exploration drilling was undertaken. The deposit consists of non-swelling bentonite that is present in sedimentary layers interbedded with the Columbia River basalt. The clay is reported to be suitable for many uses, including absorbents, oil and gas drilling muds, and filter aids.

**King County**

L-Bar Products Inc. continues to mine silica sand at the Ravensdale mine and plant. Approximately 120,000 tons of sand were mined, washed, screened, and dried to produce silica for colored bottles and cement. The sand is mined from the Eocene Puget Group.

Ash Grove Cement West, Inc., entered into a contract to market the sand produced at the Superior quarry. Approximately 40,000 tons of cement-grade silica were mined there in 1987.

Mutual Materials Co. mined 70,000 cubic yards of clay for use in the manufacture of structural brick from their Cougar Mountain pit. The company also has clay pits in Pierce, Thurston, Cowlitz, and Chelan counties.

**Okanogan County**

Columbia River Carbonates completed detailed geological mapping and modeling of the Wauconda quarry, but no new rock was mined. Production of fine-ground high-brightness calcium carbonate continued from stockpiles at the plant near Woodland in Cowlitz County.

Pacific Calcium Inc. continued quarrying of limestone and dolomite from their Whitestone property near Spectacle Lake, 13 miles southwest of Tonasket.

CM Silver Mines, Inc., a wholly owned subsidiary of Lucky Three Mining Co., conducted geologic reconnaissance and core drilling at their limestone deposit near White Rock Mountain. The company is evaluating the potential of their high-calcium limestone deposit for use in cement and for agricultural lime.

**Pend Oreille County**

Lehigh Portland Cement Co. produced slightly more than 242,000 tons of limestone from the Champane Placer. The limestone from the Cambrian Metaline Formation is used in the production of portland cement. Lehigh is presently the only company in the state to produce portland cement from limestone mined in Washington.

Buckman Construction Inc. produced 15,000 tons of silica sand from an alluvial deposit derived from Addy Quartzite. Rock from the Easy Street claim is trucked to Lehigh Portland Cement Co. for use in the manufacture of portland cement.

United Catalysts, Inc., in joint venture with FRM Minerals, Inc., continued to explore their Tolu Talc property.

**Skagit County**

Applied Industrial Materials Corp. produced olivine products after screening and milling olivine from the plant stockpile. Quarry development and exploration were also undertaken.

**Spokane County**

Interpace Industries Inc. mined 30,000 tons of clay at their Mica mine and plant. The company has been approved by the Washington State Community Economic Revitalization Board to participate in bonds issued by the board. The funds will enable the company to expand their brick factory by 7 million bricks per year. The company employs 80 workers (Journal of Business, Nov. 25, 1987).

**Stevens County**

Northwest Alloys, Inc., a wholly owned subsidiary of Aluminum Co. of America, mined more than 500,000 tons of dolomite from the Addy dolomite quarry. Northwest Alloys' mine and plant is the highest value mineral operation in the state because of the value added to the dolomite by the production of magnesia metal at the plant. The company is one of only three producers of magnesium metal in the United States and the only one to utilize the siloethermic process (whereby magnesia in calcined dolomite is reduced by silicon). The company employed more than 11 Washington Geologic Newsletter, Vol. 16, No. 2
460 workers in 1986 and continues as the largest employer in Stevens County (TEAM WASHINGTON, 1986).

Crushed dolomite was produced by several companies. Nanome Aggregates, Inc., continues to produce dolomite from several quarries, including one leased from Chewelah Eagle Mining Company at which approximately 5,000 tons of dolomite was mined. The white and colored stone is used for architectural aggregate, filler, and agricultural lime. Northwest Marble Products Co. continued to mine white dolomite from their quarry northeast of Kelly Hill. The stone is used in the manufacture of ceramics.

Hempill Brothers, Inc., continued to operate two quarries in Stevens County. Silica from a friable area of the Addy Quartzite is mined at their Lane Mountain Silica quarry. The rock is crushed, floated, dried, screened, and run through a magnetic separator to produce several grain sizes of high-purity silica. Limestone from the Cambrian Metaline Formation is mined by the Northport Limestone Division.

L-Bar Products Inc. continues to produce fertilizer and de-icer from magnesite sludge from the Northwest Alloys plant.

Cortez International Ltd. acquired a state lease in the Turf mine area. The company plans to investigate the renewed potential for magnesite from the former producer.

Whatcom County

Columbia Northwest Cement Corp. mined approximately 300,000 tons of limestone from the Kendall quarry, before the company was purchased in September by Tilbury Cement Co. of Delta, B.C., Canada. The kilns have been shut down, and imported clinker is now being ground at the plant. A large staff reduction followed the takeover. The company had been the largest producer of portland cement in the state to mine limestone in Washington.

Oxline Corp. produced 100,000 tons of clivine from their Swan Larsen quarry.

