

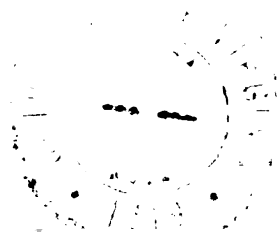
A REPORT ON WASH- INGTON TERRITORY

W. H. Ruffner BY
W. H. RUFFNER, LL.D.

ILLUSTRATED



NEW YORK
SEATTLE, LAKE SHORE AND EASTERN RAILWAY
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PREFACE

THE matter of this Report on Washington Territory is so arranged that the reader, by referring to the table of contents, can turn at once to any particular topic. The report is divided into six chapters, to wit :

First, Itinerary, which mentions briefly the places I visited, and the dates.

Second, A General Account of Washington Territory, which includes something of its History, its Location, and its great Pacific Market. Under the last of these heads is given a large body of facts which will surprise any one who has not studied the peculiar commercial advantages of our Pacific States, and above all, of Puget Sound. There is also given some account of the topography, climate, soils and natural vegetation, with special stress upon the great forests of the Puget Sound basin. The lumber industry is next described, followed by a somewhat full account of agricultural products, especially those of the Great Plain of the Columbia River. Finally, in this division,

something is said of the available labor of the country.

Third, Geology of Washington Territory. In one division I endeavor to give the Historical and Structural Geology of the Territory, and in another division I give the Economic Geology. In the latter I describe the beds of coal, iron ore, granite, limestone and marble, and also the ores of the precious and base metals as they have been discovered in all parts of the Territory.

Fourth, the special interests of the Seattle, Lake Shore and Eastern Railway are discussed. I begin with Seattle, to show its advantages as a terminus. I then say something of the terminal property owned by this Company, and of the suburban interests of many kinds, such as residences, parks, gardens and industrial works which are likely to grow up along the first twenty miles of this railway. I then take up the great timber interest along the line, which, in its magnitude and value, will give this road pre-eminence over all others. The agricultural products along the line are next spoken of. I then take up the great coal interest which will minister so largely to the road—an interest whose magnitude can be readily inferred from the fact that this railway will pass through, or

near, five and perhaps six distinct coal fields between Puget Sound and the Columbia River. I next show the advantages which this road will have in the development of the great magnetic iron-ore beds on both sides of the Cascade Mountains, and also the remarkable juxtaposition of ore, flux and fuel, which are found in the Snoqualmie Valley. Attention is also called to the business which is likely to arise from the limestones, marble and granite for building and monumental purposes. Finally, I call attention to the great advantage which this road will have, or, at least, may have, in controlling the large and increasing business connected with the mines of precious and base metals, which are being opened north and east of this line.

Fifth, Cities and Towns are briefly noticed which will, or may, bear an important relation to the Seattle Road.

Sixth, a supplementary chapter, giving latest information.

W. H. RUFFNER.

LEXINGTON, VA.

INDEX.

	PAGE
ITINERARY	17
Great Plain, 17—Cascade Mountains, 17—Hop Ranch, 17—Snoqualmie Pass, 18—Guye Mines, 18—Mt. Logan, 18—Denny Mines, 19—Salal Prairie, 19—Moss Bay Co., 19—Raging River, 20—Gilman Mines, 20—Blake- ley Mills, 20—Wilkeson Mines, 20—Kirke's Coal Mines, 21—Portland, 23—Spokane Falls, 23—Good weather, 25.	
GENERAL ACCOUNT OF WASHINGTON TERRITORY	26
HISTORICAL	26
Denny, of Denny Mines, 26—Causes of delay in settle- men, 26—Population of Washington Territory, 27.	
LOCATION AND MARKET	27
Majority of the human race in the countries of the Pacific, 28—Change in the currents of trade, 28—The China trade, 29—The trade of the Amoor River, Japan, etc., 31—The new railroad across Siberia to St. Petersburg, 32—The American Pacific States have decisive advan- tages over all others in controlling the Pacific trade, 33 —Advantages in distances, 34.	
ROUGH ESTIMATES OF DISTANCES	34
Advantage in productions, 36—Coastwise trade, 36— South American trade, 36—Large existing trade, 37—	
TABLE—Ports of the Pacific showing total value of Exports of Domestic Merchandise for year ending June 30, 1885, June 30, 1887, and total value of Imports of Merchan- dise for year ending June 30, 1885, June 30, 1887	38
PRINCIPAL EXPORTS OF DOMESTIC MERCHANDISE, YEAR ENDING JUNE 30, 1885	39
APPENDIX—List of Exports of Domestic Merchandise, year ending June 30, 1885. Exported from the seven Cust- oms Districts of the Pacific, 39—List of Imports of Merchandise, year ending June 30, 1885. Imported into the seven Customs Districts of the Pacific	41
APPROXIMATE POPULATION IN THE YEAR 1887 OF THE WORLD	42

	PAGE
TOPOGRAPHY OF WASHINGTON TERRITORY	43
Puget Sound, 44—Lake Washington, 44—West Washington and East Washington, 45—Cœur d'Alene Mountains, 46—The Great Plateau, 47—Coulées, 47—Columbia and Snake Rivers, 48.	
ALTITUDES IN WASHINGTON TERRITORY	49
CLIMATE	49
The climate of Washington Territory, 49—Mild and equable, 51—Rainfall, 51—No blizzards or cyclones, 53—Differences between East and West Washington, 53—Chinook wind, 55.	
SOILS	55
Soils all fertile, 55.	
TABLE SHOWING THE MEANS OF THE DAILY MAXIMUM AND MINIMUM TEMPERATURES IN DEGREES FAHRENHEIT.	56
TABLE SHOWING THE AVERAGE PRECIPITATION AT STATIONS OF THE SIGNAL SERVICE	57
A remarkable soil, 60.	
NATURAL VEGETATION	61
Vast vegetation, 61—Deciduous trees, 62—Larch, 62—Extraordinary evergreen forests, 63—Douglas fir, or Oregon pine, 63—The best of ship timber, 64—White cedar, 65—Beautiful house lumber, 65—Hemlock spruce, 65—Tanners wanted, 66—White pine, 66—Balsam fir, 66—Large supply of Canada Balsam, 67—The yew, 67—The superior timber of Snoqualmie Valley, 67—Range for horses and cattle, 69.	
LUMBERING	69
Magnitude of the lumber business, 70—Vast extent of the lumber market, 70—The great saw-mills, 71—Profits and prices, 73.	
AGRICULTURE	73
Clearing the land, 73—Demand for agricultural products, 74—Large crops, 74—Hop-growing on a large scale, 74—The changed agricultural conditions of East Washington, 75—Irrigation in the Yakima Valley, 75—Varied crops,	

	PAGE
77—The Great Plain, 77—Boundaries, 78—Early history, 78—Area and population, 79—Amazing wheat crops: surpassing all other States, 79—Railroads overwhelmed with freight, 80—Price of wheat and cost of production, 81—Also barley and oats, 83—The soil a natural fertilizer, 84—Quality of the wheat, 84—The market in England, China, and other Asiatic ports, 85—Astonishing growth of vegetables, 85—Crops without rain, 86—West (not East) Washington to be the great cattle country, 86—Tree-planting, 87.	
LABOR	88
Good supply of labor, but more wanted, 88—Wages, 88.	
THE GEOLOGY OF WASHINGTON TERRITORY	90
HISTORICAL AND STRUCTURAL	90
The Western Coast regions younger than the Rocky Mountains and Appalachians, 91—An outlying Continent, 91—The rise of the West Coast, 92—The rocks and minerals of the Cascade Mountains, 93—The metamorphic rocks of doubtful origin, 93—The coal beds, 94—The volcanic mountains and their great activity, 95—The wonderful cañon of the Columbia River, 96—The great sheets of basalt, 96—Origin of the rich soil of East Washington, 97—The volcanoes not wholly extinct, 98—Glacial drift, 98.	
ECONOMIC GEOLOGY	99
I. Coal	99
Thickness of the Coal Measures, 99—Fifteen workable seams, 100—Different kinds of coal described, 100—The chemical changes in coal beds, 101—Deficient nomenclature, 102—Lignite an unsuitable name for the coals of Washington Territory, 103—The coking quality not general in these coals, but found in some, 104—Analyses of Washington Territory coals, 106.	
THE COLLIERIES	106
Authorities, 106.	
ANALYSES OF REPRESENTATIVE SAMPLES OF WASHINGTON TERRITORY COALS AND LIGNITES	107
The different mines, 108.	

	PAGE
a. Carbon River Group	108
Anthracite, coking and gas coals, 108.	
b. The Green River Group	110
The Common Point, equidistant between Tacoma and Seattle, 111—Franklin and Black Diamond mines, 112—The Kirke or Moss Bay Company (English) mines, 112.	
c. The Cedar River Group	117
Cedar River mines, 117—Talbot and Renton mines, 118—Newcastle Mine, 118—Cost of mining, 119—Large production, 119—Misrepresentation, 120—Correction by Mr. Whitworth, 122.	
d. The Squak Creek, Raging River, and Snoqualmie Group	125
Gilman Mines, 125—Structure of Squak Mountain, 125—Peculiar advantages for mining possessed by the Gilman Mines, 127—Seattle Coal and Iron Company, 127—Seven seams, 128—Details, 128—Good coal, 128—Another good coal seam, 128—And another, 129—Large body of valuable coal, 131—Washington Mines, 132—Raging River coals, 132—Details, 134—Snoqualmie Mountain Coal Group, 136—Details, 136—Good coking coal, 136—Also good coking coal, 138—Large and valuable bed, 138—Another good bed, 139—Geological relations, 139—This the bottom group, 140.	
e. The Yakima and Wenatchie Group	140
Yakima or Roslyn coal field, 140—Coal on the Wenatchie, 141—Coal under the Great Bend country, 142.	
f. Bellingham Bay, Skagit River, and other Coal Fields .	142
The first mining on Bellingham Bay, 142—Coal on Skagit River, 142—Coal south of Puget Sound, 144—Total shipments of coal from Washington Territory, 144.	
g. Coal Seams in British Columbia.	145
Coal on Vancouver's Island, 145.	
II. Iron Ore	146
The iron ores, 146—The great magnetic ore beds of Cascade Mountains, 147—Resembles the Cranberry ore deposits, 147—Guye Mine on Mount Logan, 148—	

	PAGE
Denny Mine, 149—Chair Peak, or Kelly Mine, 149— Middle Fork Mines, 150—All easily reached from Se- attle, Lake Shore and Eastern Railway, 150—Cle-ellum ore beds, 150—Burch's ore bed, 152—Dudley ore bed, 153—Undoubtedly large beds of steel ores, 153—Of superior quality, 153.	
ANALYSES OF SNOQUALMIE IRON ORES	154
Proved by analysis to be unsurpassed, if equalled, 155.	
COMPARATIVE ANALYSES OF STEEL ORES	155
Improved processes, 156.	
III. Granite, Limestone and Marble	157
Granite, 157—Marble and Limestone, 158.	
IV. The Precious and Base Metals	159
Precious metals on Cascade Mountains, 159—On Cle- ellum River, 160—Large copper vein in Stevens County, 161—Precious metals on Methow River, 161—The rich mines of Okanogan, 162—The mines in the Colville region, 164—The Old Dominion Mine, 165—The Daisy Mine, 165—Young America Company, 166—The Little Dalles, 166—Cœur d'Alene Mines, 167—The large ton- nage from and to the mines, 169.	
SPECIAL REMARKS ON THE COUNTRY AND ITS RESOURCES ALONG THE LINE OF THE SEATTLE, LAKE SHORE AND EASTERN RAILWAY	171
SEATTLE	171
Commercial and manufacturing advantages, 171—Good climate, 171—Good population, 172—High civilization, 172—Railroad lines, 173—The chief ship-building cen- tre, 174—Seattle better located than San Francisco, 174.	
THE TERMINAL PROPERTY OF THE SEATTLE, LAKE SHORE AND EASTERN RAILWAY	175
Unrivalled terminal property, 175.	
SUBURBAN INTERESTS	175
But two entrances by land, 175—Superiority of the northern suburbs, 175—Factories of the future, 176— Ship canal, 176.	

	PAGE
TIMBER	176
Superiority of the timber on the Seattle, Lake Shore and Eastern Railway, 177—The forests described, 178—Forests of Raging River, 178—Forests near Hop Ranch, 179—Superior to the Long Leaf forests of the Southern States and of the Mississippi Bottom, 180—Trees ten feet in diameter, 180—Average nearly five feet in diameter and 250 feet high, 181—Lumber product per acre, 181.	
AGRICULTURAL PRODUCTS	183
Agricultural freights, 183—Produce of Hop Ranch, 183 Farming, fruit and grazing lands, 185—Hops, barley and beer, 186—The two great railroads, 187—The Great Bend country, 187—Douglas County, 188—Lincoln County, 189—Spokane County, 189—Price of farming lands, 189—Tonnage, 190.	
COAL	191
The Seattle railway passes five coal fields, 191—Largest shipments from the Gilman Mines, 192—Superior mining advantages of the Gilman Mines, 193—Mr. Whitworth's testimony, 193—Cost of mining coal, 196—Cost at Gilman Mines, 197—Prices of coal, 197.	
IRON ORE	199
Handling the iron ores, 199—Furnace sites, 199—Salal Prairie, 200—Charcoal cheaply produced, 200—Quantity of charcoal to the ton of iron, 201—Bessemer ores commonly distant from fuel, 202—High cost of Lake Superior ores, 203—Cost of producing ore in Pennsylvania, 203—Cost of Bessemer-pig in Snoqualmie Valley, 203—Large market for steel rails, 204.	
THE OTHER MINERALS	204
Limestone, 204—Marble, granite, sandstones, slates, 204—Precious and base metals, 205—Okanogan, Colville and Kootenai, 205—Cœur d'Alene, 206—Transportation lines to the mining regions, 206.	
CITIES AND TOWNS	209
The only competition is between Tacoma and Seattle, 209—Advantages of Seattle, 210—Towns of East Washington, 210—Spokane Falls and its fine prospects, 211—	

	PAGE
Mr. Paul F. Mohr's article, 211—Sprague, Colfax, and Lewiston, 215—Notes on the Colfax country, 216—Lewiston, 217—Walla Walla, 217.	
BRANCHES AND ROUTES FOR THE SEATTLE, LAKE SHORE AND EASTERN RAILWAY	218
Railroad branches, 218—The Palouse country, 219—Arguments for the Palouse branch, 220—Manitoba railroad, 220.	
SUPPLEMENTARY CHAPTER, GIVING LATEST INFORMATION	222
Rapid growth of Seattle and Spokane Falls, 222—Change in the location of the railroad, 222.	
REPORT FROM F. H. WHITWORTH, ESQ., CIVIL AND MINING ENGINEER ON SEATTLE, ETC.	223
Population of Seattle, 224—New manufacturing establishments, 224—New steamers, 224—The iron company at work, 225—Coking coals, 225—New discoveries of iron ore, 227—Lumber business growing, 228—Population and freights increasing, 228—Labor strike at Gilman Mine, 228—Gilman coal seams, 229—Progress of the West Coast Railroad, 229—Resources of the country along the new line across Cady's Pass, 230—Progress in building the road, 231—Cable Railway in Seattle, 231—Southern Pacific Railroad supposed to be coming to Seattle Harbor, 231.	
REPORT FROM E. A. ROUTHE, ESQ., CONCERNING SPOKANE FALLS, ETC.	232
Growth of Spokane Falls, 232—Prodigious development of the mining interest, 233.	
REPORT FROM PAUL F. MOHR, ESQ., CONCERNING THE CADY'S PASS AND WENATCHIE ROUTE	234
I. ENGINEERING FEATURES	234
Engineering details of the new route, 234.	
II. RESOURCES	236
Mr. Mohr's account of the resources of the new route	236
III. SCENERY	238

LIST OF ILLUSTRATIONS.

- UPPER SNOQUALMIE FALLS. FRONTISPIECE.
LAKE WASHINGTON—SHOWING MOUNT RANIER IN
THE DISTANCE. FACING PAGE 44.
A VIEW OF THE FOREST. FACING PAGE 62.
INDIANS GATHERING HOPS. FACING PAGE 74.
BRIDGE OVER THE SPOKANE RIVER. FACING PAGE 88.
LOWER SNOQUALMIE FALLS. FACING PAGE 92.
ENTRANCE TO GILMAN COAL MINE. FACING PAGE 106.
COAL-BUNKERS ON SEATTLE HARBOR. FACING PAGE 128.
A TRAIN-LOAD OF LOGS. FACING PAGE 176.
HAY-MAKING IN WASHINGTON TERRITORY. FACING
PAGE 184.
VIEW OF THE CITY OF SPOKANE FALLS. FACING
PAGE 210.
VIEW OF SEATTLE AND THE HARBOR. FACING PAGE 222.
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LIST OF MAPS.

- MAP OF ASIA AND PACIFIC OCEAN. FACING PAGE 27.
MAP OF WILKESON COALFIELD. FACING PAGE 109.
MAP OF THE CITY OF SEATTLE. FACING PAGE 170.
MAP OF SPOKANE FALLS. FACING PAGE 232.
MAP OF WASHINGTON TERRITORY. IN POCKET, INSIDE
BACK COVER.
MAP OF UNITED STATES. IN POCKET, INSIDE BACK COVER.

ITINERARY.

I ENTERED Washington Territory, by way of the Northern Pacific Railroad, on the morning of October 27, 1887, coming first to the valley of the Spokane River, and spending the entire day in traversing the plains of Eastern Washington, reaching Pasco Junction a little after nightfall. I crossed the Cascade Mountains on the Switchback, and arrived at Tacoma about noon of the 28th, at which point I took a Puget Sound steamer, and landed at Seattle about four P.M. the same day. The next morning, accompanied by Mr. F. H. Whitworth, engineer, and Mr. F. M. Guye, I went out on the Columbia and Puget Sound Railroad to the end of the road, near Newcastle, where we took horses, and reached Hop Ranch, on the Snoqualmie River, the same night.

Great Plain.

Cascade Mountains.

Hop Ranch.

October 30.—Proceeded up the south fork of the Snoqualmie River, and reached the engineers' camp near the top of Cascade Mountain, at Snoqualmie Pass. Distances by rail and by wagon road: Seattle to Coal Creek, near Newcastle, twenty miles; Coal Creek to Squak Valley, five miles; Squak to Falls City, ten miles;

Falls City to Hop Ranch (or Snoqualmie) six miles ; Hop Ranch to Engineers' Camp, twenty-six miles ; Camp to Summit, five miles.

The railroad on which I left Seattle is a narrow-gauge coal road. Between its terminus and Squak Valley is a high mountain spur. The proportion of cleared land along this whole line is not large in comparison with the forests of evergreen timber, but there are many farms of great fertility, some of them large. The timber increases in quantity and size nearly to the top of the mountain. On these points I shall speak fully hereafter. My object in thus hastening to the Cascade Mountains was to make my observations first at the point where I was most likely to be interrupted by bad weather. I found the engineers, headed by Mr. Thompson, busily engaged in making the location of the railroad, beginning at Snoqualmie Pass (the summit), and working westward and downward, so as to connect with their finished work in the neighborhood of Hop Ranch.

Snoqualmie
Pass.

Spending the night of October 30 at the camp, I went next morning to the Guye Iron Mines, which were one mile from the line of the railroad. The outcrops of ore and limestone lie high on a mountain, which I named Mount Logan, in honor of General T. M. Logan,

Guye Mines.

Mt. Logan.

who seems to have been among the first of the Eastern men to put faith in the resources of this remarkable region. I returned in the evening to the engineers' camp.

The next day, November 1, I spent visiting the Denny Mine, two miles from the railroad line, and also high on a mountain, and again returned to camp. The Chair Peak Mine (also called the Kelley Mine), thirteen miles distant from the railroad, and Guye's Mine on Middle Fork Mountain, six miles distant, I did not visit, owing to want of time.

Denny Mine.

November 2.—First rain. We returned down the mountain, and stopped for an hour at Salal Prairie, where we found a large camp occupied by the employees of the Moss Bay Iron and Steel Company, of England, who expected to build iron furnaces on this admirable location.* This night we spent at Hop Ranch, a description of which is given hereafter.

Salal Prairie.

Moss Bay Co.

November 3.—Spent the most of this day in examining the coking coal beds on Snoqualmie Mountain, three miles from Hop Ranch, and reached Falls City that night, pausing by the way to look upon that wonderful sight, the Snoqualmie River Falls, 267 feet high.

* This wealthy company has since determined to establish its works on Lake Washington, at Kirkland.

Raging River. November 4.—Left the line of the railroad and went up Raging River ten miles, where I visited the coal openings, and spent the night at the miners' camp. The Raging River valley and mountain-sides are covered with large timber.

Gilman Mines. November 5.—Descended Raging River valley six miles to the line of the railroad, which we followed to the Gilman Coal Mines, on Squak, passing a bed of ochreous earth, which might have value for paint, and may lead to a bed of iron-ore.