Clausen Lime Company continues to mine limestone from their quarry near Maple Falls. The limestone is thought to be of Pennsylvanian age (Danner, 1966).

Statewide Exploration

Meridian Mineral Company explored for and developed clay, diatomite, limestone, marble, and sources suitable for crushed stone at several places across the state.

REFERENCES CITED


Chinasaurs: The Dinosaurs of Sichuan
Come to the Burke Museum

Figure 1—Huayangosaurus taii, on display at the Burke Museum. This species resembles the well-known American Stegosaurus in having a double row of plates along its back. Photo by Virgil Fassio.

The first North American viewing of dinosaur discoveries from Sichuan Province in the People’s Republic of China are being presented by the Burke Museum. The exhibit, “Chinasaurs—The Dinosaurs of Sichuan”, is a product of collaboration between the Chongqing Natural History Museum and the Burke Museum and is sponsored by The Seattle Post-Intelligencer and United Airlines. Eight Chinese scientists and curators have accompanied the fossils to the United States.

The core of the exhibit is three full dinosaur skeletons: Omelsaurus fuxiensis, a 45-foot-long plant eater with a long tail and neck; Huayangosaurus taii, a "stegosaur" type of dinosaur (Fig. 1); and Yangchuanosaurus shangwensis, a massive erect meat-eater whose skull is one of the largest found in China. Ninety-eight other fossils are on view, including one of the largest nests of dinosaur eggs yet found in China, shells of extinct turtles, and dinosaur footprints.

The fossils on display are between 140 million and 160 million years old. They were recovered from an ancient lake bed, which has also yielded numerous other new forms. In fact, China’s dinosaurs are unmatched in diversity and abundance. Hundreds of specimens representing 22 species have been found throughout the Sichuan Basin. While one species of stegosaur has been found in the United States, Chinese paleontologists have uncovered six species.

The dinosaurs will be on view through September 18, 1988. In conjunction with the exhibit, the museum is offering a series of lectures whose topics range from the Chinese material to the museum’s efforts to expand its collection.

Admission to the exhibit costs $3.50 for adults, $2.50 for students and senior citizens, and $1 for children under 12. Group tours can be arranged by calling (206) 543-5591. More information about the exhibit and lectures is available from (206) 543-5590.
<table>
<thead>
<tr>
<th>Loc. no.</th>
<th>County</th>
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<th>Location</th>
<th>Commodity</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td>55</td>
<td>Stevens</td>
<td>Naname Aggregates, Inc.</td>
<td>Several quarries</td>
<td>Dolomite</td>
<td>Mining and milling</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>Stevens</td>
<td>Northwest Alloys, Inc.</td>
<td>Aady dolomite quarry</td>
<td>Dolomite</td>
<td>Mining</td>
<td></td>
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<tr>
<td>57</td>
<td>Stevens</td>
<td>Northwest Marble Products Co.</td>
<td>White quarry</td>
<td>Dolomite</td>
<td>Mining</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>Stevens</td>
<td>Westmont Mining Inc./International Curator Resources Ltd.</td>
<td>Twilight Canyon</td>
<td>In, Pb, Ag</td>
<td>Drilling</td>
<td></td>
</tr>
<tr>
<td>Stevens</td>
<td>Crown Resource Corp.</td>
<td>County</td>
<td>Au, Ag</td>
<td>Exploration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stevens</td>
<td>Union Pacific Resources</td>
<td>County</td>
<td>U</td>
<td>Exploration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Whatcom</td>
<td>Clauson Lime Company</td>
<td>Near Maple Falls</td>
<td>Limestone</td>
<td>Mining</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Whatcom</td>
<td>Columbia Northwest Cement Corp.</td>
<td>Kendall quarry</td>
<td>Limestone</td>
<td>Mining ceased operation in 3rd quarter</td>
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<tr>
<td>61</td>
<td>Whatcom</td>
<td>Oliverse Corp.</td>
<td>Swen Larsen quarry</td>
<td>Olivine</td>
<td>Mining</td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>Whatcom</td>
<td>Seattle-St. Louis Mining Co.</td>
<td>Minnesota mine</td>
<td>Au, Ag</td>
<td>Exploration</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>Whatcom</td>
<td>Steelhead Resources, Ltd.</td>
<td>Excelsior property</td>
<td>Au, Ag</td>
<td>Geological exploration, drilling</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Whatcom</td>
<td>Western Gold Mining, Inc.</td>
<td>New Light mine</td>
<td>Au</td>
<td>Rehabilitation of portals</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>Yakima</td>
<td>Arctic Exploration and Development, Ltd.</td>
<td>Morse Creek</td>
<td>Au, Ag</td>
<td>Drilling, geochemical sampling</td>
<td></td>
</tr>
</tbody>
</table>

ing system, which includes higher lease payments, and because of renewed exploration interest in Washington. No uranium was produced in Washington in 1987. The most recent uranium production in the state was in 1984, when two properties were being mined.

The information in this report is summarized from voluntary replies to a questionnaire sent to companies and individuals active in mineral exploration and development in the state, as well as from published information. The questionnaire is limited in scope, and therefore, details of activities on individual properties are not always available. Not all questionnaires were returned, and some information requested, particularly regarding expenditures and production, is considered confidential by many of those questioned and

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Staff Notes

Gerald (Jerry) W. Thorsen retired from the Division at the end of February, after 30 years with the State and the Division’s various predecessor agencies. Jerry came to the Division from Washington State University, The Bunker Hill Company, and Climax Molybdenum. In recent years he divided his time between on-site inspection of landslides and geologic hazards and representing the Department of Natural Resources as an expert witness in navigability, forest practice, geohydrology, seismic hazards, land-use conflicts, and other issues relating to environmental geology. Jerry looks forward to time on his boat and a relaxed pace, but we expect to see him on the "outcrop" in his capacity as consultant on geologic hazards for the Northwest Region of the Department of Natural Resources.

Bonnie Bunning, Geologist IV in the Olympia office, left the Division March 11 for a 2-year post as Chief Management Analyst for the Department of Natural Resources. In that capacity, Bonnie will examine and analyze a broad range of natural resource and management issues facing the Department and provide recommendations to the Department’s executive management. The new position offers an opportunity to work with the diverse functions of the Department, from timber harvesting to natural heritage preservation and aquatic land management. Bonnie expects her background in economic geology to enable her to bring a new perspective to natural resource management in the agency.
WHEREAS, earthquakes are among the most devastating of natural disasters; and

WHEREAS, earthquakes have caused death and damage in Washington state in the past, and may do so again; and

WHEREAS, a damaging earthquake could occur anywhere in the state without warning; and

WHEREAS, the citizens of Washington state must be made aware of the potential threat of earthquakes and of the measures that can be taken before, during and after a quake to save lives, protect property and mitigate damages and injuries;

NOW, THEREFORE, I, Booth Gardner, Governor of the State of Washington, do hereby proclaim April 10-16, 1988, as

EARTHQUAKE AWARENESS WEEK

in the State of Washington, and I urge all citizens to take advantage of opportunities to learn about this natural hazard.

Signed, this 22nd day of March, 1988

Governor Booth Gardner

Table 1.-Mineral exploration and development, 1987 (continued)

<table>
<thead>
<tr>
<th>Loc. no.</th>
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<tbody>
<tr>
<td>43</td>
<td>Pend Oreille</td>
<td>Union Pacific Resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Pierce</td>
<td>Rampart Ventures, Inc.</td>
<td>Surprise Valley</td>
<td>T.17N., R.5E.</td>
<td>Au, Ag</td>
<td>Exploration</td>
</tr>
<tr>
<td>45</td>
<td>Skagit</td>
<td>Applied Industrial Materials Corp. (AIMCOR)</td>
<td>AIMCOR Olive</td>
<td>secs. 3-4, 8-9, 16-17 T.36N., R.7E.</td>
<td>Olivine</td>
<td>Production from stockpile</td>
</tr>
<tr>
<td>46</td>
<td>Skamania</td>
<td>Plexus Resources Corp.</td>
<td>Silver Star</td>
<td>sec. 4 T.3N., R.5E.</td>
<td>Au, Cu, Mo</td>
<td>Drilled one hole</td>
</tr>
<tr>
<td>47</td>
<td>Spokane</td>
<td>Interpace Industries Inc.</td>
<td>Mica mine and plant</td>
<td>sec. 14 T.24N., R.4E.</td>
<td></td>
<td>Mining and mine development</td>
</tr>
<tr>
<td>48</td>
<td>Stevens</td>
<td>Boise Cascade Minerals, Pathfinder Gold Corp./Milliton Minerals</td>
<td>First Thought mine area</td>
<td>T.39N., R.37E.</td>
<td>Au, Ag</td>
<td>Exploration, drilling</td>
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<tr>
<td>49</td>
<td>Stevens</td>
<td>Art Bolt</td>
<td>near Flagstaff Mountain</td>
<td>secs. 1-5, 16 T.39N., R.39E.</td>
<td></td>
<td>Sampling</td>
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<tr>
<td>50</td>
<td>Stevens</td>
<td>Champion Gold and Silver, Inc.</td>
<td>First Thought mine</td>
<td>secs. 7, 18 T.39N., R.37E.</td>
<td></td>
<td>Leased property</td>
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<tr>
<td>52</td>
<td>Stevens</td>
<td>Cortez International Ltd. (Oregon Leo Minerals and Timber)</td>
<td>Turk mine area</td>
<td>sec. 36 T.30N., R.37E.</td>
<td>Magnesite</td>
<td>Acquired state lease</td>
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<tr>
<td>53</td>
<td>Stevens</td>
<td>Hemphill Brothers, Inc.</td>
<td>Northport Limestone</td>
<td>sec. 8 T.39N., R.40E.</td>
<td>Limestone</td>
<td>Mining</td>
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<tr>
<td>54</td>
<td>Stevens</td>
<td>Lane Mountain Silica Co. (subsidiary of Hemphill Brothers)</td>
<td>Lane Mountain Silica</td>
<td>sec. 27 T.31N., R.39E.</td>
<td>Silica</td>
<td>Mining</td>
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<tr>
<td>55</td>
<td>Stevens</td>
<td>Lead Point Consolidated Mines Co.</td>
<td>Lead Point Consolidated mines</td>
<td>secs. 2-13, 23; secs. 6, 17-18, 29 T.39N., R.4E.</td>
<td></td>
<td>Exploration</td>
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</table>
Table 1—Mineral exploration and development, 1987 (continued)