At Camp Gilman I looked at all the openings which were accessible, and observed the preparations making for large mining. Spent the night at Tibbett's in Squak Valley, two miles distant.

November 6.—Returned to Seattle.

November 7.—In Seattle.

Blakeley Mills. November 8.—Crossed Puget Sound to the great Blakeley Lumber Mills, and also examined Mrs. Guye's large collection of the minerals of Washington Territory.

November 9.—Made short excursions in and around Seattle, including a trip on the Seattle, Lake Shore and Eastern Railway, fourteen miles out.

Wilkeson Mines. November 10.—Went to the Wilkeson Coal

Mines, where I found the only coke ovens I saw in the Territory.

November 11.—Returned to Seattle by way of Tacoma, where I met Mr. Peter Kirke, the partner and agent of the Moss Bay Company, who is preparing to erect a steel plant; but whether he intended to build at Salal Prairie or at Cle-elum, I could not ascertain. In fact, I am not sure that he had then determined in his own mind.

November 12.—Excursions around Seattle, especially around the borders of the lakes.

November 13.—The first Sunday I have been able to observe like a Christian.

November 14 and 15.—Collecting information and constructing maps.

November 16.—Out on the line of the S. L. S. & E. Railway eighteen miles.

November 17.—To Kirke's Coal Mines on Green River. By rail as far as the Franklin Coal Mines, passing the Renton, Cedar Mountain and Black Diamond mines. At Franklin Mines, took horses to the Green River Mines, seven miles, where we spent the night at Mr. Kirke's camp.

Kirke's Coal
Mines.

November 18.—Last evening and to-day, examined all the openings on Mr. Kirke's property, and one opening on Section 34, Sugar-

Loaf Mountain, owned by Mr. Whitworth and others; and took the Northern Pacific Railroad cars at the Common Point, and got back to Seattle the same night.

November 19.—In Seattle working on maps.

November 20.—Sunday.

November 21.—Remained in Seattle.

November 22.—Went to Portland, Oregon. I will here say that Mr. F. H. Whitworth accompanied me on all my trips away from Seattle, and superintended the construction of my large maps, which were made in his own office. I found him a most obliging gentleman, and exceedingly well informed about the country. He was untiring also in collecting for me such information as he did not already possess. Judge Burke, Mr. Leary, Mr. Mackintosh, Governor Squire, Judge Lewis, Dr. Minor (the Mayor), etc., were exceedingly attentive, Judge Burke especially so. Other citizens, such as Chancellor Jones, ex-Governor Ferry, Mr. Arthur A. Denny (the oldest citizen on Puget Sound), Mr. F. M. Guye, Dr. Cumming, Mr. Haller, etc., were cordial, and ready to do me any service. Indeed, the citizens of Seattle, so far as I became acquainted with them, showed themselves in enthusiastic sympathy with the new railroad enterprise.

November 23.—Spent the day in visiting the Oswego Iron Works, six miles from Portland, in company with Mr. S. G. Reed, president of the Oregon Iron and Steel Company. The only point of special interest connected with these unfinished iron-works, is that Mr. Reed is looking forward impatiently to the progress of the S. L. S. & E. road, expecting to receive from it magnetic ore for mixture, also limestone and coke.

Portland.

November 24.—Ascended the Columbia River by steamer, with six miles of portage, to the Dalles, where I took the Northern Pacific train for Spokane Falls, having daylight from Pasco Junction.

November 25.—Nothing could be more unjust to the country than the location of the Northern Pacific Railroad, which runs most of the way to Spokane Falls in a *coulée* (or dry river bed), which completely hides most of the farming land from the traveler.

November 26.—In Spokane Falls, which I found to be a rapidly growing city of 7,000 to 8,000 people, who are pressing the interests of the town with amazing energy. Mr. Routhe, president of the Board of Trade; Mr. Cannon, president of the Bank of Spokane Falls; Mr. Paul F. Mohr, Mr. Curtis, Mr. Nash, and quite

Spokane Falls.

a number of other prominent citizens, called upon me, and showed the liveliest interest in the Seattle, Lake Shore and Eastern Railway. I collected here a mass of valuable information concerning the agricultural and mineral resources of Eastern Washington; this being an important centre of trade for farmers and miners.

November 27.—Sunday.

November 28, 29 and 30.—Went out on the Spokane Falls and Palouse Railroad to the Palouse River country. At Garfield I took the train to Colfax, which I found to be also a flourishing place, and wide awake in reference to the Seattle road. The citizens here were also ready to do all in their power to aid the enterprise.

December 1.—Arrived at Walla Walla, another of the great wheat centres, where I found leading citizens well informed as to the new railroad, but not indulging much hope of its coming within striking distance, except in the remote contingency of Snake River Valley being selected as the route of the Manitoba Railroad.

December 2.—In the afternoon came south fifty miles, to Pendleton, in Oregon, and on the morning of the 3d started for home by way

of the Oregon Short Line and Union Pacific. By this time the earth was covered with a light snow ; but upon the whole, the weather during my trip was pleasant—certainly not so much falling weather as I had a right to expect, and no severe cold.

Good weather

Thus I was five weeks and two days in Washington Territory. The entire trip, from the time I left Lexington until my return, was seven weeks and two days. Miles traveled, 8,500.

A GENERAL ACCOUNT OF WASHINGTON TERRITORY.

HISTORICAL.

Denny, of
Denny Mines.

Causes of delay
in settlement.

THE first white man who ever settled near the site of Seattle (Mr. Arthur A. Denny) now lives in that city, and can scarcely be called an old man. The country remained unsettled so long, partly because of its inaccessibility from the East, and partly because it was disputed territory between the United States and Great Britain. It became a separate Territory only in 1853. No trans-continental line of railroad touched any part of Washington Territory until four years ago, when the Northern Pacific passed across the eastern part of the Territory, and united with the road along the Columbia River, which had been built by the Oregon Railway and Navigation Company, and which had barely entered this Territory. Following this line to Portland, Oregon, and then completing the road from Portland, northward, the railroad reached Puget Sound at Tacoma by this circuitous route in 1883.

The Northern Pacific Railroad has, during the present year (1887), succeeded in reaching Tacoma by a more direct, though still angular,

line, crossing the Cascade Mountains at Stampede Pass.

Whilst thus comparatively unknown and inaccessible, it is not surprising that population should at first come in slowly. Those who came to Western Washington were chiefly lumbermen. Since that time farmers have settled large tracts of country, commerce has become large, and now every interest is going forward with great rapidity.

The population in 1880 was 67,000. Governor Semple, in his report for 1887, puts the population at 143,669, which shows a gain in seven years of over 100 per cent. But the Governor himself declares that the enumerations made since 1880 are unreliable, and it is claimed by intelligent gentlemen in Seattle that the present population exceeds 175,000. It is increasing rapidly day by day. The fact seems suddenly to have burst upon the country at large that here, in this neglected corner, is a wide region offering perhaps the richest inducements to immigration of any part of the United States.

Population of
Washington
Territory.

LOCATION AND MARKET.

(This should be read with a map of Asia and Pacific Ocean.)

In spite of Oriental exclusiveness, now broken down, the Asiatic trade has always formed a

large element in the commerce of the world, and has long been sought by the great maritime powers of Europe, especially by England. For this she conquered India, and seized upon many islands of the ocean. For this she battered in the gates of China, and established herself permanently at Hong Kong, at the entrance to the River of Canton.

Majority of the human race in the countries of the Pacific.

In these countries, and upon these islands, live more than half the human race, and with all the barbarism of some, and the old-fashioned civilization of even the best, the large majority of these people are producers of a multitude of articles wanted by the civilized world. And of late these peoples have become possessed with a strange desire to avail themselves of the products of European and American art. This market will not only grow rapidly in its demands, but the currents of trade will be diverted from Europe to America. In fact, the settlement of the west coast of America inaugurated a revolution greater than that which substituted the voyage around the Cape of Good Hope for the camel train across the Asiatic continent. It gave America a standpoint from which she would ultimately wrest the bulk of the vast trade of the Orient from Europe. The cutting of the Suez Canal mended the hold of England

Change in the currents of trade.

and other maritime European states on the Oriental market, in fact secured for them the advantage of a shorter line to the Southern Asiatic market as far as the Malay Peninsula ; but as for the rest of that great market included in the Pacific Islands, the Chinese Empire, Japan and Siberia, the revolutionary movement has commenced, whereby the bulk of that trade will be taken from England and Holland by the merchants of San Francisco and Puget Sound.

The trade of China alone has been estimated at \$130,000,000 per annum, the greater part of which is absorbed by England, and the annual value of the export and import trade of England with the Pacific Islands has been put at \$75,000,000. This already immense market may and will be enlarged, especially in China, by means of railroad and steamboat connections, which will bring to the coast the products of the interior sections. Much of the China trade now goes overland into and through India, and also through Siberia, to be consumed by the way, or pushed through to the termini of European railroads and ship-lines which are reaching to get it. And, as the transportation becomes better, so will the production increase. Railroad building, until lately forbidden in China, has now commenced, and will, in the nature of the case, go

The China trade.

on rapidly. The result will be to bring most of the trade to the Pacific coast, and thus reverse all the interior movements.

Even the capital of the Empire, the great Peking, and the productive region around it, have depended largely on the overland trade to Europe, and especially on the great Russian market opened annually at Novgorod. It only needs a railroad from the back country, through Peking direct to the coast, to bring this large trade under American control. Mr. James G. Swan (Hawaiian Consul) has written a valuable pamphlet on the regions drained by the Amoor River, in which he shows that there is an immense trade "now lying dormant in Siberia, Mongolia, Manchooria, Northern China, Corea and Japan, which will be brought into active life and diverted to the American shore of the North Pacific Ocean by the great continental railroads which will have the outlet of their commerce through the Straits of Fuca."

He gives the population of these countries as follows:

Siberia	4,000,000
Mongolia	12,000,000
Manchooria	5,000,000
Japan	36,000,000
Total	57,000,000

The Amoor River, with its great Chinese tributary, the Songaree, furnishes over 2,600 miles of steamboat navigation (a second Mississippi), but, owing to a great bend to the south, the Amoor can be reached by a short line of railroad from the Russian port Vladivostock, or Poissette Harbor. Japan lies on the way from Puget Sound to the region referred to. Major Collins, some years ago, said in a letter to Secretary Marcy concerning this market: "One item, cotton fabrics, might be introduced to the amount of millions yearly; then there are many products of these countries that could be received in exchange. This must be done through the Amoor and its affluents. It can hardly be estimated what a revolution in trade and commerce can be effected in this region; and the fondness of the people for luxuries and foreign merchandise being very great, if the means of procuring them were facilitated and the prices cheapened, the consumption would be immense, and in a few years a trade of many millions would be effected."

The trade of the
Amoor River,
Japan, etc.

Major Collins thought that these people would consume annually five dollars per head of American goods; Mr. Swan estimates two dollars per head. These goods would be paid for in silks, tea, rice, furs, skins, wax, fossil

ivory, plumbago, tin, precious stones, naval stores, etc. It is said that the overland trade of North China to Russia now requires for its transportation a caravan line of 36,000 camels and bullocks, and 100,000 horses, and that the Siberian trade is as large as that of China. The tea sold at Novgorod amounts to \$5,000,000 each annual fair. The caravan tea is preferred to the ship tea, which is said to be injured by the voyage through the tropics; another argument for the North American route.

The new railroad
across Siberia to
St. Petersburg.

Since Mr. Swan's pamphlet, the news comes that the Russian Government is now actively engaged in building a railroad from St. Petersburg across Siberia to Vladivostock on the Japan Sea; and the expectation is general that this imperial power will seize Corea so as to bring the terminus of her railroad to Ninsen at the south point of Corea. All the great trade which will thus be developed is in addition to the existing trade of China and the Islands, and will probably swell the China, Japan and Russian trade to over \$200,000,000, to which is to be added the Australian and Island trade, which already is, no doubt, over \$100,000,000.

Now comes the practical question, Who are to handle this vast trade of \$300,000,000 annually?

No one nation exclusively, of course. The Dutch and other small powers will have a little of it ; but the only contest will be between England and the American Pacific Coast. England has the lion's share now, but this great nation will hereafter labor under too many disadvantages in its contest with America. America has the needful capital, material, pluck and energy, and enjoys certain decisive advantages, as, for example—1. In distance, which of itself would in this case decide the matter ; 2. In the local production of certain staple articles which will be in great demand, and which England cannot supply so cheaply, if at all, such as lumber, meats, flour, canned goods, cheap cottons, and agricultural and other machinery, which, if not cheaper, can be more readily adapted to the wants of the market ; 3. In possessing the back country of Eastern America, whereby the entire United States become tributary both ways to the Pacific commerce ; to which may be added, 4. The ever-flowing river in the Pacific Ocean, flowing in a circle from Japan to the American coast and back—the famous Kuro Shiwo, or Japanese current ; a current which gives a gain to every ship of twenty miles a day in distance ; the current which brings the disabled Japanese junks to the American coast.

The American Pacific States have decisive advantages over all others in controlling the Pacific trade.

Advantage in
distances.

The half-way point on the Pacific side between America and England is the Malay Peninsula. This leaves even Australia and all of Oceanica nearer to us than to England, and all of China, Japan and Siberia thousands of miles nearer to us. Hong Kong and Canton are the English headquarters in China, and yet our Pacific coast is 5,000 miles nearer to these than England is. It is also 6,500 miles nearer to Shanghai, which is a more important port than Canton, because of its greater nearness to the rice and tea producing sections. The advantages are still greater in respect to Peking, Japan, Vladivostock, the terminus of the projected Russian railway, and the entire country drained by the Amoor. Our commerce is now within thirty days of the coast of China, and will be in less than ten days when the fast mail and express and passenger steamers are launched. I insert a table of distances, which is full of significance.

ROUGH ESTIMATES OF DISTANCES.

	MILES
Puget Sound to mouth of Amoor River . . .	3,900
" " " Vladivostock . . .	4,700
" " " Shanghai . . .	5,750
" " " Canton . . .	6,500
" " " Singapore . . .	8,100
" " " S. W. point of Australia . . .	9,550

	MILES
San Francisco to Vladivostock	5,200
“ “ “ Shanghai	6,100
“ “ “ Canton	6,800
“ “ “ Singapore	8,400
“ “ “ S. W. point of Australia	9,500
“ “ “ St. Petersburg via Vladivostock	9,700
St. Petersburg to Vladivostock	4,500
San Francisco to Calcutta	10,200
Liverpool to mouth of Amoor River	13,550
“ “ Vladivostock	12,700
“ “ Shanghai	11,750
“ “ Canton	10,900
“ “ S. W. point of Australia	10,750
“ “ Singapore	9,300
“ “ Calcutta	8,700

Liverpool and Puget Sound are about equally distant from west coast of the Malay Peninsula.

	MILES
New York to Canton, via Puget Sound	9,500
“ “ Shanghai “ “ “	7,800 to 8,000

By this it will be seen that New York, by way of Puget Sound, is 1,400 miles nearer to Canton than Liverpool is, and nearly 4,000 miles nearer to Shanghai. Mr. Swan makes the distance from the Pacific coast less than I have given. It should also be noted that Puget Sound has the advantage of distance over San Francisco also.

Puget Sound has also the advantage over all

Advantage in
productions.

competitors of being able to produce a large bulk of the materials for commerce in its own vicinity. In this report there will be a large array of facts concerning the present and future productions of Washington Territory, which will amply confirm and illustrate the above statement. The only real competitor of Puget Sound on the American coast is British Columbia, but British Columbia cannot vie with Washington Territory in the production of the materials of commerce, and Canada at large furnishes no such background as the United States.

Coastwise trade.

It will, of course, not be overlooked, that in the great coastwise trade which the Pacific States have and must always have with each other, they will minister to each other's prosperity. And here it will be shown that Puget Sound will have the advantage in supplying the wants of others.

South American
trade.

In addition to these is the foreign trade along the coast of British Columbia, Mexico, Central America, and all the Pacific States of South America. Chili is a prosperous State. She has nearly doubled the volume of her trade in ten years. From 1874 to 1883 her exports went up from \$32,000,000 to \$73,000,000, and her imports from \$35,000,000 to \$50,000,000. The

United States imports over \$4,000,000 of goods from the Pacific side of South America, and exports about \$8,000,000 to these states. England, however, gets the most of the West South American trade, so that here again we must enter the lists with Britannia. Already the contest has begun, and our Pacific States must bear off the palm sooner or later.

Thus it is evident that a vast field of commercial enterprise is wide open to the people of Washington Territory as well as to Oregon and California. And our commercial statistics show what handsome progress has already been made. Taking both ex-ports and imports, there is already a business of \$80,000,000 done by the seven Pacific ports of entry. San Francisco is now far ahead of the others, and this city has nothing to fear from any other port except Puget Sound, which will gain upon her rapidly and ultimately surpass her. Washington Territory has all that California has on which to trade, and a great deal besides; and has the advantage of position. When our commercial statistics were made up, Puget Sound had no direct railroad communication with her own back country east, much less a trans-continental line. A very different story will be told a few years hence. I here insert

Large existing
trade.

a table of summaries which show that the commercial revolution is now in operation.

PORTS OF THE PACIFIC.	TOTAL VALUE OF EXPORTS OF DOMESTIC MERCHANDISE FOR YEAR ENDING		TOTAL VALUE OF IMPORTS OF MERCHANDISE FOR YEAR ENDING	
	JUNE 30, 1885.	JUNE 30, 1887.	JUNE 30, 1885.	JUNE 30, 1887.
Humboldt, Cal.	\$ 201,500		\$ 1,731	
Oregon	1,928,829		161,170	
Puget Sound, W. T. . . .	1,877,485		238,036	
San Diego, Cal.	65,654		71,166	
San Francisco, Cal. . . .	37,082,520	\$32,027,995	35,040,350	\$40,707,708
Willamette, Oregon . . .	4,142,156		277,386	
Wilmington, Cal.	252,673		187,348	
	\$45,550,817		\$35,977,127	

In the latest report to which I have access, San Francisco is the only one of the Pacific ports mentioned separately.

Much of the exports above reported to the credit of Oregon really came down the Columbia River from the eastern part of Washington Territory; and the great bulk of the exports from San Francisco consists of wheat, flour, and other breadstuffs, an item in which Washington Territory can surpass all competitors. The following table shows the principal items of export from the Pacific ports.

Let it be noted that in respect to the production of the larger items, to wit, wheat and flour, wood and its manufactures, animals, iron and steel and their manufactures, machinery of all sorts, fish, etc., Washington Territory can surpass all competitors.

PRINCIPAL EXPORTS OF DOMESTIC MERCHANDISE,
YEAR ENDING JUNE 30, 1885.

PORTS ON THE PACIFIC.	APPROXIMATE VALUES.	
Humboldt, Cal.	\$ 165,000	Wood, and Manufactures of.
Oregon, Oregon	1,493,600	Canned Salmon.
	400,000	Wheat and Flour.
	32,000	Wood, and Manufactures of.
Puget Sound, W. T.	830,000	Wood, and Manufactures of.
	240,000	Wheat and Flour.
	160,000	Animals.
	58,000	Animals.
San Diego, Cal.	4,000	Wood, and Manufactures of.
	1,800	Machinery.
	27,226,000	Wheat, Flour, and other Breadstuffs.
	1,211,000	Manufactures of Iron and Steel.
	900,000	Fish.
San Francisco, Cal.	745,000	Ginseng.
	700,000	Cotton Manufactures.
	650,000	Wood, and Manufactures of.
	430,000	Fruit.
	375,000	Gunpowder, etc.
	358,000	Medicines, etc.
	3,339,153	Wheat.
Willamette, Oregon	704,000	Flour and Breadstuffs.
	37,000	Wood and Manufactures of.
Wilmington, Cal.	211,928	Wheat.
	33,600	Honey.

NOTE.—Humboldt, Oregon, San Diego, Willamette, and Wilmington have almost no exports except those included in this list. Puget Sound and San Francisco have a great variety of exports.

APPENDIX.

LIST OF EXPORTS OF DOMESTIC MERCHANDISE, YEAR
ENDING JUNE 30, 1885. EXPORTED FROM THE
SEVEN CUSTOMS DISTRICTS OF THE PACIFIC.

Agricultural Implements.	Books, Maps, etc.
Animals.	Brass, and Manufactures of.
Art Works.	Breadstuffs, Wheat, etc.
Bark, and Extract for Tanning.	Bricks.
Billiard Tables, etc.	Broom-corn, Brooms and
Blacking.	Brushes.
Bones, Hoofs, Horns, etc.	Candles.