<table>
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<tr>
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<tr>
<td>26</td>
<td>Okanogan</td>
<td>L.F. Baum Associates</td>
<td>Turtle Lake</td>
<td>secs. 9-10 T.39N., R.26E.</td>
<td>Au, Ag, Cu</td>
<td>Exploration</td>
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<tr>
<td>27</td>
<td>Okanogan</td>
<td>CM Silver Mines, Inc.</td>
<td>Reed Limestone</td>
<td>sec. 35 T.39N., R.26N.</td>
<td></td>
<td>Limestone Drilling</td>
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<tr>
<td>28</td>
<td>Okanogan</td>
<td>Columbia River Carbonates</td>
<td>Wauconda quarry</td>
<td>sec. 24 T.38N., R.30E.</td>
<td></td>
<td>Limestone Geologic study</td>
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<tr>
<td>29</td>
<td>Okanogan</td>
<td>Herdrick Mining Co.</td>
<td>Ida</td>
<td>secs. 21, 28 T.39N., R.31E.</td>
<td>Au</td>
<td>Sampling and mapping</td>
</tr>
<tr>
<td>31</td>
<td>Okanogan</td>
<td>Keystone Gold, Inc.</td>
<td>Crystal Butte/Gray Eagle</td>
<td>secs. 16, 25-26, 35 T.40N., R.30E.</td>
<td>Au, Ag</td>
<td>Geologic reconnaissance</td>
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<tr>
<td>32</td>
<td>Okanogan</td>
<td>Omak Minerals, Inc.</td>
<td>Hauberle Ranch</td>
<td>North of Riverside</td>
<td></td>
<td>Au, Mo Drilling</td>
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<tr>
<td>33</td>
<td>Okanogan</td>
<td>Pacific Calcium, Inc.</td>
<td>Whitestone quarry</td>
<td>sec. 14 T.38N., R.26E.</td>
<td></td>
<td>Limestone, Dolomite Quarrying and milling</td>
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<tr>
<td>34</td>
<td>Okanogan</td>
<td>Quintana Minerals Corp.</td>
<td>Mazama</td>
<td>T.32-33N., R.21E.</td>
<td>Au</td>
<td>Sampling</td>
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<tr>
<td>35</td>
<td>Okanogan</td>
<td>Newkirk Gold Mines Ltd.; Reliant Resources, Inc./Nord Resources</td>
<td>Smith Canyon</td>
<td>T.32-33N., R.21E.</td>
<td>Au</td>
<td>Drilling</td>
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<td>36</td>
<td>Okanogan</td>
<td>Silver Bell, Inc.</td>
<td>Silver Bell mine</td>
<td>sec. 25 T.38N., R.31E.</td>
<td>Au, Ag</td>
<td>Sampling</td>
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<tr>
<td>38</td>
<td>Okanogan</td>
<td>Westmont Mining Inc./Crow Resource Corp,</td>
<td>Bodie</td>
<td>sec. 34 T.39N., R.31E.</td>
<td></td>
<td>Geologic exploration and sampling</td>
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<tr>
<td>39</td>
<td>Pend Oreille</td>
<td>Buckman Construction Inc.</td>
<td>Easy Street Claims</td>
<td>secs. 23, 24 T.39N., R.44E.</td>
<td></td>
<td>Silica Mining</td>
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<td>40</td>
<td>Pend Oreille</td>
<td>Leithport Portland Cement Co.</td>
<td>Champlain placer</td>
<td>sec. 27 T.39N., R.43E.</td>
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<td>Limestone Mining</td>
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<td>41</td>
<td>Pend Oreille</td>
<td>Lewis and Clark Mines</td>
<td>Lewis and Clark 1-7</td>
<td>sec. 17 T.38N., R.44E.</td>
<td>Ag, Mo, Pb,</td>
<td>Drilling</td>
</tr>
</tbody>
</table>

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Earthquake Awareness Week: Planning and Preparation Can Reduce Losses

Because the threat of catastrophic earthquakes in Washington does not go away or diminish with time, Governor Booth Gardner has again set aside a full week for reminding citizens to prepare themselves. This week, Washington has suffered the damaging effects of ten earthquakes, three in the month of April. The most recent occurred in Seattle on April 29, 1965; seven people were killed, and damages totaled more than $50 million (1984 dollars).

To reduce damages of this magnitude in the future, Governor Gardner has proclaimed April 10 through 16 Earthquake Awareness Week. Throughout the week, state and local emergency managers will be offering safety tips and information through educational programs, displays, and brochures.

"Citizens of Washington State must be made aware of the potential threat of earthquakes," Gardner stated. "They also need to know what can be done before, during, and after a quake to save lives and minimize injury and property damage." While it has been 23 years since the last damaging earthquake, another earthquake could happen at any time.

Earthquakes are caused by the shifting of the various plates that make up the Earth's crust. Vibrations of the ground accompanying the plate motions may sever phone, electric, sewer, and gas lines; destroy freeways; overpasses; and dooms huge buildings and house on busy streets and sidewalks.

The Division of Emergency Management and several local emergency management agencies have prepared educational programs, brochures, and displays to help people to protect themselves from damage or injury. These will be available to the public during Earthquake Awareness Week. For more information, contact your local emergency management agency.

[From text supplied by the Department of Community Development]

Note: The March 1982 issue of Sunset Magazine offered an article titled "Getting ready for a big quake." In this article are many useful tips on preparing for an earthquake and some basic advice about general earthquake preparedness. The Division of Geology and Earth Resources has several technical publications about the locations and effects of earthquakes in Washington. Contact the Division for more information.

Sources of Information about Earthquake Preparedness

From the Federal Emergency Management Agency (FEMA)

The following are representative titles; many other related publications are available from this agency. The FEMA publication number is given in parentheses. All these publications are free.

- "Earthquake Public Information Materials—An Annotated Bibliography" (67)
- "Earthquake Preparedness Information for People with Disabilities" (70)
- "Reducing the Risks of Nonstructural Earthquake Damage—A Practical Guide" (74)
- "An Action Plan for Reducing Earthquake Hazards of Existing Buildings" (90)
- "Improving Seismic Safety of New Buildings—A Non-technical Explanation of NEHRP Provisions" (99)
- "Marketing Earthquake Preparedness—Community Campaign that Get Results" (112)

Federal Emergency Management Agency (FEMA)
P. O. Box 70274Washington, D.C. 20024

From the Washington State Division of Emergency Management

- "Washington State Seismic Safety Report"
- Washington State Division of Emergency Management
- Department of Community Development
- 4220 E. Martin Way
- Olympia, WA 98504

From the U.S. Geological Survey

- "The Interior of the Earth" (free)
- "Safety and Survival in an Earthquake" (free)
- "The Severity of an Earthquake" (free)
- "Earthquake" (free)
- "Seismology Map of the World" ($3.10 each)

U.S. Geological Survey
Public Inquiries Office
Room 687, U.S. Courthouse
West 920 Riverside Ave.
Snoqualmie, WA 98021

(continued on p. 24)

Washington Geologic Newsletter, Vol. 16, No. 2
Sources of Information about Earthquake Preparedness
(continued from p. 23)

From the American Red Cross (local chapters):
- "Family Disaster Plan and Personal Survival Guide"
- "27 Things to Help Your Survive an Earthquake"
- "Safety and Survival in an Earthquake"

From county or local emergency management offices:
- "27 Things to Help You Survive an Earthquake"
- "Family Earthquake Drill"
- "Coping with Children's Reactions to Earthquakes and Other Disasters"
- "Earthquake Safety Checklist"
- "Safety Tips for Washington Earthquakes"
- "Home Hazard Hunt"
- "Learning to Live in Earthquake Country: Preparedness for People with Disabilities, and Preparedness for Apartments and Mobile Homes"

DGER to Contribute to Timber, Fish and Wildlife Research and Monitoring Program

by Robert (Josh) Logan

The Washington Department of Natural Resources (DNR) manages its own timberlands and regulates all non-federal timberlands within the state. With the help of funding from the Timber, Fish and Wildlife (TWF) Committee on Research and Monitoring, the Division of Geology and Earth Resources (DGER) can now initiate a preventive approach to landslide hazards. An engineering geologist is currently being sought by DGER to complete a TWF pilot program for mapping landslide hazards on forested lands. Slope processes and landslide inventory maps will be completed for a test area to be selected by the project geologist. The map information will be compared in a series of manually prepared or computer-generated overlays to develop hazard zonation maps that may be used by field personnel to identify landslide hazards.