Carriages, and parts of.	Instruments and Apparatus for Scientific purposes.
Cars, passenger and freight.	Iron and Steel, and Manufactures of.
Casings for Sausages.	Jewelry, and Manufactures of Gold and Silver.
Chemicals, Drugs, Dyes, and Medicines.	Lamps, etc.
Clocks and Watches.	Lead, and Manufactures of.
Coal.	Leather, and Manufactures of.
Coffee and Cocoa, ground or prepared, and Chocolate.	Lime and Cement.
Copper, and Manufactures of.	Malt Liquors.
Cotton, Manufactures of.	Marble and Stone, and Manufactures of.
Earthen, Stone, and China Ware.	Matches.
Eggs.	Musical Instruments.
Fancy Articles.	Naval Stores.
Fertilizers.	Oakum.
Fish.	Oil-cake and Oil-cake Meal.
Flax, Hemp, Jute, and Manufactures of.	Oils.
Fruits.	Ore, Gold and Silver bearing.
Furs and Fur-skins.	Paraffine and Paraffine Wax.
Glass and Glassware.	Paints and Painters' Colors.
Glucose, or Grape-Sugar.	Paper, and Manufactures of.
Glue.	Plated Ware.
Grease, and all Soap Stock.	Provisions (comprising Meat and Dairy Products).
Gunpowder, and other Explosives.	Quicksilver.
Hair, and Manufactures of.	Rags.
Hides, and Skins other than Furs.	Rice.
Hay.	Salt.
Honey.	Seeds—Timothy, etc.
Hops.	Silk, and Manufactures of.
Ice.	Soap.
India-rubber and Gutta-percha, and Manufactures of.	Spermaceti and Spermaceti Wax.
Ink.	Spices, ground and prepared.
	Spirits, Whisky, etc.

Spirits of Turpentine.	Umbrellas, etc.
Starch.	Varnish.
Stationery, except Paper.	Vegetables.
Stereotype and Electrotype Plates.	Vessels sold to foreigners.
Straw and Palm-leaf, and Manufactures of.	Vinegar.
Sugar and Molasses.	Wax (Bees').
Tin, Manufactures of.	Wine.
Tobacco, and Manufactures of.	Wood, and Manufactures of.
Trunks, Valises, etc.	Zinc (pigs, bars, plates, and sheets).

LIST OF IMPORTS OF MERCHANDISE, YEAR ENDING JUNE
30, 1885. IMPORTED INTO THE SEVEN CUS-
TOMS DISTRICTS OF THE PACIFIC.

Animals.	Cotton, unmanufactured.
Articles, the growth, produce or manufacture of the United States, returned.	Dairy Products.
Art Works.	Diamonds, uncut.
Art Works, the production of American artists.	Earthen, Stone, and China Ware.
Books, etc.	Eggs.
Brass, and Manufactures of.	Fancy Articles.
Brushes.	Farinaceous Substances, and preparations of.
Buttons, some kinds of.	Fish, a few.
Cement.	Flax, Hemp, Jute, etc., and Manufactures of.
Chemicals, Drugs and Dyes.	Fruits and Nuts, some.
Clays, etc.	Furs and Fur-skins, undressed.
Clocks, and parts of.	Furs, dressed, and Manufac- tures of.
Coal, bituminous.	Glass and Glassware.
Cocoa, Coffee.	Household and Personal Ef- fects, Clothing, Tools, etc., of persons arriving from foreign countries.
Confectionery.	
Copper, and Manufactures of.	
Corsets.	
Cotton, Manufactures of.	

Hair, Hats and Bonnets, etc.	Seeds.
India-rubber and Gutta-percha.	Silk, Manufactures of.
Iron, Steel, and Manufactures of.	Silk, unmanufactured.
Jewelry, Manufactures of Gold, Silver, and Precious Stones.	Soap.
Lead, and Manufactures of.	Some Breadstuffs.
Leather, and Manufactures of.	Spices, ground.
Malt Liquors.	Spices, unground.
Marble and Stone, Manufactures of.	Spirits, Distilled and Spirituous.
Meats, prepared, of all kinds, and Extracts, etc.	Sponges.
Metals, some.	Sugar and Molasses.
Musical Instruments, and parts of.	Tea.
Oil, animal and vegetable.	Tin (bars, blocks, etc.).
Opium, and other Medicines.	Tobacco, and Manufactures of.
Paints and Colors.	Vegetables, some, in natural state, in brine, preserved, etc.
Paper, and Manufactures of.	Wines.
Paper Stock, crude.	Wood, and Manufactures of.
Plaster-of-Paris, unground.	Wood, unmanufactured.
Rice.	Wools, Hair of the Alpaca goat, etc., and Manufactures of.
Salt.	Zinc, Spelter or Tutenegue, and Manufactures of.

APPROXIMATE POPULATION IN THE YEAR 1887 OF

The World	1,500,000,000
Japan, Siberia, Chinese Empire, Anam, Siam, Oce- anica, India	792,500,000
Mexico, Central America	11,800,000
U. S. of Colombia, Ecuador, Peru, Bolivia, Chili, Pata- gonia	11,700,000
Canada	4,500,000
TOTAL	<u>820,000,000</u>

TOPOGRAPHY OF WASHINGTON TERRITORY.

Washington Territory will make one of the largest States of the Union. It is larger than England and Wales combined, as will be seen by the following table :

Washington Territory	. 66,880 square miles.
New York	47,620 " "
Virginia	40,125 " "
England and Wales .	58,320 " "

The shape of the Territory is regular, having the general form of a parallelogram, with its longer axis running east and west. Its relief is simple. Along the Pacific coast runs the Coast Range of mountains from the mouth of the Columbia River to the Straits of Juan de Fuca. In this range there is only one practicable opening from the interior, which is the trough of the Chehalis River, which terminates in Gray's Harbor. The bar here, as at the mouth of Columbia River, forms a serious obstruction to the entrance of vessels drawing more than twenty feet of water.

Sixty miles east of the Coast Range, and parallel to it, runs the Cascade Range, which divides the Territory by a north and south line. It is a lofty range, presenting a serrated outline, whose lower depressions are 3,000 to 4,000 feet

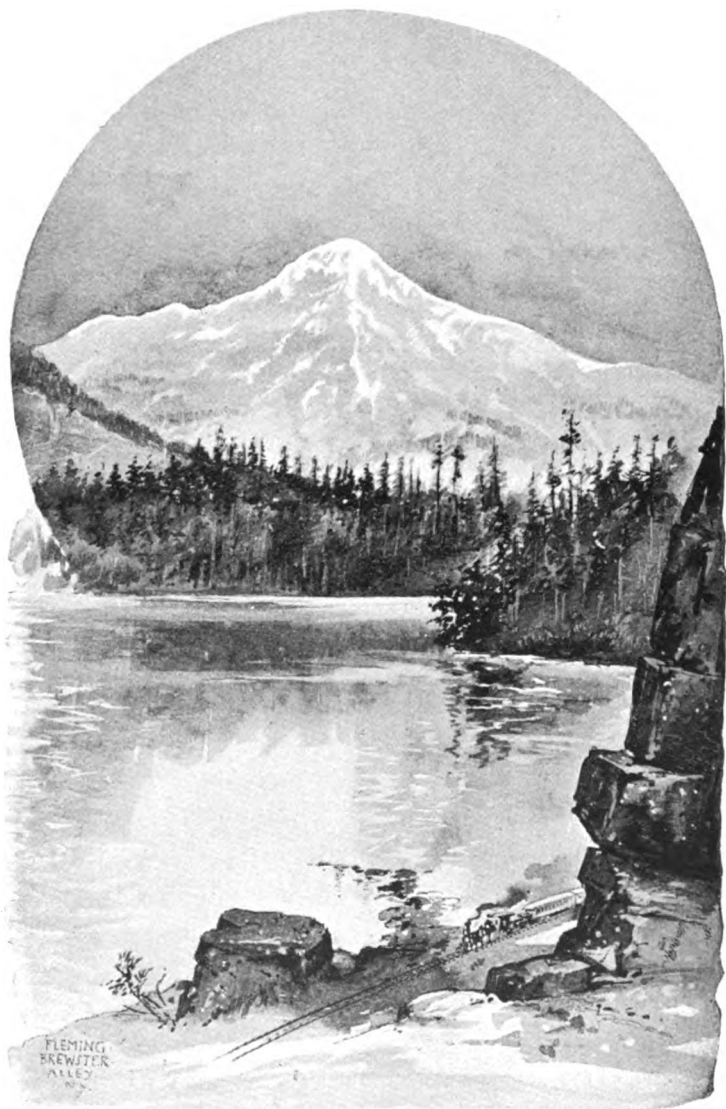
above tide, while summits of 5,000 to 8,000 feet are common ; and at intervals still higher peaks raise their snow-covered heads from 8,000 to 14,500 feet.

Between the Cascade Mountains and the Coast Range lies Puget Sound, with its outlet through the Strait of Fuca. South of this sound, and on each side, are wide spaces of flat and rolling country, with numerous and somewhat disconnected mountains of comparatively small size, though some of them rise as high as 1,500 feet. These mountains show many natural terraces, which may be the result of land-slides.

Puget Sound.

The Puget Sound basin is exceedingly well supplied with streams and lakes ; whilst the Sound itself, with its sheltered position, its deep water, and indented shore-line, is one of the most interesting and valuable inland bodies of water in the world. It has a broad outlet to the ocean. Lake Washington is a beautiful and navigable sheet of water. There are numerous other lakes scattered over the Territory, enlivening its scenery and often affording convenient waterways. Quite a number of the rivers emptying into Puget Sound are partially navigable for small steamers. The rivers and creeks generally have bottom-lands, which are

Lake
Washington.



LAKE WASHINGTON—SHOWING MOUNT RANIER IN THE DISTANCE—
ON LINE OF SEATTLE, LAKE SHORE AND EASTERN RAILWAY.

sometimes narrow, and sometimes wide. Cowlitz River flows south into the Columbia River. It has fine bottom-lands, and its valley may be regarded as a prolongation and complement of the Willamette Valley, Oregon.

All the country lying west of the crest-line of the Cascade Mountains is known as West Washington, and is quite different in topography, as in many other respects, from the country known as East Washington, which name applies to all of the Territory lying east of the Cascade axis.

West Washington and East Washington.

East Washington is a rectangular plateau, set in a frame of mountains, and drained by the Columbia River and its tributaries. The Cascade Range being the west side of the frame, the north side is formed by irregular spurs which run out at right angles from the Cascade Mountains along the Canada border, and connect with the Cabinet Mountains. The east side of the frame is in Idaho, and consists chiefly of the Cœur d'Alene Mountains. On the south lie the Blue Mountains, which are partly in Washington Territory, but chiefly in Oregon. The mountains on the north have a few peaks 5,000 to 9,000 feet high, and many of the dividing ridges are high, steep and rugged. Much of the region is described, however, as high plateau

country, dotted over with small, conical mountains. It abounds in streams of water, generally small. A strip of arable land runs on the east side of the Columbia River from the mouth of the Spokane River to the mouth of the Colville River and the valleys of Colville and the Little Spokane River are highly spoken of as agricultural regions. The elevation of these river valleys is from 1,200 to 1,600 feet above tide-water.

Cœur d'Alene
Mountains.

Passing to the east side, we find the plateau country at its north corner extending to the Idaho line where the foot-hills of the Rocky Mountains begin, and soon rise into the Cœur d'Alene Mountains, which—being the local name for part of the Bitter Root Range—is a part of the western branch of the Rocky Mountains. The Cœur d'Alene River and Lake belong to the Columbia River basin, and are so naturally connected in mining and trading interests with Washington Territory, that in another connection I shall have much to say of the Cœur d'Alene country, as also of the Colville country, and other parts of the mountain rim. South of the Cœur d'Alene Lake the plateau country extends far into Idaho, and gives to that State its best farming lands.

The Blue Mountains which mark the southern

limit of the plateau in Washington Territory do not extend more than half-way across the plain, leaving a long projection of the plateau to extend southward into Oregon.

The shape of the plateau in Washington Territory is an irregular square with a diameter each way of about 150 miles. Followed into Idaho and Oregon, the diameters would reach 200 miles. Its surface is generally smooth, but there are frequent patches of rock, and sometimes large areas are roughened by rocky outcrops. The plateau is elevated and rolling, rising from 1,000 to 3,000 feet above the surface of Columbia River. Its elevations usually are mere swells, except along the precipitous edges of coulées. I know of only one mountain upon it, and that is quite a small one; but it served as a refuge for Lieutenant Steptoe and his handful of soldiers when attacked by the Indians; and hence is called Steptoe Butte. The surface of the plain is scarred in a number of places with coulées, or dry river-beds, which are cut down twenty to one hundred feet, and sometimes more, and their sides are usually marked by bluffs, often of rock. These coulées are an advantage, or a disadvantage, in road-making, according to whether the road goes with, or across, the coulée. The Northern Pacific Rail-

The Great
Plateau.

Coulées.

road found it convenient to use one of them for a long distance. The deepest cuts in the plateau are made by its rivers. Of these the Columbia is chief. This river, as already intimated, has cut a channel for itself along the north and west edge of the plain from 1,000 to 2,000 feet below the general level. The Snake River, which is the largest affluent of the Columbia, has numerous branches, all cut deep into the basalt which underlies the plain.

Columbia and
Snake Rivers.

The Columbia and Snake are both steamboat rivers, but navigation is interrupted by rocky rapids, which prevent through lines of steamers. The Columbia is one of the largest rivers in the world, and has abundant water for steamboats from its mouth to a point in Canada, north of Farwell, where it is crossed by the Canadian Pacific Railway, and steamboats run at intervals to the most northerly point; and there are navigable stretches not yet used for boats which will have steamers in connection with future railroads. The steamers on Snake River are very useful, and run to Lewiston, in Idaho, and perhaps further.

This plateau, or Great Plain of the Columbia, as it is called sometimes, is a most interesting and important region, concerning which I shall have much to say under subsequent heads.

ALTITUDES IN WASHINGTON TERRITORY.

	FEET.
Mount Ranier (Tacoma)	14,444
Mount Baker	10,827
Mount Adams	9,570
Mount St. Helens	9,750
Natchess Pass	4,900
Stampede Pass, Summit	3,980
Tunnel, Stampede Pass	2,885
Snoqualmie Pass	3,110
Kechelus Lake	2,388
Kachess Lake	2,158
Ellensburg	1,518
Yakima City	990
Ainsworth	351
Palouse Junction	858
Sprague	1,200
Spokane Falls	1,910
Colville	1,917
Fort Spokane	1,300
Okinagane Lake	1,163
Great Plain of Columbia River, 1,000 to 3,000	
Snake River, N. P. R. R.	358
Colfax	1,941
Dayton	1,360
Walla Walla	1,000
Wallula Junction	326

CLIMATE.

Climate is a matter of temperature, moisture and atmospheric dynamics. The general law of temperature is that the farther north the colder

The Climate of
Washington
Territory.

the weather ; and yet currents of water and prevailing winds may give to the country a climate geographically belonging to quite a different latitude. We know how this is with England, which, judged by latitude, ought to be colder than Maine, but which, in fact, has one of the mildest and most equable climates in the world. England is farther north than Washington Territory, which latter is in the latitude of France ; but it is also in the latitude of Montana, Dakota and Maine, States remarkable for sudden changes and for terrible cold. But it is well known that our Pacific States, at least on their western borders, have a temperature free from extremes in both summer and winter. Taking July and January as the hottest and coldest months, it will be found that the average temperature at San Francisco and Puget Sound is from 7° to 14° cooler than it is in the Rocky Mountains and in New England during the same months. And on the other hand, taking January as the coldest month, we find that Bismarck, Denver, New England, etc., are 30° to 40° colder than the points on the Pacific. In other words, that the range of the thermometer between extremes averages near 50° more in the East than it does in the West in the localities named ; a very great difference when we

consider comfort, health, cost of living, and opportunity to labor in the open air.

This greater mildness and equability of temperature on the Pacific Coast is to be ascribed to the winds and currents of the great ocean. During the summer the winds come from the north-west, and during the winter from the south-west and south. Much influence in tempering the cold of winter is ascribed also to the Japan Current, mentioned under a former head. It does for the Pacific Coast what the Gulf Stream does for England.

Mild and
equable.

The same causes regulate also the rainfall on the Pacific Coast. In one respect there is the same peculiarity along the whole coast, namely, dry summers and, comparatively, wet winters. There is, however, a gradual increase in the amount of rainfall northward from San Diego to Sitka; so that when we reach Washington Territory we do not find the excessive dryness which characterizes the summer climate of California.

The figures of different authorities do not agree exactly as to the precipitation on the Pacific Coast: for example, in the older volume on Rain Tables, published by the Smithsonian Institution, the annual rainfall and melted snow on Puget Sound, measured at Steilacoom,

Rainfall.

near Olympia, from 1849 to 1867, amounted to 43.98 inches. Governor Semple, however, gives from Sergeant McGovern, in charge of the station, a total of 53.89 inches annually, measured at Olympia from 1878 to 1886. But I find in the report of the chief signal officer to the War Department for 1884, that the average from July 1, 1877, to December, 1883, for Olympia, was 62.81 inches. This difference of nine inches is partly accounted for by the fact that the precipitation in the subsequent years not included in the report of the Signal Service Bureau, namely, 1884, 1885 and 1886, averaged only 41.88 inches, which would, in great measure, relieve the discrepancy. It will probably turn out on further observation that 53 inches is about the total annual rainfall for Puget Sound. But according to the report of the chief signal officer for 1884, we have the following annual totals: San Diego, 9.40; San Francisco, 23.32; Portland, Oregon, 54.16; Puget Sound, 62.81; Sitka, Alaska, 97.28 inches.

Comparing these with points farther east, we have Bismarck, Dakota, 21.35; Denver, 14.97; Sandusky, Ohio, 41.43; New Haven, Connecticut, 51.55; Norfolk, Virginia, 52.14 inches.

The value of rainfall depends more on its distribution among the months than on its

annual aggregate. England has but 25 inches rain per annum, but it comes at such times as makes it most effective. The rains on the Pacific Coast are not distributed in the most favorable way for agriculture—the summers being too dry. At San Diego there is less than one-third of an inch in the three summer months, and still less at San Francisco. On Puget Sound, for that time, the fall is 2.57. In Washington Territory the spring rains are as abundant as in the Atlantic States, and the summer breezes seem laden with moisture.

In respect to cold waves, winds and storms, Washington Territory is singularly favored. There is nothing to correspond with the blizzards, northers, hurricanes and cyclones which trouble some other States. Even ordinary thunder-storms are rare. The climate of East Washington is different from that of West Washington, and yet, when compared with that of Montana and Dakota, it will be seen that it is really transitional and intermediate between the climates on each side. The range of thermometer from the heat of July to the cold of January is, at Bismarck, 65°; at Spokane Falls, 45°, and on Puget Sound, 22°. And, in like manner, the amount of rain is intermediate between the heavy rainfall of the

No blizzards or
cyclones.

Differences be-
tween East
and West
Washington.

Sound and the lighter rains of the Rocky Mountain country. The explanation of this is, that while the Cascade Range, like all high mountains, condenses the moisture of the air on the windward side and changes its temperature, yet this range is not sufficiently high and cold to have the effect of the Himalayas or the Andes in depriving the leeward lands of rain.

The mountain rim of the plateau country has not the moisture which distinguishes the west side of the Cascade, and it varies in its amount at different places.

Some statements have already been made in reference to the dryness and summer heat of the Yakima Valley on the east flank of the main mountain. The mountains running along the Canada line have probably a better summer climate than the east side of the main mountain. I do not know how it is with the Cœur d'Alene and Blue Mountains, but the climate of the plateau has no unusual character in the matter of temperature. Half of the States of the Union have as great or greater extremes; but the plateau has less than half the precipitation of Puget Sound, as shown in the tables given on pages 56 and 57. And the rainfall in the summer is so scant that one would

not, *a priori*, expect any form of vegetation to progress at all. These meteorological phenomena render almost unaccountable the facts of agriculture, which will be given hereafter.

The Chinook wind, which springs up in winter and melts the snow on the plateau, and to some extent in the mountains, is simply a southerly wind, such as is common in the Mississippi Valley and even on the Atlantic seaboard. In the Pacific States it does not, from the descriptions, appear to differ from the breezes of the coast, except in its greater strength and steadiness. I heard an intelligent gentleman, residing in Spokane Falls, say that he thought the Chinook was a disadvantage in winter, as it caused a disagreeable thaw, and so relaxed the human system as to render it more sensitive to cold; but generally the Chinook is enjoyed in East Washington.

Chinook wind.

SOILS.

The arable soils of Washington Territory, so far as I could see, or otherwise learn, may be classified as follows, to wit: *a.* Humus; *b.* Alluvium; *c.* Drift; *d.* Loam; *e.* Basalt.

Soils all fertile.

a. HUMUS. In West Washington the whole country is top-dressed with vegetable mould, derived obviously from the heavy growth which

TABLE SHOWING THE MEANS OF THE DAILY MAXIMUM AND MINIMUM TEMPERATURES IN DEGREES FAHRENHEIT.

The Means are obtained by dividing the sum of the daily readings of the Maximum and Minimum Self-registering Thermometers by the number of days in the month.

STATIONS.	1883												1884											
	July.		Aug.		Sept.		Oct.		Nov.		Dec.		Jan.		Feb.		March.		April.		May.		June.	
	Mean.		Mean.		Mean.		Mean.		Mean.		Mean.		Mean.		Mean.		Mean.		Mean.		Mean.		Mean.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Bismarck, Dak. . .	79.5	55.8	78.6	54.8	69.4	43.7	48.3	33.4	38.7	15.0	25.0	4.5	14.5	7.6	8.9	9.8	29.0	10.5	47.6	30.2	67.1	44.1	81.2	54.8
Dayton, W. T. . .	87.3	53.6	85.1	53.2	77.5	45.2	57.8	34.7	51.6	33.3	35.8	18.5	31.0	11.5	24.9	4.8	35.6	19.6	43.9	29.6	59.5	40.7	73.7	51.8
Denver, Col. . .	82.6	58.7	83.6	58.8	74.7	50.2	57.6	36.8	56.1	31.1	36.8	17.4	25.7	5.3	30.8	10.8	43.0	25.7	58.2	39.6	71.5	50.2	81.2	61.3
Lewiston, Idaho . .	90.0	59.1	87.1	57.6	76.0	47.7	57.9	39.5	57.6	35.5	41.7	29.3	39.1	25.0	35.1	18.8	53.6	34.7	66.6	42.1	79.3	48.9	80.8	57.3
New Haven, Conn. .	80.3	62.4	77.6	57.9	70.4	50.6	58.4	40.4	50.5	34.1	38.3	21.6	38.6	15.8	40.8	24.3	42.4	26.6	54.1	37.2	63.8	47.2	78.2	55.4
Norfolk, Virginia .	87.9	71.1	82.4	68.9	76.4	63.8	68.4	56.7	62.2	45.0	53.9	38.8	46.7	29.9	59.0	41.0	58.1	42.1	61.9	47.0	76.9	58.8	81.8	64.6
Olympia, W. T. . .	76.1	48.2	71.3	55.1	67.0	48.1	57.3	42.9	50.2	44.9	45.9	35.4	44.7	35.2	42.1	27.5	52.5	34.4	61.7	41.6	70.1	43.9	71.5	48.9
Portland, Oregon . .	80.0	57.0	73.8	54.2	72.3	52.6	58.4	45.8	52.8	72.0	49.0	36.8	46.2	33.3	44.4	20.4	55.8	37.8	65.1	45.3	73.6	48.7	74.9	53.7
San Diego, Cal. . .	75.5	64.0	75.9	63.5	78.2	62.0	69.0	54.7	67.7	50.2	65.7	49.0	64.5	45.6	62.9	48.6	62.0	50.4	64.4	51.1	69.2	56.1	72.1	58.4
Sandusky, Ohio . .	—	—	77.1	62.8	69.2	55.8	59.2	47.3	52.5	37.2	39.8	27.5	26.9	12.9	39.0	24.4	41.6	28.7	52.1	39.3	68.8	51.3	77.9	62.7
San Francisco, Cal. .	64.5	55.0	64.4	53.9	60.9	50.3	60.9	52.0	58.8	49.4	55.5	46.2	54.7	46.6	55.9	45.6	59.2	49.8	61.2	50.7	65.3	53.4	65.2	55.3
Sitka, Alaska . . .	57.9	48.1	59.3	48.8	58.9	48.5	50.0	41.0	38.6	27.3	41.6	30.5	43.8	34.2	37.8	25.8	42.5	33.3	51.7	37.7	51.9	40.6	57.9	46.4
Spokane Falls, W. T. .	85.0	53.4	83.2	72.5	72.4	44.2	53.7	35.0	46.6	32.0	35.6	22.4	32.6	17.5	30.2	12.7	46.4	27.8	62.2	39.0	74.5	46.0	78.7	53.9
Washington City. . .	87.7	67.2	82.4	62.7	74.8	56.2	65.5	49.3	56.2	39.4	63.1	45.3	49.7	31.8	65.6	47.0	67.8	51.6	73.6	54.8	81.4	63.0	87.4	68.5

TABLE SHOWING THE AVERAGE PRECIPITATION AT STATIONS OF THE SIGNAL SERVICE,

COMPUTED FROM THE COMMENCEMENT OF OBSERVATIONS AT EACH,
TO AND INCLUDING DECEMBER, 1883.

TAKEN FROM THE REPORT OF THE CHIEF SIGNAL OFFICER TO THE WAR DEPARTMENT FOR 1884.

57

STATIONS.	ESTABLISHED.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	TOTAL INCHES.
Bismarck, Dak.	Sept. 15, 1874 . .	0.57	0.66	1.21	2.04	3.31	3.64	2.21	2.71	1.34	1.33	0.71	0.72	21.35
Dayton, Wash. Terr. . . .	July 1, 1870 . . .	4.11	3.64	2.04	3.26	2.02	0.86	0.79	0.49	0.67	2.64	2.55	4.05	28.02
Denver, Colorado	Nov. 10, 1871 . .	0.60	0.43	0.86	1.71	3.05	1.60	1.89	1.54	0.96	0.79	0.74	0.71	14.97
Lewiston, Idaho.	July 1, 1870 . . .	2.45	1.53	1.16	1.28	1.12	0.94	0.76	0.36	0.52	1.03	1.66	3.40	17.11
New Haven, Conn.	Dec. 10, 1872 . .	4.20	4.22	5.29	4.32	3.71	3.80	4.66	5.62	4.15	3.85	4.15	3.48	51.55
Norfolk, Virginia	Jan. 1, 1871 . . .	3.89	3.85	4.35	4.29	3.54	4.15	5.30	6.11	5.23	5.06	3.86	3.80	52.14
Olympia, Wash. Terr. . . .	July 1, 1877 . . .	9.36	10.67	6.20	4.34	2.70	0.82	0.86	0.83	2.98	1.60	22.16	10.17	62.81
Portland, Oregon	Nov. 1, 1871 . . .	7.34	8.11	7.27	3.48	2.44	1.82	0.71	0.81	1.62	0.95	7.34	8.27	54.16
San Diego, Cal.	Nov. 1, 1871 . . .	1.85	2.07	0.97	0.68	0.26	0.05	0.02	0.23	0.05	0.40	0.70	2.12	9.40
Sandusky, Ohio	Aug. 2, 1877 . . .	2.19	3.13	2.20	2.70	3.34	5.06	4.06	4.27	3.54	3.50	3.68	2.97	41.43
San Francisco, Cal.	March 8, 1871 . .	5.10	3.95	2.88	1.80	0.71	0.16	0.01	0.01	0.15	1.13	2.70	4.72	23.32
Sitka, Alaska	March 30, 1881 . .	9.44	11.64	9.76	4.40	3.23	3.13	5.82	5.82	9.97	9.33	11.87	12.67	97.28
Spokane Falls, Wash. Terr.	Feb. 5, 1881 . . .	3.34	3.02	0.85	1.90	1.38	1.00	1.04	0.25	1.14	2.90	2.22	2.06	21.19
Washington City	Nov. 1, 1870 . . .	3.10	2.85	4.04	3.07	2.98	4.23	4.08	4.97	4.42	3.00	2.84	2.22	42.56

has covered the surface for ages. Of course there are bare spots, and where the growth has been light, the top-dressing is thin; but the mountain sides, the hills, and notably the low grounds, are overlaid from one to ten inches, and often much more, with this vegetable mould.

δ. ALLUVIUM. This includes the transported matter of the bottom-lands, the swales, and the tidal flats. Here we have humus, not only as a top-dressing, but also intermixed, and sometimes constituting a large proportion of the soil for a considerable depth. No land could be richer than this, and its relative proportion to the whole is larger than would be inferred even from the great number of streams, for it includes the lowlands about Puget Sound and the lakes. The mountain streams have, with some exceptions, but little alluvial land. There are areas of swale, or wet bottom-lands, which may be drained to advantage. The tidal flats along the Sound are peculiarly fertile, because enriched by both vegetable and animal matter, including calcareous shells and fish bones. Owing to this great fertility, and the ease with which large areas are reclaimed by dykes, their convenience to transportation, and, it may be added, the labor of clearing the forest lands, the work of

dyking these flats has been commenced, especially in Snohomish and Skagit counties, and it is thought that two hundred thousand acres may thus be redeemed from the water. Alluvial lands constitute but a small feature in East Washington.

c. DRIFT. The origin of these gravel soils is given hereafter, under the head of Geology. They constitute the hill lands, as distinguished from the bottom lands and Sound flats on the one hand, and the mountain lands on the other. They are composed of sand, clay, gravel, and some large boulders. Rarely the gravel predominates so as to render the land unfit for cultivation. Sometimes there are only clay and sand, and sometimes chiefly clay. This soil, though not equal to the alluvium, or to the basaltic land, is much better than glacial precipitate usually is. It gave all the indications of a fertile soil, resembling the best hay lands of Massachusetts, which have the same glacial origin. Its natural growth is luxuriant, and when cleared it inclines to clothe itself in white clover and the grasses. It is said to be specially adapted to fruits and vegetables.

d. LOAM. I mean by this a clay soil containing fine-grained sand enough to make it friable. This is the soil made by the slates and sand-

stones of the coal measures, and is generally found on the highlands above the drift. It is a medium land as to quality, but valuable for the tendency to grass, which characterizes all the lands of West Washington. Much of it will make good cropping land. There is a great deal of it. It is found high on the cretaceous hills and mountains, often extending to the top.

A remarkable
soil.

e. BASALT. This is the magic soil of the Great Plain (or plateau) of the Columbia. And it is found also in large areas on the Cascade Mountains. It has an ashy look and texture; sometimes black, but generally of ashen hue. Rarely it is compact and clayey. There are perhaps twenty thousand square miles of this basaltic land; enough of itself to make a medium-sized State. Of course there are inequalities in the productiveness of this land. The basaltic rock in many places crops out, as mentioned under the head of Topography, and there are coulées and galled spots. I cannot say what proportion of the surface is rendered valueless by these irregularities. The outcropping basalt does not destroy the value of the land; for the soil spaces between the rocks may be greater than the rock spaces, and whilst unfit for the plough, they may be suited to trees, or cattle range. But, judging by all that I saw

and heard, I should think that the smooth land considerably predominates over the rough. Certainly there is more smooth, comparatively level, fertile, productive, and easily cultivated land here in proportion to the whole area than I have ever seen elsewhere. The great plain of East Colorado is a vast and beautiful stretch of country, but it is unproductive without irrigation. Taking everything into consideration, the plateau of East Washington seems to me to be unequalled in combined extent and productiveness.

This subject of soils will be incidentally continued in connection with the next two heads.

NATURAL VEGETATION.

Here the two sides of the Cascade Mountains must again, as under other heads, be considered separately. The natural vegetation of the west side is vast rather than varied. Wherever the sun touches the ground, one may expect to see grass; chiefly white clover and green sward, which seem to be indigenous to the country. There are, of course, many herbs and shrubs which need not be mentioned in a report like this. The ferns of the Snoqualmie bottoms, for size, remind one of the tree ferns of the carboniferous period, though, of course, not so large. Many

Vast
vegetation.

of them were seven feet high, which is five feet higher than I ever saw elsewhere. The Sal-al is a low shrub, almost herbaceous, and semi-procumbent, of brown foliage, bearing a berry and belonging to the wintergreen family, though much larger than the wintergreen of the Alleghenies. The Sal-al abounds on the little prairie which bears its name. The mosses are most abundant and luxuriant in the deep, moist shades of the evergreen forests, and I noticed that the Cayuse ponies fed upon them as eagerly as reindeer upon the Iceland mosses.

Deciduous
trees.

Deciduous trees are rare, but not wholly wanting. The cottonwood grows to rather extra size. The alder, which is only a large bush in the Alleghenies, here becomes a tree, perhaps thirty feet high. I saw some small maples. It is said that there are groves of oak and maple of sufficient size to cut for lumber.

Larch.

The Larch (tamarack) is interspersed among the evergreens on the Cascade Mountains, and attains good size. The American larch is rather more slender in habit than the European variety, but it has a heavy, close-grained wood, and is regarded as specially suited for railroad ties—an important point in this country. It is also reported to make durable fence-posts and ground sills. In Europe its bark is valued for



A VIEW OF THE FOREST ON THE LINE OF
THE SEATTLE, LAKE SHORE AND EASTERN RAILWAY.

tanning next to oak bark, and the two are used together. The Venice turpentine comes from the resinous sap of the larch. The older trees are better than the younger ones for durability. But with regard to this class of trees, results depend much on incidental circumstances. Larch is one of the woods used in Europe for making gas. These are the only deciduous trees I know of in Washington Territory, except fruit trees.

Evergreens constitute the bulk of the great forests, and I shall name these in the order of their importance: Douglas (or red) fir, white cedar, hemlock spruce, white pine, balsam (or white) fir and yew.

Extraordinary
evergreen
forests.

The Douglas Fir constitutes the greater part of the forests, but not so large a proportion as seven-eighths, as stated in the Census report, but more than one-third, which is the proportion given in Hough's Forestry Report. The wood of this tree is yellow when young, and hence some persons make two varieties out of the same tree. When older, it becomes an orange color, but not red like the heart of the sweet gum and red cedar. It is, however, usually called the red fir. The tree yields a clear yellow resin, which is not at present collected. Its timber is of the best quality, greatly superior to that of the fir tribe generally, probably superior

Douglas fir, or
Oregon pine.

The best
of ship timber.

to that of any other fir-tree in the world. The firs shade into each other by an almost insensible gradation, and are much modified by soil and climate, and names have been multiplied unnecessarily. The fir, like the larch, must be studied in each locality in order to determine its value. The firs of Sweden and Norway make good masts and spars, and soft, light boards; but the boards are apt to split and are not strong enough for ship-work. But the timber of the Douglas fir is heavy, strong and firm, and well suited to ship-building, as has been abundantly demonstrated on Puget Sound. For all ordinary building purposes this timber has a world-wide reputation. It is often called the "Oregon Pine." Its growth as a tree is luxuriant on good soil, and often gigantic. I saw many single specimens which I estimated at 300 feet in height and 10 to 12 feet in diameter. When disconnected, they have the usual conical shape of the firs, with limbs branching from the ground, but it is rare to see such specimens in Washington Territory, as the forests are so dense there is no room for limbs, except near the top. The trunks stand as straight and regular as posts set with a plumb-line. This crowding often prevents the full development of the trunk also, except on

the most moist and fertile lands. The absence of lower branches insures a great length of lumber free from knots.

The White Cedar is a variety of the well-known arbor vitæ of the Eastern States, but there is a wonderful difference in the size and habits of the tree on the two sides of the Continent. On the Atlantic side it may, under very favorable circumstances, reach fifty feet in height, but usually it is dwarfish and crooked. But in Washington Territory the white cedar is the peer of the Douglas fir, and its largest specimens perhaps exceed the latter somewhat in diameter. It is also next in abundance and value. Its wood is soft, light and cream-colored. It splits with remarkable ease and regularity, so that the pioneer with axe and frow can prepare all the timbers needed for his house. For shingles it is fully equal to its congener, the cypress; and for house-facings and some kinds of furniture it is the favorite wood.

White cedar.

Beautiful
house lumber.

Hemlock Spruce is not so abundant, but it constitutes a noticeable element in the Snoqualmie Valley forests. It seems to be exactly the same tree which so abounds in our Eastern and Northern Lake States, and is common in the moist valleys all along the Appalachian Mountains. It is called hemlock in the Northern

Hemlock spruce.

Tanners
wanted.

States, and spruce in the Southern. Its wood, though unsuited for many purposes, is largely used in the North for the frames of cheap buildings and also for fencing-plank, and its bark is in great demand for tanning, especially for making the red sole leather. It is also used for tanning upper leather and calf-skins, though its light leather is not so good as that made from the oak barks. The hemlock bark has not been considered quite equal to the chestnut-oak (or rock oak) bark for any tanning purposes, but in Virginia the price is usually the same. It certainly makes good sole leather. The logger in Washington Territory neglects this tree, and there are no tanneries yet to call for it, but this will soon be changed, and the hemlock will take its position, not only as the most beautiful of the evergreens, but as among the most useful. This tree does not attain as great size as the two above mentioned, but I observed many specimens ranging from four to five feet in diameter.

White pine.

The general character of the White Pine is well known. I saw but a few of them, and they not specially good. I doubt whether this tree forms an important feature in these forests.

Balsam fir.

The Balsam (or White) Fir abounds on the higher slopes of the Cascade Mountains, and it

is so balsamic that it will receive attention from the collectors of "Canada Balsam," which is becoming increasingly popular for many purposes, especially in mounting specimens for the microscope. Such forests as lie near the Snoqualmie Pass will not long remain unnoticed. The wood is white and easily worked, but the trees do not rank in size or value with those previously mentioned.

Large supply of
Canada Balsam.

The Yew is found sparingly on the mountain heights; but, though interesting, it seems to have no economic value.

The yew.

As to the extent of these evergreen forests, they may be said to cover West Washington with almost unbroken continuity, though they vary in density and the size of the trees, some tracts containing little or no mill-timber. In my travels, which were, of course, quite limited, I saw no forests which answered the usual unqualified descriptions, except in the Snoqualmie Valley, and here they far exceeded my expectation, as will be shown in the detailed description, given hereafter, of the country lying along the line of the Seattle, Lake Shore & Eastern Railway. The finest forests lie between Puget Sound and the crest of the Cascade Mountains, though even in this area there are variations. And after all the chopping and sawing—of which

The superior
timber of
Snoqualmie
Valley.

more will be told later—the forests as yet show but little diminution.

East of the Cascade Range the forests are smaller, and confined to the mountain sides. There are some narrow belts of pine along the northern edge of the Great Plain of the Columbia, which furnish a little lumber for local uses; but these will soon be worked out. The mountain rim lying along the Canada line is said to be covered with forest, some of it heavy. The Douglas Fir, the Yellow Pine, the White Pine, and the Larch are all to be found there. There are also skirts of the same timber along the Spokane River. And, at wide intervals, there are strips and bunches of scrubby yellow pine on the Great Plain, which is, however, generally treeless.

The spurs and ridges of the Blue Mountains are thinly covered with small pines and larches. There are some areas of mill-timber on the east and south-east flanks of the Cascade Mountains.

The flora of the great plateau presents a strange appearance to the traveler. The vegetation is short and scanty, the chief growth being the "sage-brush," a dwarfish, dead-looking shrub, with a hard, crooked stem, of no value as forage, but which is sometimes used for fuel

when nothing else is to be had. There are said to be some medicinal, and also some edible, plants ; but the only thing of any value is the dry, thin, short, bunch grass which furnishes a fattening food for horses and cattle ; though many acres are required to support an animal, and close grazing is rapidly destroying this resource. Indeed, the tract is so barren and desert-like in appearance that in the geographies of my boyhood it was put down as a part of the Great American Desert. And yet, as will be seen hereafter, this is probably the most productive upland in America.

Range for
horses and
cattle.

LUMBERING.

Lumbering was the first industry of Washington Territory. Even food was imported for a time. Logging began on Puget Sound, and went up such streams as afforded transportation and water-power. Steam-power soon became the chief reliance for sawing, but water-power will be largely used when the railroads penetrate inland.

Logging and sawing are separate branches of business, which may or may not be carried on by the same parties. And so with transportation to the mill and to market. Large con-

cerns carry on all the branches, even to the building and owning of ships.

Magnitude
of the lumber
business.

Governor Semple gives the capacity of the Washington Territory sawmills in 1887 as 645,500,000 feet of lumber per annum, of which the Puget Sound mills produce 344,500,000 feet. Of this, they (Puget Sound mills) sent 200,000,000 feet to California; 2,600,000 to Boston, Mass.; 500,000 feet to other Atlantic ports, and over 100,000,000 feet to foreign ports. Among foreign ports, London received 551,500 feet, and the rest went to Mexico, South America, China, Australia, and other Pacific Islands.

Mr. Cyrus Walker, of the Puget Mill Company, Port Ludlow, in a letter which I have from him, says:

Vast extent
of the lumber
market.

"It is safe to say that the lumber market of the Sound may be considered all countries and ports on the Pacific Ocean."

But it may make a more vivid impression of the Pacific market for me to give a list of the ports to which shipments have been actually made in the last year by the lumber dealers of Puget Sound. This list I get not only from public documents, but directly from the millers and port officials:

Melbourne,	Sandwich Islands,	San Pedro,
Callao,	New Caledonia,	Hong Kong,
Sydney,	Mollendo,	Ensenada, Mex.,
Guaymas,	Montevideo,	Falmouth,
Iquique,	Honolulu,	Shanghai,
Taku,	Valpa,	Autofogasta,
Hilo, H. I.,	Suava, Feejee Is.,	Rio de Janeiro,
San Francisco,	Kahalui,	Broken Bay,
Townsville,	Cadera, Chili,	Adelaide,
West Coast,	San Diego,	Coquimbo.
Btisbane,		

This is not a complete list of all the ports visited by the lumber ships of Puget Sound, and by no means represents the business of the future, which will increase as fast as the mills can be built to furnish the lumber.