The pilot project will also be useful in determining the applicability of computerized geographic information systems to slope stability problems. Both DNR and the U.S. Geological Survey (USGS) have such systems available. The USGS has completed several landslide hazard maps for California. However, Washington has different terrain, geology, and forest cover than California; these differences may limit the utility of current computer programs in this type of project in Washington.

Meetings

American Mining Congress MINExpo International
April 24-28, 1988
McCormick Place, Chicago, IL
For further information, write:
AMC MINExpo International '88
1920 N Street NW
Suite 300
Washington, DC 20036

Pacific Northwest Metals and Minerals Conference
AIME Columbia Section, "Gold Quest"
May 4-6, 1988
Sheraton Hotel
Spokane, WA
For further information, write:
PNMMC (AIME)
c/o NWMA
414 Peyton Blvd.
Spokane, WA 99201
(509) 624-1150

Table 1—Mineral exploration and development, 1987 (continued)

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</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td></td>
<td>Sundance Mining-Development, Inc.</td>
<td>Gold Hill 1</td>
<td>Danville district</td>
<td>Au, Ag, Cu</td>
<td>Leased property to United States Borax and Chemical Corp.</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>United States Borax and Chemical Corp.</td>
<td>Gold Dike/ Gold Hill</td>
<td>secs. 7-8</td>
<td>T.40N., R.34E.</td>
<td>Au</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>Vulcan Mountain, Inc.</td>
<td>Gold Dike</td>
<td>secs. 7-8, 17-18</td>
<td>T.40N., R.34E.</td>
<td>Au, Ag, Cu</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>Asarco Inc.</td>
<td>Several areas</td>
<td></td>
<td></td>
<td>Au, Ag</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>Crown Resource Corp.</td>
<td>Several areas</td>
<td></td>
<td></td>
<td>Au</td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>Newmont Gold</td>
<td>West of Danville</td>
<td></td>
<td></td>
<td>Au</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>Stuart Jackson</td>
<td>Northwestern part of county</td>
<td></td>
<td></td>
<td>Au, Ag</td>
</tr>
<tr>
<td>21</td>
<td></td>
<td>Basic Resources Co.</td>
<td>Rock Top</td>
<td>secs. 20</td>
<td>T.22N., R.26E.</td>
<td>Clay</td>
</tr>
<tr>
<td>22</td>
<td></td>
<td>Witco Corp.</td>
<td>Grant County pits</td>
<td>secs. 7-8</td>
<td>T.18N., R.24E.</td>
<td>Diatomite</td>
</tr>
<tr>
<td>23</td>
<td></td>
<td>Witco Corp.</td>
<td>Grant County pits</td>
<td>secs. 17</td>
<td>T.18N., R.23E.</td>
<td>Diatomite</td>
</tr>
<tr>
<td>24</td>
<td></td>
<td>Ash Grove Cement West, Inc.</td>
<td>Superior quarry</td>
<td>secs. 1</td>
<td>T.19N., R.7E.</td>
<td>Silica</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>Kennebec Exploration</td>
<td>White River</td>
<td>secs. 6</td>
<td>T.18N., R.8E.</td>
<td>Au</td>
</tr>
<tr>
<td>26</td>
<td></td>
<td>L-Bar Products, Inc.</td>
<td>Ravensdale</td>
<td>secs. 1</td>
<td>T.21N., R.6E.</td>
<td>Silica</td>
</tr>
<tr>
<td>27</td>
<td></td>
<td>Mutual Materials Co.</td>
<td>Cougar Mountain pit</td>
<td>secs. 31</td>
<td>T.24N., R.6E.</td>
<td>Clay</td>
</tr>
</tbody>
</table>
Table 1—Mineral exploration and development in Washington, 1987. Locations given where available. See Figures 2a and 2b for property locations.