No one without seeing it can have an adequate idea of the magnitude of the operations of one of the great sawmills of Puget Sound. The Puget Mill Company, for the first ten months of last year, sawed on an average 290,000 feet every day of ten working hours. I visited the Port Blakely Mills, just across the Sound from Seattle. There I found a fleet of ships in the harbor, owned chiefly by the company; also, ships building on the stocks; railroads going out to the logging camps; a basin for receiving the logs, and a mill, with four separate tracks, bringing the logs in at one end, and

The great saw-mills.

carrying out the lumber at the other. A high iron trestle carried off the slabs to an enormous fire which never ceased to burn, where all this waste was consumed.

Around the mill was quite a town, in which a large number of races and nationalities were represented. This mill cut about 59,000,000 feet in 1887. Up to the 10th of November it had shipped as follows: To California, 32,464,763 feet; to South America, 6,847,427 feet; to Sandwich Islands, 1,799,891 feet; to Australia, 6,681,668 feet; to Feejee Islands, 511,815 feet; and used at home for ship-building, railroads, etc., 2,312,000 feet.

The Tacoma Mill Company and the Washington Mill Company produced the following lumber, etc., during 1886 and the first ten months of 1887:

	LUMBER. FEET.	LATH. NO.	PILES. LINEAR FT.
Tacoma Mill . . .	103,448,350	28,815,095	642,385
Washington Mill .	42,195,478	8,772,800	266,403

There were other large mills whose statistics I was not able to get in time. Mr. Walker thinks that the cut of all the mills on Puget Sound averages 1,200,000 feet per day; all of which finds ready sale.

I was not able to ascertain the profits of

these mills, but there can be no doubt that, with proper management, the profits are very good. The Seattle wholesale prices were as follows :

Profits and
prices.

Lumber, common, per thousand feet	. . .	\$12 00
" sized, " " "	. . .	14 00
" Flooring		\$15 00 to 20 00
Dressed lumber, per thousand feet	. . .	14 00 to 30 00
Laths		2 00 to 2 25
Shingles		1 50 to 2 00

AGRICULTURE.

After hearing of the forests in West Washington, one cannot be surprised to learn that the agricultural interest develops slowly in this part of the Territory. Even after the logger has taken what he wants, there remains a heavy mass of vegetation which is expensive to clear away. A thorough clearing, including the removal of stumps, costs \$75 to \$100 per acre; and yet this is sometimes done for hops, hay and vegetables. But the common way is to "slash and burn," at an expense of ten to fifteen dollars an acre. This clears off everything but stumps, and such trees as may be reserved for the mill or other purposes. There are fine farms in every direction, but I had no means of ascertaining the proportion of cleared land, or of the agricultural population. The natural

Clearing the
land.

Demand
for agricultural
products.

fertility of the soil, the high prices of produce, and the rapidly growing demand, both foreign and local, will tempt to a wasteful destruction of timber in order to prepare the ground for crops. There need be no doubt as to the extraordinary productiveness of the soils, even be-

Large crops.

yond that of the same quality of lands elsewhere; because the climatic conditions are extra favorable for the growth of all crops suited to the country. There are some crops, such as corn, lima beans and sweet potatoes, which are contra-indicated. The cool summer nights check the maturing of these. Wheat, also, is not suited, though produced to some extent. But for almost everything else the conditions favor extra production. The conditions could scarcely be better for grass and hay. The scantiness of the summer rains is more than compensated for by the long growing seasons in fall and spring. No soil and climate could be better for oats and potatoes. The reported yield of these three staples would be called fabulous if not established by good testimony. Three tons of hay, 100 bushels of oats, and 600 bushels of potatoes per acre are above the average, but by no means reach the maximum on the best lands. Most fruits do well. In the production of hops West Washington has

Hop-growing on
a large scale.



INDIANS GATHERING HOPS, WASHINGTON TERRITORY,
ON LINE OF SEATTLE, LAKE SHORE AND EASTERN RAILWAY.

become celebrated as to quality and yield per acre. This is probably the largest of the agricultural interests in this part of the Territory, and was at one time enormously profitable. Present prices are thought to leave some margin, but not much.

As heretofore remarked, the agricultural conditions change suddenly on crossing the Cascade Mountains to the eastward; and this change begins at the crest line, and is more marked on the mountain side and near its base than anywhere else. The winters are longer and more severe, and the summers drier and hotter. There is natural pasturage similar to that of the plateau country, coming up to the timber line, the lower edge of which is high on the mountain. Much of this mountain land, though covered scantily with sage brush and bunch grass, is really fertile, and, besides supporting cattle, can be made to bring fair crops of wheat and other things; but the rainfall is so insufficient that irrigation is necessary for the development of any large agricultural interest. Fortunately, in the large basin of the Yakima, irrigating streams are abundant, and its enterprising people are availing themselves of this happy resource. By reference to a good map it will be seen that the Yakima River is

The changed
agricultural con-
ditions of East
Washington.

Irrigation in the
Yakima Valley.

made up of an unusual number of streams. A group of these come together near Ellensburg, and another group near the town of North Yakima; and there are said to be large bodies of land susceptible of irrigation by these streams. The Ellensburg valley is thirty miles long, and about ten miles wide; and is the best agricultural section in Kittitas County. It is claimed that forty bushels of wheat to the acre can be produced here without irrigation; and that 1,000,000 bushels of wheat were actually produced in this basin in 1887. Hay, hops, vegetables, berries and fruits also do well naturally, but with irrigation the product is uniformly large. There are four irrigating canals in the valley. The Teanaway Ditch Company has one fifty miles long which can water 75,000 acres of land. The Ellensburg Ditch Company has a ditch ten miles long, covering 10,000 acres. Mr. Bull has one six miles long, and the owners of the new roller mill have two and a half miles of ditch.

Next below Kittitas is Yakima County, which contains a number of fertile valleys, and also good uplands, and is well supplied with irrigating streams, which have already been brought into use. Two large ditches are drawn from the Natchess River. Ditches are also taken

from the Ahtanum, which is the principal hop-raising section. A plateau, three by ten miles, between the Cowiche and Natchess, will all be irrigated. The Moxee Valley is largely owned by Eastern and other capitalists, who seem to be expending much money in the improvement of the country. This company has fourteen miles of ditch.

By the help of these ditches the people of Yakima Valley are producing corn, which under the hot sun of the locality perfects its product. Tobacco has been tried also with fair results. And the Moxee County will try the dairy business. There is a disposition also to try improved breeds of cattle. The spirit of enterprise has resulted largely from the passage of the Northern Pacific Railroad along the Yakima Valley; but at the same time the greatest obstacle in the way of irrigation lies in the ownership of alternate sections by this railroad. The Yakima Indians have good lands, and Klickitat County is well spoken of. Sweet potatoes, tomatoes, peaches, grapes, and other things requiring much heat, are said to thrive in the lower parts of the Yakima Valley.

Varied crops.

We enter now the last grand division of the country, the Great Plain, or, more strictly, plateau of the Columbia River. In spite of its

The Great Plain

Boundaries.

unpromising aspect, this is the chief agricultural region of the Pacific States. To get the exact boundary, find the point (a little below Wallula Junction) where Washington and Oregon both corner on the Columbia River. From this point, follow the Columbia up to the mouth of Spokane River ; follow Spokane River up to the Idaho line ; follow the Idaho line south to the Oregon line ; follow the Oregon line due-west to the beginning, and within these lines lies the region which is destined to be the granary of the Pacific States.

Early history.

The settlement of this plain began near Walla Walla, where a Christian mission was established by Whitman, the hero and martyr, who saved this country to the United States. Hence the most thickly populated part of the plain is between the Oregon line and Snake River. This region was supplied with transportation by the Oregon Railway and Navigation Company. The largest agricultural production is here.

Immigration next moved north of Snake River into the valley of the Palouse River, and here we have the next largest area of production. When the Northern Pacific Railroad came in from the east, the new-comers entered the Great Bend country, which is the northern half

of the plain. The chief settlement here is in Spokane and Lincoln counties, which cover nearly half of the Great Bend. Douglas County covers the remainder, and is beginning to be settled. There are ten counties on the plateau, with an aggregate area of 20,000 square miles and a population of 52,000. Of this population, 20,000 is south of the Snake River, 14,000 north of Snake River, and 18,000 in the Great Bend, including Spokane Falls.

Area and population.

The great staple of this country is wheat, though almost every crop is grown, and most of them with remarkable results. Corn is grown only south of Snake River, where it yields thirty bushels to the acre. The average yield of wheat year by year for the entire Territory is put by Governor Squire at twenty-five bushels, and no one who knows the country can regard this otherwise than as a moderate estimate. This average places Washington Territory beyond comparison first among the States of America, and, so far as I can learn, second only to England among other nations. England, by the highest manuring, has brought her wheat product up to thirty bushels, which is double the average of former years. By the census of 1880, Washington Territory, as a whole, leads all the other States. The following tables

Amazing wheat crops : surpassing all other States.

give the average of ten of the chief wheat-producing States:

WHEAT, PER ACRE.	BUSHEL.
California	15.8
Dakota	10.6
Minnesota	11.3
New York	15.7
Ohio	18.0
Pennsylvania	13.4
Virginia	8.6
Washington Territory	23.5
Oregon	16.8
Illinois	15.5

The year 1886 was the worst wheat year ever known in Washington Territory: its crop averaged sixteen and a half bushels.

Railroads overwhelmed with freight.

It is thought that the wheat crop of East Washington for 1887 will exceed 10,000,000 bushels. It certainly went far beyond the ability of the railroads to carry it away before winter. The most amazing glut of freight I have ever seen was along the railroads in Walla Walla County. Not only were the depots crowded to the roof, but piles of sacks larger than the depots stood outside. It was a common sight through the whole Snake River country to see 10,000 sacks of wheat in one pile outside of the depots.

The price of wheat runs from 40 cents to 60

cents a bushel ; whilst the cost of production on good land need not exceed 25 cents a bushel. Mr. Hamilton, of Colfax, has a farm which he cultivates entirely by hired labor, and he told me that the cost of his wheat was from 20 cents to 25 cents, and that his profit was \$5 per acre. Good farms about Colfax can be rented out at \$2.50 per acre for the whole farm. Mr. Miles C. Moore, of Walla Walla, probably the most exact business man of that region, farms largely by hiring labor. He gave me the following statement of his own operations :

Price of wheat
and cost of pro-
duction.

WHEAT GROWING AND DELIVERING.

<i>Dr.</i>	Cost of ploughing, per acre	\$1 50
	Cost of twice harrowing and sowing	1 00
	Seed, $1\frac{1}{4}$ bushel	62
	Thirteen sacks at 8 cents	1 04
	Keeping up fences	10
	Harvesting and hauling five miles to depot, 17 cents per bushel	4 76
		\$9 02
<i>Cr.</i>	By 28 bushels per acre at 50 cents	\$14 00
	Cost of production	9 00
	Profit	\$5 00

This product could not be expected on inferior lands, but with the working farmer the cost of production is less. The yield of wheat

on the best lands of East Washington is large—almost beyond belief. Mr. Houghton, attorney for the Spokane Falls and Palouse Railroad, told me that he had known of 800 bushels of wheat being raised on ten acres; that it was measured by a committee. Mr. Miles C. Moore has known 1,000 acres to average fifty bushels. A farmer (apparently honest) told me that he had raised seventy-five bushels to the acre over his whole wheat area. His crop was harvested by the acre, and the area measured by the county surveyor. It was all sold, except seed. Thus he got both area and product accurately. Many more instances were stated to me on good authority. But there are different grades of fertility in these lands as in other lands, and the amount of rainfall makes a difference also. Wallula has but twelve inches of rain, and is unproductive. There must be fifteen inches for wheat. Walla Walla has seventeen, and is productive. Nearer to the Blue Mountains the rainfall is thirty to thirty-five inches; here are the largest crops. Spokane Falls has twenty-one inches. Yet where else on the earth can such crops be raised even occasionally? I have been growing wheat for thirty-five years on good land in the Valley of Virginia, and I never could reach thirty bushels

to the acre on a single field ; and I do not believe that my neighbors can do better than I do. We count twenty bushels an extra crop.

Besides wheat, these lands produce barley of superior quality, weighing fifty pounds to the bushel, at the rate of fifty to sixty bushels per acre, and oats weighing thirty-eight pounds to the bushel at the same rate per acre. The weight of wheat is sixty pounds to the bushel. Barley sells at 90 cents per 100 pounds, and is largely shipped East to be made into beer.

Also barley and
oats.

The wheat usually grown is the Little Club, a short, strong white wheat ; but the Little Giant, Red Chaff and Chili Giant are productive. Spring wheat is generally sown, but winter wheat is probably best. Blue stem brings five cents extra in Portland. Freight, \$5 a ton from Walla Walla to Portland ; thirty-three bushels counted a ton.

The wheat here has no enemies—no fly, nor rust, nor weeds, nor lodging.

Much of the land has been cultivated for sixteen years without rest or manure, and without diminution of crop ; but the best farmers prefer to rest and cultivate in alternate years. By the latter system the ploughing is done in the off-year, and the land left a naked fallow. This is thought to cleanse the land and renew

The soil a natural fertilizer.

its strength. And in some cases in which lands have an excess of alkali, their productiveness increases with cultivation. Sometimes the land contains as much as eighteen pounds of potash to the cubic yard ; which fact, by the way, suggests the possibility of leaching the land to procure potash and other alkalies.

Quality of the wheat.

The wheat of the Pacific coast has 4 per cent. less gluten in it than the Eastern wheat, and this practically shuts it out of the Eastern market. Nitrogen in Washington Territory wheat is 22 per cent. to 26 per cent., whilst in the Eastern it is 34 per cent. to 40 per cent., and inferior in quality. The true gluten is too brittle. It is better than the California wheat, however, which has 4 per cent. to 6 per cent. less nitrogenous matter, and the gluten inferior in quality. But the California wheat makes a whiter flour than the Washington Territory wheat, which is an advantage in selling. It should be remarked that the term nitrogen, when applied technically to wheat, includes true gluten, the phosphates, and all albuminoids, and excludes starch, sugar and water, which latter comprise about seventy-two per cent. of the wheat. Still, the Washington Territory wheat-grower has the advantage in quantity per acre, which gives him a better profit than is now made in California or any

Eastern State. The price at Spokane Falls varies from 45 cents to 60 cents per bushel, which would give the farmer \$10 to \$12.50 per acre for his crop, which is more than the average Eastern farmer gets, whilst the cost of production ought to be, and ultimately will be, less.

Flour is sent to England, by Cape Horn, at a cost of \$1.30 per barrel from Spokane Falls, and in Liverpool brings within 20 cents a barrel as much as the Minneapolis flour, and it is also shipped to China and other Asiatic ports, where it seems destined to supersede rice for bread. China raises wheat, but not nearly enough for home consumption. The Asiatic and Oceanic market will, ultimately, want all the wheat of our Pacific States.

Besides the cereals, vegetables of nearly all kinds grow to great size on this plateau. Those requiring a more uniformly warm temperature, such as tomatoes, sweet potatoes, beans and peanuts, do best in the region lying south of the Snake River, which is much less elevated than the country north and east. And this is true also of peaches, grapes, and other fruits requiring similar conditions. But as regards most vegetables, especially roots, and also fruits, the plateau generally is very productive. This is almost unaccountable in view of the fact that

The market in
England, China,
and other
Asiatic ports.

Astonishing
growth of vege-
tables.

Crops without
rain.

after the first of June there is little or no rain until late in the fall. Whilst rain seems to be necessary to start the small seeds, large crops of potatoes are sometimes raised without a drop of rain. The moisture must come partly from the soil, which has retained the winter water, and partly from the deposition of moisture by the sea-air which comes through the gap in the Cascade Mountains and penetrates the deep, loose soil. Mr. Paul F. Mohr has measured a parsnip four feet long and eight inches across the top. I saw potatoes in Colfax, thirty of which filled a bushel measure.

As before intimated, I doubt whether the plateau can ever become a good grass and hay country. For long forage, besides straw, the people must depend upon the cereals mowed in the green state.

West (not East)
Washington
is to be the great
cattle country.

For this reason the plateau, as will also be the case with the great plains eastward, can never carry the number of cattle that can be grazed in a grass country. A farmer told me it required fifteen acres of bunch grass to support one horse or steer, whilst in a grass country three acres are ample, and on the best sods one acre is sufficient. Still, the bunch grass is, and ought to be, utilized. And the areas of unimproved land are so vast that the herds of cattle,

horses and sheep which range upon them altogether constitute a large item of wealth. And on these treeless plains the effort seems to be to train the cattle and horses to live like buffaloes and wild horses in both summer and winter.

The tree problem will, I think, work out satisfactorily, though, of course, no such trees can ever be produced there as abound in West Washington. Walla Walla is embowered in trees of artificial growth. The Lombardy poplar seems to have been most successful. At various points I saw plantations of box elder, and was told that this tree is easily grown. The cottonwood is said to grow readily. Captain John McGowan reports the successful culture of locust, walnut, maple and catalpa in Lincoln County. He says, also, that the plum, peach, apricot, apple, pear and grape succeed : and so with strawberries, raspberries and blackberries. All these fruits are grown about Spokane Falls, but I think that the grape and peach sometimes fail to mature. A good many plantations of trees have been set out under the timber-culture act of Congress, but it is thought that much imposition has been practised on the Government by the failure to take proper care of the trees after they were planted. The truth

Tree-planting.

about the whole matter seems to be that, with proper care, trees of most varieties may be grown on the plateau, but that they will grow slowly and not attain large size. I might add many details concerning the products of this wonderful country, but these will suffice as illustrations.

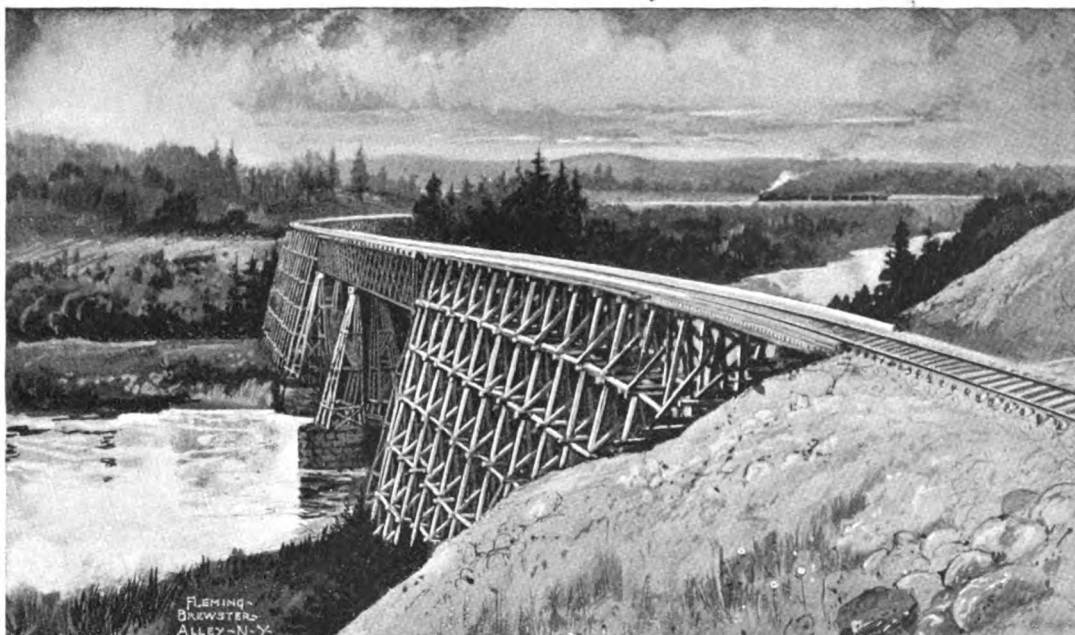
LABOR.

Good supply of
labor, but
more wanted.

Under this head I will merely say that, though the laboring population of Washington Territory is very mixed and has not the settled character of labor in the old States, and though many more laborers could find employment, there does not seem to be any special deficiency of this class, and the high wages that are paid will, no doubt, bring in more workmen as they are wanted.

Wages.

Governor Squire, in his report for 1885, page 41, gives quite a detailed list of wages, which shows that the rates are at least fifty per cent. higher than in the Middle States, and double what is paid in the Southern Atlantic States. Farm laborers get from \$25 to \$30 a month and board. Loggers pay from \$35 to \$40 per month to common hands, and \$65 to \$70 to teamsters. Skilled labor receives high wages, and railway contractors sometimes have to pay



BRIDGE OVER THE SPOKANE RIVER, SEATTLE, LAKE SHORE AND EASTERN RAILWAY.