<table>
<thead>
<tr>
<th>Loc. no.</th>
<th>County</th>
<th>Operator(s)</th>
<th>Property or area</th>
<th>Location</th>
<th>Commodity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chelan</td>
<td>Asanera Minerals Inc./Breakwater Resources Ltd.</td>
<td>Cannon mine</td>
<td>sec. 16, T.22N., R.20E.</td>
<td>Au, Ag</td>
<td>Mining and milling</td>
</tr>
<tr>
<td>2</td>
<td>Chelan</td>
<td>Asanera Minerals Inc./Breakwater Resources Ltd.</td>
<td>Lovitt mine</td>
<td>sec. 22, T.22N., R.20E.</td>
<td>Au</td>
<td>Drilling and sampling</td>
</tr>
<tr>
<td>3</td>
<td>Chelan</td>
<td>Welcome Nugget Mines</td>
<td>Welcome Nugget #1</td>
<td>sec. 30, T.26N., R.18E.</td>
<td>Au, Ag</td>
<td>Exploration</td>
</tr>
<tr>
<td>4</td>
<td>Clallam</td>
<td>Ideal Basic Industries, Inc.</td>
<td>Twin River</td>
<td>secs. 22-23, T.3N., R.10W.</td>
<td>Clay</td>
<td>Mining</td>
</tr>
<tr>
<td>5</td>
<td>Ferry</td>
<td>Chemgold, Inc./Crown Resource Corp.</td>
<td>South Penn</td>
<td>secs. 27-28, T.37N., R.32E.</td>
<td>Au, Ag</td>
<td>Mining, heap leach</td>
</tr>
<tr>
<td>6</td>
<td>Ferry</td>
<td>Cyprus Gold Exploration Corp.</td>
<td>Lone Ranch Creek</td>
<td>secs. 11-12, T.40N., R.35E.</td>
<td></td>
<td>Drilling</td>
</tr>
<tr>
<td>7</td>
<td>Ferry</td>
<td>R.A. Degersen, Inc./Inland Gold and Silver Corp.</td>
<td>Leland property</td>
<td>secs. 10-15, T.24-27, R.34-35, T.37N., R.33E.</td>
<td>Au, Ag</td>
<td>Reconnaissance</td>
</tr>
<tr>
<td>9</td>
<td>Ferry</td>
<td>Echo Bay Mines Ltd./Crown Resource Corp., Gold Texas Resource, Ltd.</td>
<td>Key, Overlook</td>
<td>secs. 7-8, T.37N., R.34E.</td>
<td>Au</td>
<td>Pre-development surface drilling at Overlook deposit</td>
</tr>
<tr>
<td>10</td>
<td>Ferry</td>
<td>Hecla Mining Co.</td>
<td>Republic Unit, Golden Promise shaft</td>
<td>sec. 35, T.37N., R.32E.</td>
<td>Au, Ag</td>
<td>Mining and milling, exploration</td>
</tr>
<tr>
<td>11</td>
<td>Ferry</td>
<td>High Country Mining and Exploration</td>
<td>Valley mine</td>
<td>sec. 6, T.37N., R.33E.</td>
<td></td>
<td>Mining and milling</td>
</tr>
<tr>
<td>12</td>
<td>Ferry</td>
<td>Hendrick Mining Co.</td>
<td>Morning Star</td>
<td>sec. 16, T.40N., R.34E.</td>
<td>Au, Ag, Cu</td>
<td>Mapping and sampling</td>
</tr>
<tr>
<td>13</td>
<td>Ferry</td>
<td>Kettle River Resources Ltd., Curlew Lake Resources Inc.</td>
<td>Empire Creek</td>
<td>sec. 6, T.38N., R.33E.</td>
<td>Au</td>
<td>Drilling and sampling</td>
</tr>
</tbody>
</table>

Mineral Collecting Opportunities in Washington (continued from p. 2)

Washington State Mineral Council

This is an umbrella organization for all rockhound clubs in the state of Washington. Their most noted activity is the establishment of recreational rockhound sites for the enjoyment of the public and club members. Walker Valley (Skagit County) and Hansen Creek (King County) are examples of such sites. For further information about the council, contact: Earl Barnhart, President Washington State Mineral Council P.O. Box 2404 Desmet Spokane, WA 99202

Friends of Mineralogy, Pacific Northwest Chapter

This chapter has members in British Columbia, Idaho, Oregon, and Washington. Members are primarily interested in mineral collection and the science of mineralogy. The group hosts an annual symposium in Tacoma during September. For information, contact: Richard O'Donnell, President Friends of Mineralogy 4601 E. 18th St., Apt. #57 Vancouver, WA 98661

Society of Paleo loggers

This is an international organization drawing most of its members from the Pacific Northwest and having its headquarters in the state of Washington. Members' interests lie in collecting, displaying, and studying of petrified wood. For membership information, contact: L. Steve Edmondson, Secretary Society of Paleologers 6202 N. 84th Ave. East Tacoma, WA 98445

Mining Awareness Week

The United States Senate has proclaimed April 24-30, 1988, as “Mining Awareness Week”. A similar House resolution was being sponsored by Representative Jim Wright of Texas and others. Following is the text of Senate Resolution 296:

Whereas, the ability of the domestic mining industry to survive and prosper at home and in the international market is vital to the economic well-being and world leadership position of this nation; Now, therefore, be it

Resolved, That the Senate of the United States hereby proclaims April 24-30, 1988, Mining Awareness Week, in recognition of the economic importance of the mining industry.
THESES

U.S. GEOLOGICAL SURVEY REPORTS

GEOPHYSICAL SURVEY OF CANADA REPORTS


by

Nancy L. Joseph

According to information obtained by the Division of Geology and Earth Resources, 23 metal and industrial mineral operations (excluding sand and gravel) produced gold, silver, limestone, dolomite, silica, olivine, diatomite, and clay in 1987 (Table 1). Three portland cement plants and seven plants producing lime, calcium chloride, precipitated calcium carbonate, or ground limestone were also in operation (Table 2).