\$2 to \$2.50 per day for common hands. Servant girls are scarce, and wanted, at \$15 a month and board. Hotel servants get from \$20 to \$25 a month. Chinamen are extensively employed for family servants. Many of them are tolerable cooks, and get \$30 a month and board. Indians are working more than formerly. The men "slash" the forests, pick hops, etc. Squaws always were industrious—had to be! The Sandwich Islands, as well as China and Japan, furnish some laborers. The employers are favorable to this class of immigrants, whilst the white laborers are bitterly opposed to them. Canada will continue to employ cheap Chinese labor, and thus place our Pacific States at a disadvantage, if the present policy of excluding Chinese labor is continued.

THE GEOLOGY OF WASHINGTON TERRITORY.

HISTORICAL AND STRUCTURAL.

I SHALL not say much about the historical geology of Washington Territory, because it contains some problems which have never been adequately studied, and which I had no opportunity to investigate. It is to be hoped that the regular work of the Government Survey may soon be extended to this important region. Hitherto it has been neglected. A few able geologists such as Joseph Le Conte, Pumpelly, Newberry, Bailey Willis, and some others, have made visits to the country on special errands; but except the treatise of Bailey Willis in Vol. XV. of the Census Reports, and some brief allusions to the country in systematic works on general geology, I had nothing to guide me as to the structure of the country, or the age of its deposits. For all practical purposes, however, I had no difficulty in understanding the work I had to do.

All agree that the country west of the Rocky Mountains proper, and including nearly all of

California, Oregon, and Washington Territory, is geologically younger than the main range, and younger than the Appalachian country. At the close of the carboniferous period proper, the Rocky Mountain range constituted a separate continent, with a sea covering what is now the main Mississippi Valley, including the wide plains immediately east of the Rocky Mountains, and connecting, probably, with the polar sea, whilst the Pacific Ocean washed the western edge of this Rocky Mountain continent; so that until after that period there were no Wahsatch and Uintah mountains, no Sierra Nevada and Cascade Range, no Coast Range, and, of course, none of the intervening country. It is quite possible, however, that there was a third continent lying west of the present continent in what is now ocean, from whose waste the sediments were derived which were afterwards elevated and became the land now included in the three States bordering the Pacific, whilst the mother continent, which furnished the sediments, sank beneath the ocean. If there were such an outlying continent, additional force is given to the views of Dr. George F. Becker, endorsed by Dr. C. A. White, and to some extent anticipated by Prof. J. D. Whitney, which render it probable on other grounds that

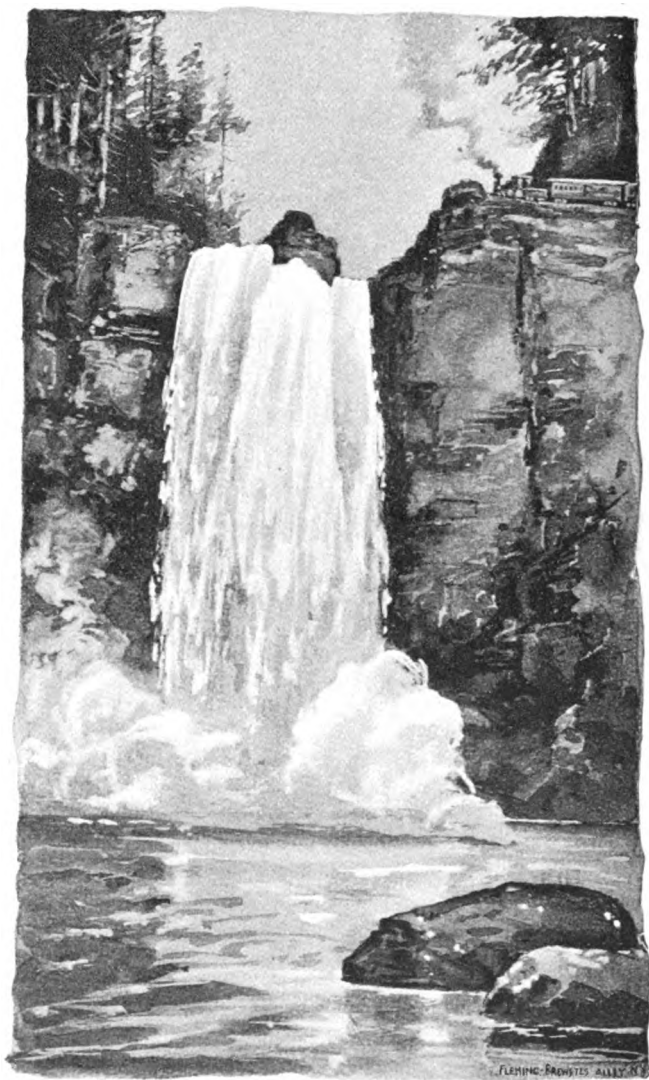
The Western Coast regions younger than the Rocky Mountains and Appalachians.

An outlying Continent.

The rise of the
West Coast.

the two great lines of mountains, viz., the Sierra Nevada and Cascade Range and the Coast Range, began their upward movement simultaneously during the early ages of the Juro-Trias. The rise of these mountain lines was gradual and marked by reverse movements, whereby, after appearing above the surface, they sank and rose alternately, receiving fresh sediments, which, especially in the Washington Territory region and part of Oregon and California, when above water, became clothed with an enormous vegetation which was packed into coal-beds, layer after layer. In the lapse of time these all came above the surface. The mountains grew higher and higher, attended by intense heat in the axes of the ranges, and at different periods, down almost to the present, exhibiting volcanic action on an enormous scale. At other periods, a large portion of the region was visited by ice-floods, succeeded by water-floods, which top-dressed great areas with a mingled deposit of gravel, sand and mud, and carried away vast blocks of the rocky substance of the country, and cut deep channels in all the highlands.

As Washington Territory is now presented to us, it exhibits a scene of mountains, lowlands, and elevated plateaus, which are full of interest



LOWER SNOQUALMIE FALLS, 268 FEET HIGH,
ON LINE OF SEATTLE, LAKE SHORE AND EASTERN RAILWAY.

and variety. Some general account of its topography has already been given.

The core of these high ranges is chiefly rock originally stratified, which has been metamorphosed by heat, and perhaps inside of all, with branches bursting out at various places, are plutonic rocks which have never been stratified. This is the state of things on the top of the Cascade Range, near Snoqualmie Pass, as well as on some subordinate peaks and ranges. On Mount Logan, the Denny Mountain, etc., are large bodies of syenitic granite whose age I have no means of determining. Associated with this are quartzites of fine grain, and extremely hard, porphyries, and serpentinitoid and chloritic rocks of different sorts, in which are imbedded the magnetic iron ores; and also large beds of crystalline limestone, both fine and coarse grained. Crossing these, at various angles, are veins containing the precious and base metals.

The rocks and minerals of the Cascade Mountains.

Whether these rocks are Palæozoic or Archæan in their origin, or whether they are simply the metamorphosed strata of the upper Juro-Trias, or the lower Cretaceous, is a question for future study. These plutonic and metamorphic rocks are believed to extend through the mountainous region lying north of the Columbia River; and they are reported also in the Cœur

The metamorphic rocks of doubtful origin.

d'Alene Mountains. It is quite certain that on both flanks of the Cascade Mountains we find in their natural state Cretaceous conglomerates, sandstones, and shales bearing coal, at least in their upper beds. The deposits on the east side of the mountain have been much grooved and denuded, until we find only small areas of the Cretaceous strata on the Yakima and the Wenatchie rivers, and the Peshastan ridge between, with a patch of the coal-bearing rocks on the Yakima, and another on the Wenatchie. On the west side of the mountain range, the Cretaceous and coal-bearing areas are much larger.

The coal beds.

The coal deposits of all the Cretaceous regions of the West are regarded as belonging to the Laramie period which closed the Cretaceous age, and constitutes a transition period between the Cretaceous and Tertiary. But I do not regard this question as settled. The inferior lignites of the Rocky Mountains, and the semi-lignites which constitute the upper beds of the Washington Cretaceous coal properly belong to the Laramie period; but to include the underlying bituminous coals in the same group may be a matter of question. More will be said in reference to these coal beds under the next head. The Western coal-bearing rocks begin on outlying mountains, standing at the west foot of the

main Cascade Range. These outlyers are irregular in size, height and direction ; but many of them are 1,000 to 1,500 feet in height, and they are found in groups, separated by denuded spaces, from the Cascade Mountains to the Pacific Ocean, and from the Canada line nearly to the Columbia River. The largest and most important field, however, lies south of the Snoqualmie River and between Puget Sound and the Cascade Mountains. Some of the coals found in the most southern part of the field, and on the Coast Range, are referred to the Tertiary period.

A smaller and wholly undeveloped field lies on the Skagit River, and another on, and west of Bellingham Bay. Similar beds are found on Vancouver's Island. Coal-bearing strata are found also on the Chehalis, Des Chutes, Nisqually and Cowlitz rivers. Whilst some of these southern and western strata are referred to the Tertiary period, there has been no systematic study of their geologic relations.

It seems to be settled, however, that the lofty volcanic mountains which form conspicuous features in the scenery of the Cascade Range, were active in the Tertiary period, and not only built their own crests 9,000 to 15,000 feet high, but inundated much of the surrounding country

The volcanic mountains and their great activity.

with lava to an amazing breadth and depth. In this region, Mount Baker, Mount Ranier (also called Mount Tacoma), Mount St. Helens and Mount Adams in Washington Territory, and Mount Hood in Oregon, were the centres of the grandest operations; and so continued for ages.

The wonderful
cañon of the Co-
lumbia River.

We see gigantic results of this activity in the cañon 1,000 to over 3,000 feet deep, which the Columbia River has cut through this volcanic matter in its passage through the Cascade Mountains. This volcanic deposit consists of brown basalt, which in cooling crystallized into vertical, polygonal prisms, or columns, which have been sculptured by the weather into endlessly varied forms, beautiful, fantastic, and grand; altogether presenting a scene, or succession of scenes, for twenty-five miles, such as can nowhere else be equaled on the American continent, unless it be near by, on a tributary of the Columbia, the Des Chutes River of Oregon.

The great sheets
of basalt.

This great pile of basalt was built up by a succession of overflows of lava, the joints of which are plainly visible. The basaltic area, though perhaps thickest here, continues with a thickness of 1,000 to 1,500 feet up the Columbia for hundreds of miles; indeed the

whole plateau, or prairie country of East Washington, which is a quadrilateral of some 200 miles in diameter, is but a continuation of the great lava-sheet seen at the Cascades and the Dalles. Through it the Columbia and Snake rivers have cut deep channels; and other, though shallower channels, have been cut across the surface of the plateau by departed streams.

Whether the extremely fertile soil which overlies the basalt in East Washington is a top-dressing of volcanic ashes, or is decomposed basalt, cannot readily be determined. It cannot be referred to the Glacial period, as I observed no appearance of drift anywhere except in the valley of Spokane River. Such a wide spread of lava is not unexampled in view of somewhat similar overflows now occurring at intervals in the Sandwich Islands, where lava runs and spreads itself like water. These Hawaiian flows are mentioned by Captain C. F. Dutton in his report of the Zuni Plateau.

Origin of the
rich soil of East
Washington.

A ledge of sandstone belonging to the Miocene Tertiary is visible under the basalt at the lower cascade in the Columbia River; and a stratum of iron ore and vegetable matter is found on the Willamette at Oswego, lying horizontally between great masses of basalt, showing a long interval between overflows.

The volcanoes
not wholly
extinct.

These eruptions probably continued with diminishing force until near the present time. It is reported that Mount Hood has sent out smoke or steam since the settlement of Oregon. The crater of Mount Ranier was visited by two gentlemen within a few years, and a night spent in its bottom by the side of a jet of steam. Such, at least, is the account given by one of them, Mr. Stevens.

Glacial drift.

The Quaternary or Drift Period has left abundant, though by no means universal, traces of its presence. As before intimated, I saw no relics of it in East Washington, except a deposit of rather small, generally very small, and well-rounded quartz gravel, thickly strewing, and really forming, the flats bordering Spokane River. This gravel macadamizes the streets of the City of Spokane Falls, and the neighboring roads, so as to make them firm at all seasons. These gravelly bottoms are not tillable except in a few spots.

The undulating country north and east of Puget Sound is in many places deeply covered with drift material which shows the effect of both ice and water. Blocks of partially rounded granite several feet in diameter are found on the hills around Seattle. This gravel deposit is not often found on high points, but there is a

ridge in the Cascade Mountains, near Salal Prairie, which is thickly bestrewed at an elevation of 1,000 feet. This, however, was quite exceptional, and may be the lateral moraine of a local glacier. The deposit around Seattle is not only easy to cultivate (its soil being a light blue loam), but seems fertile. The bottom lands are free from gravel.

So much for the general geology.

ECONOMIC GEOLOGY.

NOTE.—The location of the coal-fields and collieries mentioned in the following pages may be seen on an accompanying map.

Under the head of Economic Geology, I shall describe with more detail the mineral beds which have a commercial value, and in the following order:—I. Coal; II. Iron Ore; III. Granite, Limestone, and Marble; IV. Precious and Base Metals.

Thickness of the
Coal Measures.

I. COAL.—The thickness of the Coal Measures of the Puget Sound basin is estimated by Bailey Willis at something like 14,000 feet, though he admits the obvious possibility of error in the calculation by reason of undiscovered faults. We may fairly expect them, however, to be thicker than the same group in the Rocky Mountains, which measure about 9,000 feet. As heretofore remarked, the sediments become

thinner from west to east. Of course, the maximum thickness is not to be expected in every locality. Mr. Willis's estimate was made in the Wilkeson and Green River fields, and really did not reach the limit of the coal-bearing rocks. The coal rocks of the Cedar River and Snoqualmie basin have never, so far as I know, been estimated, but probably this group is equal in thickness to that of any other part of the field. The difficulty of measurement arises from the numerous fractures and changes of strike which exist.

Fifteen workable
seams.

The number of distinct workable seams of coal of three feet and upwards, belonging to the measures, may safely be put down at not less than fifteen.

Different kinds
of coal described.

Before considering the quality of these coals, I will, for better understanding, make some prefatory statements in regard to the character of coals generally. Charcoal has greater purity than mineral coals usually have, because there is nothing in the charcoal except what naturally belongs to the woody matter. Mineral coal, however, having been buried in water, mud, and sand, must, almost of necessity, have some mixture of foreign matter, either slate, which is simply hardened mud; silica, which may have been derived from sand; iron and sulphur, some

of which may have been in the wood, but most of it, probably, introduced in solutions; to which should be added, unexpelled oxygen, which is not only useless as fuel, but which combines with a portion of the contained hydrogen, and forms water in the substance of the coal.

The proportion of ash in coals of the same class is usually determined by the amount of slate in the coal, in addition to the mineral matter which belonged originally to the vegetable material from which the coal was formed. In the pure state, the proportion of ash increases as the transformation of woody fibre goes on from peat to anthracite.

It is worth while to note what are the changes which take place in the vegetable matter during the process. It may be described in a word as a progressive loss of oxygen, and by this loss the coal becomes richer, for the reason just given. The deoxidizing process is carried on by means of chemical changes in the substance of the coaly matter. The oxygen combining with a certain proportion of the carbon, forms carbon di-oxide, or carbonic acid gas; and a certain other portion, combining with hydrogen, forms water. Both of these are volatile in their character, and gradually escape. An-

The chemical
changes in coal
beds.

other loss is effected by the combination of hydrogen and carbon, forming marsh gas. We have deadly proof that these combinations are in progress in all coal mines by the occurrence of "choke-damp" and "fire-damp," which are the miners' names for these gases.

Deficient nomenclature.

Unfortunately, we have no settled nomenclature for the varieties of coal, excepting the broad names lignite or brown coal, bituminous coal, and anthracite. Even the term "bituminous" is scientifically inaccurate, there being, in fact, no bitumen in any coal. But it is applied to such coals as contain more oxygen and volatile combustible matter and water than anthracite, and less of these elements than lignite. The term lignite is made to include a great variety of substances, covering the lignites of the Juro-Trias of James River (Dutch Gap), which retain not only the structure, but the appearance of decaying wood; the lignites of the State of Mississippi, which are of the same geologic age as those of the Rocky Mountains, but which, owing to their watery and crumbly character, are unfit for market; the lignites of the Grand and Moreau rivers of Dakota, which are reported to have no commercial value; the lignites of Bozeman, Montana, which are really valuable, but soon break down

into chips and grits; the lignites of Green River, Wyoming, which are firm, bright, lump coals; and the lignites of King County, Washington Territory, many of which are hard, bright, steam and shipping coals. And when brought to the laboratory, it is found that chemically these lignites vary even more than they do optically.

This want of a varied nomenclature is to be regretted, because it sometimes handicaps a good coal with an inferior name. It is only of late that the Laramie or Cretaceous coals of Washington Territory have been divided into lignites, bituminous coals, and anthracites. These grade into each other so insensibly that it would be impossible to classify them sharply. None of the lignites which I saw were as low in grade as the typical lignite. The woody structure was quite discernible in some samples of the Franklin coal, and less in the Newcastle and Green River; but in respect to the two latter, I could not with the naked eye discern more of the woody structure than I have seen in some of the West Virginia coals, which belong to the Carboniferous period. I sat by fires of Newcastle and neighboring coals for a month, and observed no unusual amount of smoke, and no peculiar odor. By analysis,

Lignite an
unsuitable name
for the coals
of Washington
Territory.

these coals show a larger percentage of oxygen than the typical bituminous coal, but decidedly less than is found in the brown coal of Germany, or in some of the lignites of Montana. They need a new name. Their heating power is not so great as that of the bituminous coals of the same region. Their streak and powder are less black, and their fracture more conchoidal, but not decidedly so.

The bituminous coals have the usual cubical fracture. The Wilkeson readily breaks down into small cubes. The lignites are black and lustrous. They come out as lumpy as ordinary coal, and, when exposed to weather, do not break up into powder and grits like ordinary lignite. This is true, at least, of the Newcastle coal.

The coking quality not general in these coals, but found in some.

The coking quality of these coals cannot be determined by calculating the proportion between the fixed carbon and the volatile, combustible matter. I am not sure that Professor Fraser's fuel ratio tables are a safe guide in any case. So far as now known, only a few of the Washington Territory coals can be made into good coke. On this point, however, we have only laboratory and rough field tests, excepting at the Wilkeson mines, where twenty-five ovens were turning out a superior quality of coke, as

proved by every test save the use of it in high furnace stacks, in which there had been no opportunity for trial. It is claimed by many persons that seams on Green River, Skagit, Yakima, and Snoqualmie will furnish good coking coal. The coal on Snoqualmie Mountain, near Hop Ranch, has not been studied, but it certainly has the external characteristics of good coking coal, and Mr. Peter Kirke made a rough trial of it in an earth-pit with decidedly encouraging results.

Somewhat similar coal is found on Raging River, but where opened, so much slate was interleaved with the coal that washing would be necessary before use. More will be said hereafter with regard to these coals; but the remark may be repeated here in respect to the entire Puget Sound basin, that much additional examination is necessary before its coals will be fully understood. The variations in character of these are not owing entirely, or even chiefly, to their relative ages, but also to the conditions to which they have been subjected, especially in respect to heat. This metamorphic agency has acted not only in the body of the Cascade Mountains, but all through the coal-fields, where faults, flexures, and intrusive rocks have occasioned changes in the original condition of

the coal-beds, giving results along the whole scale of metamorphism from lignite to anthracite.

Analyses of
Washington
Territory coals.