Nonfuel mineral production in Washington in 1987 was valued at $402 million, according to preliminary figures compiled by the U.S. Bureau of Mines. This represents a 7 percent increase over the 1986 value of $376 million. The 1986 figure, which is considerably greater than the preliminary $254-million figure previously reported (Joseph, 1987), includes adjustments to the preliminary figures and reporting by the Bureau of Mines, for the first time, of the value of magnesium metal production by Northwest Alloys, Inc.

In 1987 Washington ranked 20th in the nation in nonfuel mineral production, according to the Bureau of Mines. Precious metal production increased significantly because of increased output at both the Canyon mine and the Republic Unit. Increases in production and value of gold and silver, increased production of sand and gravel, and the steady, near-capacity output of magnesium metal were more than sufficient to offset a 22 percent decrease in the production of portland cement, which was caused, in part, by the shutdown of Columbia Northwest Cement Corp.

Total revenue from prospecting, mining, and quarrying, including sand and gravel production, on state lands was $506,069 for the fiscal year ending June 30, 1987 (Fig. 1). This represents a nearly 12 percent increase in revenues over the previous fiscal year. Revenues for the present fiscal year should exceed those of 1987 because of reform of the mineral leas-
Mineral Collecting Opportunities in Washington
by Raymond Lasnalis, State Geologist

This issue of the Division newsletter features an article by Nancy Joseph on the status of Washington's mineral industry during 1987. Minerals provide one of the foundations for an industrialized society, as well as an important source of revenue for Washington.

In addition to their economic role, minerals, as well as fossils and other geologic materials, also provide enjoyment to a significant portion of Washington's population. Whether the activities involve field collection, the faceting of a gemstone, or the study of crystals, all are a means of learning about our Earth.

As with virtually everything else these days, we are becoming more specialized at work and play. So it is with "rockhounding." Depending on one's interest, there is an organization to match and foster it. With the advent of spring and opportunities to visit collecting sites, we offer some information for those wishing to get involved in mineral collecting. Among the groups active in Washington are the following:

Northwest Federation of Mineralogical Societies

The northwest region covers Alaska, Idaho, Montana, Oregon, Utah, and Washington. The federation's individual club members are involved in all aspects of rockhounding, with emphasis on lapidary arts, but many members are basically collectors. The federation's Northwest Federation has an annual exhibition. The membership directory lists, for example, 40 clubs for Washington and their memberships. The directory costs $3 and is available from:

Hemmen Kololi, Directory Chair
Northwest Federation of Mineralogical Societies
208 Fairview 2 East
Great Falls, Montana 59404

Other Reports of Interest

Association of State Floodplain Managers, 1987, Realistic approaches to better floodplain management: proceedings of the 11th annual conference: University of Colorado Natural Hazards Information Center Special Publication 18, 326 p.


King County Parks, Planning and Resources Department, 1987, Sensitive areas map folio, King County, Washington: King County Parks, Planning, and Resources Department, 1 v.


Peterson, Donald; Cordell, Allen; Jeffries, Allen; Melby, Lynn; Ziegler, Gordon, 1987, Special investigation report by the Department of Social and Health Services Iodeine-129 Task Force: Washington Department of Social and Health Services, 59 p.


Division Releases
"Selected Papers on the Geology of Washington"
and Three Open-File Reports

The Division of Geology and Earth Resources announces the publication of its Bulletin 77, "Selected Papers on the Geology of Washington". J. Eric Schuster is editor of this volume. The 406-page book is a collection of technical papers derived from a symposium presented at the Cordilleran Section meeting of the Geological Society of America in 1982. Not all talks given at the symposium are represented in the volume, and several papers on related topics have been added to those from the symposium. Virtually all papers have been updated within the last year. The 19 papers cover topics ranging from geochronology to tectonics and from the Priest River metamorphic complex to recent deposits at Mount St. Helens.

The publication is available from the Division's Olympia office; its address is given on page 2 of this newsletter. The price is $14.84 + 1.16 tax (Washington residents) = $16.00. Please add $1 to each order for postage and handling.

Connie Manson, Division librarian, has compiled literature about landslides in western Washington. Open File Report 88-1, which is 58 pages long, is titled "Landslides of Western Washington—A preliminary bibliography and index". The index is arranged primarily by county or geographic area.

A second bibliography, also compiled by Connie Manson, covers literature for Ferry County. Open File Report 88-2, "Bibliography of the geology and mineral resources of Ferry County, Washington, 1900-1987" is 58 pages long. It contains a subject index, and the bibliographic entries are also listed by geologic age of the described materials.

Open File Report 87-17 is a series of geologic maps of the Twisp River-Chelan Divide region of the North Cascades of Washington. The author of this report is Robert B. Miller of San Jose State University. A summary map is at 1:100,000-scale, and 11 component maps are at 1:24,000.