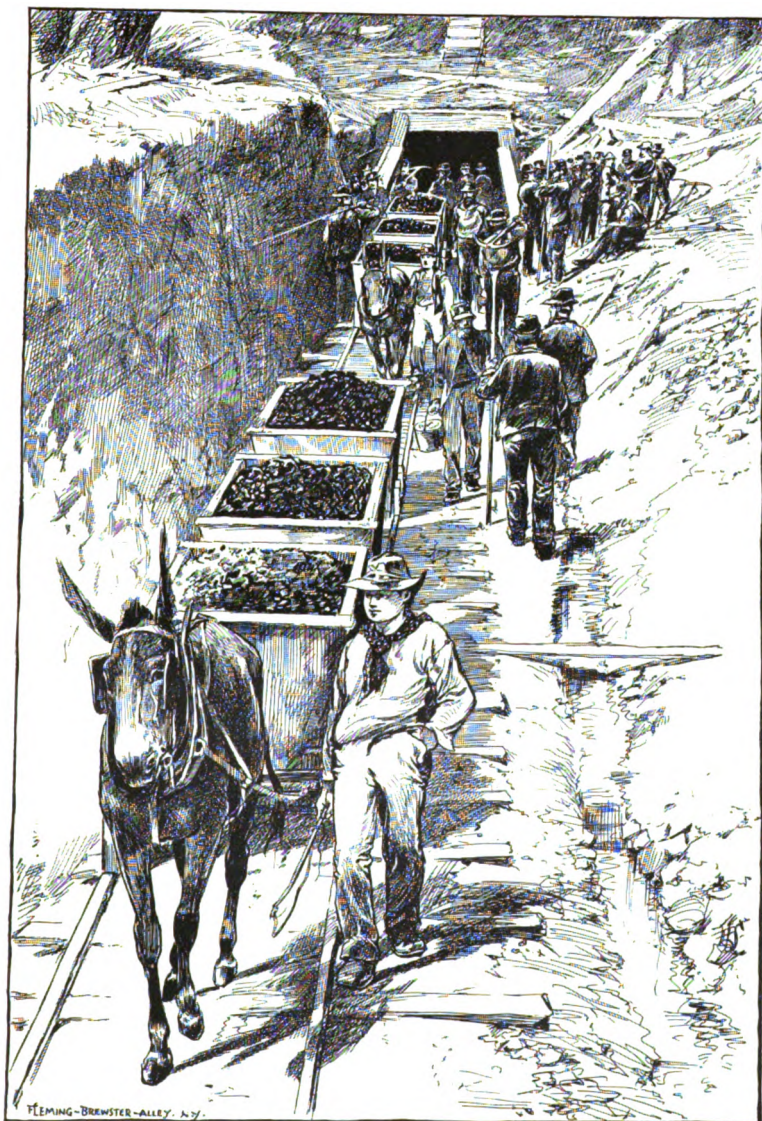
I here introduce (on the opposite page) a table of analyses made in Washington City from representative samples of Washington Territory coals and lignites selected by Mr. Bailey Willis during the examination which he made of this field for the Census Bureau, and found in Vol. XV. of the Census Reports.

THE COLLIERIES.

I will now give some account of the principal coal seams which have been worked in Washington Territory, namely, those in the field lying east and southeast of Puget Sound ; and in so doing I shall add to my own knowledge all information from any reliable sources. Unfortunately, the sources of information are few.

Authorities.

In the Report of Bailey Willis to Professor Pumpelly for the Census Bureau, we have the best account extant of the Carbon River and Green River basins. Mr. Willis spent three years in his examination, assisted by topographical engineers. He made numerous trial-pits and borings with diamond drill, and forwarded samples to Washington City for analysis. Mr. F. H. Whitworth, of Seattle, accompanied me



ENTRANCE TO GILMAN COAL MINE ON THE LINE OF THE
SEATTLE, LAKE SHORE AND EASTERN RAILWAY.

ANALYSES OF REPRESENTATIVE SAMPLES OF WASHINGTON TERRITORY COALS AND LIGNITES.

	LIGNITES.		BITUMINOUS LIGNITES.								BITUMINOUS COALS.												
	Miles City, Dakota.	Newcastle, Washington Territory.	Green River Field, Washington Ter.							Wilkeson Field, Washington Territory.													
			Vein (?) G. R. C.	Vein 33, G. R. C.	Vein (?), G. R. C.	Vein xviii. G. R. C.	Vein ix. G. R. C.	Vein vi. G. R. C.	Vein iii. G. R. C.	Upper Yakima River, Wash'n Ter.	Carbon Station, Wyoming Territory.	Rock Springs, Wyoming Territory.	Wingate Vein, Carbonado.	Vein cxviii. W. C.	Vein xviii. W. C.	Vein v. W. C.	Vein i. W. C.	Vein lviii. B. B. C.	Altered by Intrusive Rocks.				
																			Vein xiv. B. B. C.	Vein 4, Carbon River, W. C.			
Original Sample No. . .	79	84	59	56	50	27	42	43	45	—	—	—	12	125	17	64	37	136	135	68	76	—	—
Moisture	14.10	4.16	7.27	9.98	8.68	2.50	4.82	3.34	3.24	0.80	8.10	7.00	1.80	3.08	1.33	1.16	1.54	0.61	0.44	2.56	1.17	2.0	1.66
Volatile Hydro-Carbons.	36.95	44.84	36.02	40.63	35.90	45.71	42.02	39.39	30.52	40.87	34.70	36.81	42.27	28.64	25.88	28.17	29.58	5.84	8.43	14.46	37.1	34.48	34.48
Fixed Carbon	35.76	43.86	28.48	41.07	47.07	48.37	37.12	41.40	48.39	46.30	51.65	54.46	52.11	54.10	60.67	60.38	59.70	56.18	73.08	83.27	64.56	51.6	60.08
Ash	13.19	7.14	28.23	8.32	8.35	3.42	16.04	15.78	9.85	11.94	1.55	1.73	3.82	13.28	12.12	9.37	10.59	13.63	19.74	5.74	19.87	9.3	3.78
F. C.—V. H. C.	0.97	0.98	0.79	1.01	1.31	1.06	0.88	1.05	1.22	1.13	1.46	1.40	1.23	1.88	2.34	2.07	2.12	1.89	12.67	9.87	4.48	1.39	1.74
Coke	None	None	None	None	None	Poor	None (a)	None (a)	Worthless	Fair	—	—	Very good	None (b)	Excellent	Excellent	Poor (b)	Black and Friable.	None	None	Rather Poor	Good	Good

NOTE.—G. R. C.—Green River column. W. C.—Wilkeson column.

(a) Produced fragile coke in field test. (b) Produced first-class coke in field test.

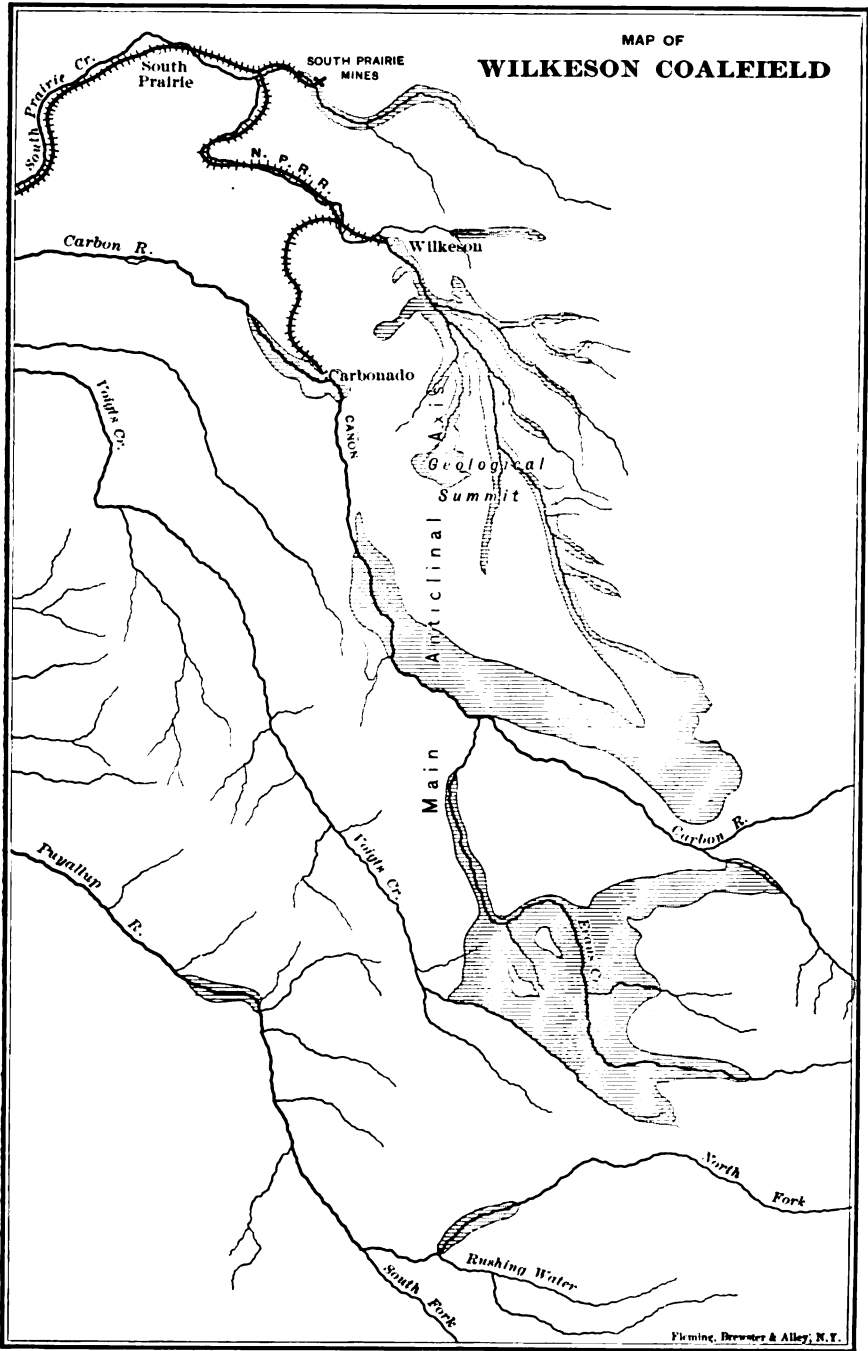
in my excursions, and prepared maps which are filed herewith. Mr. Whitworth has probably more practical knowledge of the Puget Sound coal basin than any one else. A small volume on the Pacific coal field was prepared some years ago by Mr. W. A. Goodyear. And Governor Squire's lucid and intelligent reports contain valuable information upon the coal, and all the other interests of Washington Territory. Governor Semple has also, in his Report for 1887, given us the latest official information.

The different
mines.

In my brief sketches, I shall group the coal-beds as follows: *a*, Carbon River Group; *b*, the Green River Group; *c*, Cedar River Group; *d*, the Squak, Raging River, and Snoqualmie Groups; *e*, the Yakima and Wenatchie Group; *f*, Bellingham Bay, Skagit River, etc.; *g*, British Columbia Group.

Anthracite,
coking and gas
coals.

a. Carbon River Group.—These beds lie on South Prairie Creek and Carbon River, tributaries of the Puyallup River. Anthracite coal in thin beds is reported high up on Carbon River, near the base of Mount Ranier; the result of metamorphism. Also undeveloped outcrops of soft coal at numerous points on the same river. There are, however, only three collieries at work in this group. One is called the Carbonado mines, which are on the Carbon



River. Three miles north, a little east, are the famous Wilkeson mines; and two miles north-west of Wilkeson, are the South Prairie mines, on South Prairie Creek. (See Map.)

These coal-beds stand at high angles (fifty degrees and upwards), and dip in different directions. At Carbonado, there are four seams in pairs, separated by Carbon River, two of which dip to the south, and two to the north. At the South Prairie mines there are two seams, one of which dips to the east, and the other to the west. At Wilkeson there are three seams, all of which dip to the west. Mr. Willis interprets this coal-field as being a dome-like anticlinal, with compressed and crumpled sides, whose major axis runs nearly north and south. The Wilkeson and South Prairie mines are on the line of the major axis, whilst the Carbonado mines are in a group of subordinate short folds lying south of the main line. The anticline extends to Nisqually River, and shows two other coal areas south of Carbon River, the coal of which is said to resemble the Wilkeson coal.

The Carbon River coal-field first having been almost engulfed by volcanic uplifts and overflows, and almost buried by glacial drift, is now visible only in narrow strips along creeks, and at intervals along the Carbon River.

Owing probably to the heating of its beds, we find in this little field the coal which stands highest in reputation for coking and heating qualities. There are some differences in the coal at the three mines. That at South Prairie was sold chiefly for making gas. The best of the Wilkeson coal is made into coke, and is in demand beyond the supply. The price is \$7.00 a ton at the ovens. The entire product of the Carbonado mines is said to go to the Central Pacific Railway. It is impossible to say what may be under the Drift; but, to all appearance, the amount of coal here is not large, and the beds are sadly faulted, and pitch deep into the ground.

b. The Green River Group.—I include in this group the Black Diamond and Franklin collieries, the Kirke or Moss Bay Company mines, and the Sugar Loaf Mountain beds. This, as well as the Carbon River field, is nearly equidistant from Tacoma and Seattle, being about thirty miles in a right line from each place. The Carbon River basin is geologically associated with Mount Ranier; the Green River basin with the outliers or foot ridges of the Cascade Mountains. The latter are much more approachable than the former. At the east edge of this field, the Northern

Pacific Railroad emerges from the Cascade Mountains, having come down the cañon of Green River. This point is known as "The Common Point," because the cities of Tacoma and Seattle are about equally distant, and the routes afford equally good grades from this point.

The Common Point, equidistant between Tacoma and Seattle.

The narrow gauge road from Seattle now comes to the Franklin mines, and by continuing it a few miles to connect with the Northern Pacific there would be railroad connection to Seattle as well as to Tacoma. The river here cuts through the Coal Measures, leaving the less valuable part of the field on the south side. The area of this field is roughly estimated at fifty square miles. It contains all, or nearly all, the grades of coal from lignite to bituminous; the variety of coal depending upon the degree of local disturbance. As a rule, so long as the coal is not crushed, the more pitched and flexed the rocks, the better the coal; which fact indemnifies the miner for extra expense in mining. Here, the tendency is for the seams to become steeper and more broken from west to east; *i. e.*, as they approach the foot-hills of the Cascade Mountains. The strata in Lizard Mountain on the south side, however, form an exception. Here the strata are nearly horizontal.

Franklin and
Black Diamond
mines.

The Franklin mines are on the north bank of Green River and at the south edge of what has been known as the McKay basin, and the Black Diamond mines are on, or near, the north edge of the same small, oval synclinal basin. From this basin the dips become steeper toward the mountain, where Kirke's beds stand at a high angle. On the west edge of the Green River basin, say a mile west of Franklin, there is an outcrop of lignite. The coal of the Franklin and Black Diamond mines is bituminous lignite. The Kirke coal, or at least part of it, as judged by the eye, may be called bituminous coal, though not so much deoxidized as the Wilkeson. The coals mined in this basin are firm, black and shiny; they burn freely, and make but little dust. They have not, however, so far as tested, the heating power or coking qualities of the Wilkeson coal. Two seams are worked at Franklin, and three at Black Diamond. All of the seams worked are above four feet. A number of volcanic dikes and flows are found in and around this basin.

The Kirke or
Moss Bay Com-
pany (Eng-
lish) mines.

The Kirke or Moss Bay Company mines are six miles east of Franklin, and within a mile of Green River. They lie against the mountain. The strike of the mountain is north-west. The coal beds dip toward the mountain

at a high angle. There are five seams of from five to fifteen feet in thickness; one of them (No. 2) may be said to be over forty-seven feet in thickness, though not all good coal, as the details given below will show. The top of the outcrops above sea-level are as follows:

	FEET.
No. 1	970
No. 2	1,160
No. 3	1,350
No. 4	1,461
No. 5	1,513

Some places on the outcrop rise much higher. The base of the mountain is about five hundred feet above sea-level. No shipping has been done from here. A gang of miners was at work opening the beds, with the special view of testing their coking qualities in order to be used, if practicable, by the Moss Bay Company for smelting the steel ores of the Cascade Mountains.

The only seam well opened when I was there (Nov. 17th and 18th) was No. 3, which is a large bed and shows an excellent quality of bituminous coal. The bed shows the side and end (or "tooth") structure. The coal is very black and moderately lustrous, and breaks readily into small rectangles of less than an inch. Its coking qualities have not been tested.

Nos. 4 and 5 are said to be softer and more powdery, and may possibly be better for coke than No. 3. They have an available thickness of about ten feet each. The details of No. 3 are as follows :

	FT.	INS.
Roof, Black Shale.		
Coal	0	9
Bone	1	6
Coal	0	7
Hard Slate	2	0
Coal	0	8
Bone	0	2
Coal	0	5
Bone	0	1
Coal	1	2
Soft Parting	0	$\frac{1}{2}$
Coal	1	0
Bone and Coal	0	7
Coal	1	0
Bone	0	1
Coal	1	3
Bone	0	$\frac{1}{4}$
Coal	0	5
Bone	0	$\frac{1}{2}$
Coal	0	7
Bone and Coal	1	8
Coal	0	$4\frac{1}{2}$
Bone	0	1
Coal	0	7
Sandstone bottom.		
Total	15 ft.	$\frac{3}{4}$ ins.

There is a natural exposure of No. 2, the "Big Seam," which I saw on the mountain-side above the miners' camp, and took the following details :

No. 2, Big Seam, descending.								FT.	INS.
Coal	.	.	.	.	.	.	.	1	2
Bone	.	.	.	.	.	.	.	0	2½
Coal	.	.	.	.	.	.	.	0	5
Bone	.	.	.	.	.	.	.	0	4
Coal	.	.	.	.	.	.	.	1	4
Bone	.	.	.	.	.	.	.	0	1½
Coal	.	.	.	.	.	.	.	1	0
Bone	.	.	.	.	.	.	.	0	¼
Coal	.	.	.	.	.	.	.	0	8
Bone	.	.	.	.	.	.	.	0	1½
Coal	.	.	.	.	.	.	.	0	7
Bone	.	.	.	.	.	.	.	0	1
Nigger-head and Coal								0	6
Bone	.	.	.	.	.	.	.	0	1½
Coal	.	.	.	.	.	.	.	1	8
Bone	.	.	.	.	.	.	.	0	¼
Coal	.	.	.	.	.	.	.	2	0
Bone	.	.	.	.	.	.	.	0	4
Coal	.	.	.	.	.	.	.	1	10
Bone	.	.	.	.	.	.	.	0	1
Coal	.	.	.	.	.	.	.	0	7
Bone	.	.	.	.	.	.	.	0	1½
Coal	.	.	.	.	.	.	.	1	0
Bone	.	.	.	.	.	.	.	0	¼
Coal	.	.	.	.	.	.	.	1	2
Bone	.	.	.	.	.	.	.	0	2½
Coal	.	.	.	.	.	.	.	0	6

	FT.	INS.
Bone	0	1 ½
Coal	0	3
Bone	0	¼
Coal	1	3
Bone	0	¼
Coal	1	8
Shale	0	1 ½
Coal	0	6
Bone	0	4
Impure Bituminous Matter	21	5 ¾
Coal, clean and good	5	6
Total	47 ft.	6 ins.

The Kirke mines are sixteen miles from Salal Prairie, and two miles from the Northern Pacific Railroad at the Common Point. The route has been surveyed by the Northern Pacific Railroad.

Adjoining the Kirke, or Moss Bay Company property, is a section of coal land (No. 34) on Sugar Loaf Mountain, owned by parties in Seattle, who offer it at \$50,000. There are a number of seams on the property, but I could examine only one which had been opened near the foot of the mountain. It is a good seam of bituminous coal, of the same character with the Kirke coal. I took the following details:

	FT.	INS.
Sandstone Roof.		
Coal	1	6
Soft Shale	0	¼

	FT.	INS.
Coal	0	2
Soft Clay	0	$\frac{1}{4}$
Coal	0	1
Soft Material, mining	1	2
Coal	0	$6\frac{1}{2}$
Slate	0	$\frac{1}{4}$
Coal	1	0
Bone	0	$\frac{1}{2}$
Coal	0	10
Bone	0	$\frac{1}{2}$
Coal	0	5
Bone	0	$\frac{1}{2}$
Coal	0	7
Bone	0	1
Coal	0	$4\frac{1}{2}$
Bone	0	$2\frac{1}{2}$
Coal	1	4
Hard Slate Floor.		
Total	8 ft. $5\frac{3}{4}$ ins.	

c. The Cedar River Group.—This group consists of the Cedar River mines, nineteen miles from Seattle by rail, the Renton and Talbot mines, ten miles, and the Newcastle, eighteen miles. These coals are in the same river basin, and are all high grade lignites.

The first shipment made from the Cedar River mines was in July, 1884. There are two good seams here, one of which measures eleven feet. The outcrop curves from a south to a southwest strike. The dip is 20° toward the east.

Cedar River
mines.

Talbot and Renton mines.

The Talbot and Renton mines, ten miles from Seattle, are on the same seam, but, owing to faults and other causes, they have not been worked of late. The seam is seven to nine feet of good coal, resembling the Newcastle, but has a bad roof, and soon reaches water. The dip is to the southeast at the grade of 10° to 25°. The outcrop curves as at Cedar Mountain. This always bodes trouble.

Newcastle Mine.

The principal mine in this basin is the Newcastle, from which more coal by far has been mined than from any other. Its present annual output is equaled only by the Carbonado mines, which are pressed to their full capacity by the Central Pacific Railroad. The Newcastle coal is a high grade lignite, of firm texture, shining black color, and angular fracture. It is not a coking coal, but has a wide and established reputation for grate, stove, and boiler uses. It is the typical "Seattle" coal, and is sold chiefly in Oregon and California. (To-day, owing to scarcity, it would bring \$25 per ton in Los Angeles). It has not the heating power of bituminous coal, but it is greatly superior to many of the lignitic coals. Many difficulties have been met with in the mining at Newcastle, the most of which seem to have been owing to the necessity for mining on the down grade, or

fall of the coal ; and the mines being now 1,000 feet deep.

I was twice at these mines, but, owing to the just previous destruction of the hoisting machinery, I could not make an examination.

An additional difficulty was that the mine had taken fire.

The cost of mining at Newcastle has ranged from 85 cents to \$1.50 per ton, averaging about \$1.10. Cost of mining.

According to Governor Squire, in 1884, the beds mined at Newcastle were, beginning at the lowest, 14 feet, 10 feet, and 5 feet in thickness. The dip is 30° to 40° northward, and the trend north 80° west. Governor Semple gives the following as the output of the Newcastle mines from June 30, 1878, to June 30, 1887: Large production.

1879	.	.	.	.	.	.	127,381
1880	.	.	.	.	.	.	128,853
1881	.	.	.	.	.	.	149,602
1882	.	.	.	.	.	.	158,340
1883	.	.	.	.	.	.	218,742
1884	.	.	.	.	.	.	149,948
1885	.	.	.	.	.	.	149,050
1886	.	.	.	.	.	.	85,561
1887	.	.	.	.	.	.	140,701
Total							1,308,178
Average per year							145,353

“The great falling off in the output for 1886 is attributable mainly to the labor troubles of that year, the mine being closed for several months; also the abandonment of the workings from the No. 4 vein.”

The slope has now been sunk to a depth of 950 feet, and the mine is being operated entirely from this level. When this lift is finished, it is thought that several others of equal depth can be sunk as the basin is likely to be very deep.

Misrepresentation.

After writing the foregoing, I received a volume issued annually by the United States Geological Survey on the Mineral Resources of the United States for 1886; and on page 364 I read with surprise the following statements in regard to the Newcastle mines of Washington Territory: “Considerable iron pyrites is present in this coal, which fact, added to the chaff-like character of the coal for igniting, causes much annoyance and cost to the mine from fires. Coal, or the mine refuse, piled in large quantities quickly ignites.”

I knew when I was in the Territory that the mine was on fire, as I have heretofore stated; but I heard no intimation of spontaneous combustion. In fact, I was told that it was accidental.

I wrote at once to Mr. David T. Day, of the Government Survey, who is the present editor of this valuable work, asking his authority for such statements concerning this mine as had never, so far as I knew, been made before; though the mines have been described, or mentioned, in all the preceding volumes of the same work, and were mentioned with approval by Bailey Willis, Goodyear, and all other writers on the resources of Washington Territory. Moreover, that I had spent weeks in the neighborhood of the mines, and never heard anything of iron pyrites or spontaneous combustion.

Mr. Day replied that he had no personal knowledge on the subject; but that those statements had been furnished him by Mr. James F. Jones, who is connected with some mining operations along the Northern Pacific Railway.

I wrote also to Mr. F. H. Whitworth, of Seattle, calling his attention to the above statements, and asking what was the truth of the matter. I received his reply just in time to insert in this Report. I copy below all that he says on the subject, which puts a different face on the matter.

“No, I do not think there is any of any consequence of iron pyrite in the Newcastle mines. Nor do I consider that the fires in the mine

Correction by
Mr. Whitworth.

originated in the decomposition of the pyrites. The fire in the mine originally started in the 'gob,' close to the furnace used for ventilation, and where the ashes of the furnace were thrown. Therefore, I have always believed that the fire was not spontaneous in its origin. The fire originated in the upper water level 'lift.' But it was led down into the second and third 'lifts' by carelessly breaking through the chain pillar, and thus letting the fire down. Several years before the fire started in the mine, and about three-quarters of a mile, or a mile, west of the point where it started, by careless mining and drawing of pillars, there was a 'squeeze,' and the mine heated; the result, I think, of the crush; but the mine did not fire. While you were out here the mines were in danger of firing, and when the cause was not the proximity of the present fire—but that, too, I think, was brought on by reckless mining. Running their 'breasts' 75 feet wide and more, and leaving only skeleton pillars, a 'squeeze,' of course, resulted, and the crushing produced the heat, and it did finally fire. The crushing being so great that the top work came down to within five or six inches of the bottom, you see easily producing crushing sufficient to cause fire.

"But the coal does fire outside spontaneously,

or rather the slack does, when it is piled in considerable quantities, and after a year or more of exposure. The combustion in the slack piles usually commences in the firing of the shaley cap rock, which is thrown in with the slack as the rock disintegrates, or as that process goes on with the 'nigger-heads' thrown into the slack pile. And yet I feel satisfied that the slack piles fire when there appears to be almost none of the rock or 'nigger-head' in it. Two conditions, I think, are required: first, that the slack particles be small, and second, that large quantities of water be present. And I have supposed the heat and firing was caused by changing of the conditions; small particles of slack by disintegration to much smaller particles.

"And yet it may be possible that there may be sulphur in the form of pyrite present in sufficient quantity to do its work. Very semi-occasionally, very seldom, I have seen in the sulphur streaks some slight indications of pyrite; but generally the sulphur streaks, or balls, seem to be composed almost entirely of sand, with very little sulphur, and some coaly matter.

"The coal never has fired on shipboard.

"I remember that, several years, ago Mr. Howard, of the O. I. Co., had collected and stored in his yard in San Francisco, Cal., in one

pile, several thousand tons of Newcastle coal, and was carrying it for some time in stock, and that he complained that his coal was heating, and feared fire. Since then they [have not] stowed in such large piles, nor carried stock so long.

“No, sir; the sulphur that we rooted [out] at Gilman was not in form of pyrite, nor have I seen any so far. I do not fear spontaneous combustion, because in the Newcastle, when it has occurred, it has resulted from carelessness.”

This statement from Mr. Whitworth is certainly satisfactory on the main point, namely, that there is nothing in this suggestion which need diminish the reputation of the Newcastle coal as a stocking and shipping coal.

In 1884, Mr. Jones (the same man) made a special report to Governor Squire on the coals of Washington Territory, in which he describes the Newcastle coal, speaking of it most highly, and saying nothing of spontaneous combustion. He uses the following language concerning the Newcastle coal: “The coal is taken from three beds, and is commercially known as the ‘Seattle lignite,’ having a bright lustre and good fracture. It is a good and choice fuel for steam generating and for

domestic use. The condition of the coal adds much to its value."

d. The Squak Creek, Raging River, and Snoqualmie Group.—These are not all in the same hydrographic basin, but they are considered together because they are the coals which will be reached by the Seattle, Lake Shore and Eastern Railroad. A great outcrop of coal seams occurs in the valley of Squak Creek in the mountain spur which lies between Squak and the Newcastle mines. These seams are now being opened by the Seattle Coal and Iron Company, and are known as "The Gilman Mines."

Gilman Mines.

The geological structure of the Squak Mountain and its coal seams is peculiar. With all their local irregularities, the general trend of the coal-bearing rocks in Washington Territory is north and south ; so determined by the line of the Cascade Mountains, which is the main axis of elevation, with numerous subordinate and parallel axes. But on Squak Mountain we find the whole group of rocks and coal seams whirled at right angles to the general line. In other words, their general direction is east and west, instead of north and south, and the rocks lie in regular order against their central axis, dipping northward at a high angle, and showing no fault,

Structure of
Squak Mountain

so far as I know, except, possibly, a vertical fracture somewhere in the mountain, as suggested by a change of 38° in the strike at a point about one mile west of the outcrop on Squak. If the fracture exists, it does not follow that there is any serious dislocation. These coal seams are thus carried almost squarely across the spur from Squak Creek to Coal Creek, or from the Gilman Mines to the Newcastle Mines.

The simple explanation is, that, in the upheaval of the country, the Squak Mountain was made by a cross axis of elevation which runs east and west, or at right angles with the Cascade Mountains. Its metamorphic core shows itself along the crest of the mountain.

The part of the mountain which holds the coal seams is a high spur which puts off at right angles northward from the crest or backbone, and continues to Lake Washington, a distance of five miles. At the point where the spur leaves the backbone, it may be 1,000 or 1,200 feet high, and it declines gradually to the lake, and then makes a bluff shore-line. On the east side of the spur on Squak Creek it is steep, whilst on the west side, next Newcastle, it drops off more gradually. This difference of grade occasions a great difference in the economy of

mining on the two sides. On the east, or Squak Creek side, the ends of the seams are boldly presented, showing in diagonal parallel lines extending from the top of the spur to the creek level, an average exposure of, say, 900 feet in elevation. Here the entries are being driven in horizontally near the water level, and the future progress of the mining will be inward and upward instead of downward and sidewise, as at Newcastle. The entries will all be on the horizontal line crossing the seams. The extreme distance, 1,300 feet. The length of the seams on the company's land is about two miles. Depth below water level, indefinite.

Peculiar advantages for mining possessed by the Gilman Mines.

No shipments have yet been made from Squak Creek, Raging River, or Snoqualmie Mountain, but active developing work has been in progress since September last at the Gilman Mines (forty miles from Seattle), and shipping will begin shortly. A switch of only 600 yards in length is required from the main line of railway to reach the outcrop of the coal, and there is every natural advantage for mining.

The Seattle Coal and Iron Company own this property, which consists of 1,300 acres underlain by seven coal seams, five of which will be mined ultimately, three in the beginning. I

Seattle Coal and Iron Company.

Seven seams. was able to examine three seams which will be mined at first, and give the following details.

Details.

Top Seam, No. 4, descending :

Roof, rich Bituminous Black Slate,
containing streaks of—

	FT.	INS.
Coal	2	3
Bone	0	1½
Coal	0	7
Slate, variable	0	0½
Coal	0	11
Clay	0	0½
Coal	2	0
Clay, variable	0	1¾
Coal	1	1
Clay, mining	0	3
Coal	1	1

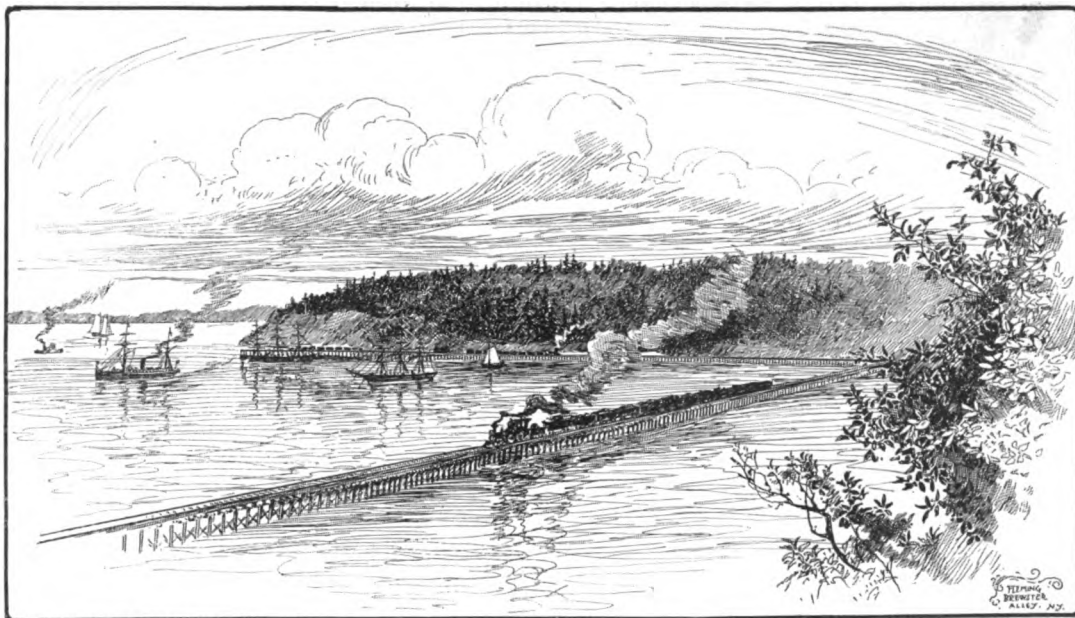
Total, good . . . 6 ft. ¾ ins.

Good coal.

This is a good seam of coal, five feet six inches of which can be depended on for shipping. The coal is dull-black in color, and easily mined. The bottom is soft sandstone. Overlying the roof-slate, is sandstone. The seam here is said to be one foot thicker than it is at Newcastle.

Another good coal seam.

Seam No. 2 has been uncovered by the diggings on the railroad, and happens to be at an



COAL-BUNKERS OF THE SEATTLE, LAKE SHORE AND EASTERN RAILWAY,
ON SEATTLE HARBOR.

unfortunate place for showing the coal. A stump, partly silicified, with part of its bark lignified, had been taken out of the coal bed, and on each side of it was a tapering band of "Nigger-head," tapering from eight inches at the stump to nothing at the distance of five feet six inches from the stump. Selecting an average place, I got the following section, descending:

Good roof of Argilaceous Sandstone.	FT.	INS.
Bone	0	1
Coal	0	6
Nigger-head, local	0	5
Coal	1	10
Coal, sulphurous	0	3
Coal	1	3
Bone	0	0½
Coal	2	0
Black slate floor.		
Total	6 ft.	4½ ins.

Judging from this outcrop, which I suspect does not do full justice to the bed, at least six feet of merchantable lignitic coal may be depended on from this seam.

Andrew's bed could only be seen at a point 200 feet above the railroad. It is nearest to the metamorphic axis of the mountain, and hence is the bottom seam in the group. It is

And another.

said to be wanting at Newcastle. The coal is in two benches, descending :

UPPER BENCH.

Slate roof :						FT.	INS.
Coal	.	.	.	.	.	0	5
Bone	.	.	.	.	.	0	0 $\frac{1}{8}$
Coal	.	.	.	.	.	0	4
Bone	.	.	.	.	.	0	3
Coal	.	.	.	.	.	1	8
Pyrite	.	.	.	.	.	0	1 $\frac{1}{2}$
Coal	.	.	.	.	.	1	2
Slate	.	.	.	.	.	0	5
Coal	.	.	.	.	.	4	4
Total						8 ft. 8 $\frac{1}{8}$ ins.	

LOWER BENCH.

						FT.	INS.
Fire-clay	.	.	.	.	.	0	6
Coal	.	.	.	.	.	1	4
Clay	.	.	.	.	.	0	1
Coal	.	.	.	.	.	0	4
Clay	.	.	.	.	.	0	0 $\frac{1}{2}$
Coal	.	.	.	.	.	1	1
Bone	.	.	.	.	.	0	1
Coal	.	.	.	.	.	1	9
Total						4 ft. 8 $\frac{1}{2}$ ins.	

The lower bench would probably be neglected for the present, but the upper bench is worthy of immediate development. The coal is of

good quality. Perhaps on analysis it would be classed with bituminous coals, although the woody structure is discernible in places. It burns freely. The outcrop of this bed is visible lower down the creek in a crushed condition.

My visit was rather premature for a proper study of the group; but there can be no doubt that there is here a large body of valuable coal. The quantity is estimated by the mining engineer, Mr. Whitworth, at 10,500,000 tons. I saw no other coal beds in the territory so favorably situated for mining and loading. Of course, coal standing at an angle of forty degrees cannot be mined so cheaply as if it were horizontal; but all the mines in Washington Territory must contend with this disadvantage, and in all cases coming under my observation, except this one, the mining had to be done on the down grade, which involved much hoisting, pumping, bad air, etc., which can be avoided at the Gilman Mines.

Large body of
valuable coal.

An incidental advantage, also, is that the Squak Valley furnishes any amount of timber for building, propping, railroad ties, etc., and when more generally cultivated, a superabundance of agricultural products. The experience of Newcastle, and the rapid growth of the

market, indicate that these mines may be enlarged in their operations, almost without limit.

Washington
Mines.

Washington Mines, on one of the upper branches of Squak Creek, show the outcroppings of three seams of lignite coal, dipping S. of W. I did not visit this place, but was informed that a company, known as the Washington Coal Company, was engaged in cutting these seams; but I am not informed as to what are their prospects.

Raging River
coals.

The Raging River coals. Six miles east of Gilman Mines, where the railroad enters the Raging River Valley, is found another group of coal seams, older than the Squak coals, and perhaps corresponding in age with the Franklin and Black Diamond coals, though apparently more bituminous than they. Raging River is about twelve miles long, and the railroad first approaches it about midway its length. There are indications of local metamorphism, if not intrusion, visible in the rocks between Squak Creek and Raging River, and this is further indicated by an outcrop of anthracite at the north end of the coal seams, within a mile of the road. Mr. Whitworth represents this anthracite seam as five feet thick, but crushed and fragile. Its structure is laminated, and it breaks into small cubes. He spoke, also, of

another seam of anthracite high up on Raging River, three feet thick, with three inches slate six inches from the top. He mined in on this for thirty feet without observing any change. The outcrop of this group of coal seams extends from near the line of the railroad, up the west side of the valley, parallel with the river, and about a mile from it, and lying in high hills. This coal property is also owned by the Seattle Coal and Iron Company. The principal mining camp is near the head of the valley, ten miles above Falls City, six miles above the line of railway. Here I saw the coal seams, which had been uncovered without having been cut into sufficiently to determine fully their character. One seam is open in a ravine, half way up the mountain, but most of them near the top, at an elevation of about 800 feet above the river. There are at least six seams, and if the one on the mountain side be a different seam, there are seven. The coal generally is of good quality: bituminous, with cubical fracture; but its value is greatly diminished by numerous slate partings, and some of the seams are too thin for profitable mining. The dip is to the southwest at high angles: about eighty degrees on the mountain side—less in the top seams.

Details.

The seam on the mountain side showed a total thickness of seven feet with sandstone over and under; but of this there was only about 2 feet 8 inches of good coal in a body, and the rest coal and slate interleaved. Near the top of the mountain there are six seams open near a rivulet, and quite near together. Reaching the top of the mountain, I found the upper opening (geologically the under opening), No. 1, to contain about two feet of good black coal, with one slate parting of an inch thick.

No. 2. This seam shows a total thickness of eight feet, but it contains so many slate partings that I could not estimate the bed highly.

No. 3. Here I saw fifteen inches of coal, with slate partings.

No. 4. An irregular bed, four to seven feet in thickness, crushed, and probably dislocated, and so slaty as to be of doubtful value.

No. 5. Another crushed and irregular exposure, four to six feet thick. The coal looks better, and promises to be a good seam when found in its natural state.

No. 6. A two-foot seam resembling No. 1.

Mr. Whitworth furnished me the following details of an opening near the camp on Raging River, which was not in a condition to be seen during my visit, but which has since been gone

in upon for about fifteen feet. From bed-rock, ascending :

	FT.	INS.
Clay	0	2
Coal, crushed	0	5
Black bone	0	1
Coal, crushed	0	11
Black bone	0	1
Coal, hard	0	6
Sand rock	0	3
Coal, good	0	10
Bone	0	2
Coal, good	0	6
Bone	0	1½
Coal, good	0	6
Bone	0	1
Coal, crushed	0	36
Clay and rock (diminishing)	4	6
Coal, crushed	3	0
Strike, north, 76½° east.		
Dip 22° to south.		

Mr. Whitworth says that the coal improved as he went in, and he is quite hopeful about this seam. But his record reads to me like the description of a slide ; still it may not be so.

The show upon the whole, as seen by me, was not satisfactory—and yet the beds might possibly improve inward ; and if the coal should coke well, it might pay to wash it ; as could easily be done at Raging River.

The Snoqualmie Coal Group outcrops some

Snoqualmie
Mountain Coal
Group.

hundreds of feet up the west side of Snoqualmie Mountain, and about three miles southwest of Hop Ranch. The outcrop has been traced perhaps one mile. There are five seams here running north and south with the strike of the mountain rocks. The seams dip west at an angle of 45° , *i. e.*, away from the axis of the mountain.

Details.

Seam No. 3 is the third seam from the bottom. A side entry had been driven in on the coal for 60 feet, but water now barred the entrance and prevented a thorough scrutiny of the seam. Its thickness was about 3 feet 6 inches, of which there was a band of lignitic coal of three-quarters of an inch near the top, and five inches of the same near the bottom. The weathered outcrop of this, as of the coal-beds of Washington Territory generally, had a brownish hue, but the fresh surfaces showed a good black bituminous coal. It lies firm and regular in its bed. When dug and handled, it goes to small pieces, and may generally be crushed to powder in the hand; which, of itself, is no bad sign of a good coking coal.

Good coking
coal.

Seam No. 4, the second seam from the bottom, descending:

						FT.	INS.
Roof, Slate	.	.	.	.	.	2	0
Bone	.	.	.	.	.	2	0

	FT.	INS.
Coal	0	6
Fine-grained Sandstone, average	2	2
Natural Coke	0	6
Bituminous Shale	0	6
Coal	4	2
Bottom, Sandstone.		

The coal of this seam is soft, black and lustrous. An entry was driven in 50 feet, which required much propping, the roof being bad. At the end of this distance we came squarely against a wall of sandstone, showing a fault. At this point six inches of the top coal is thrown up vertically, which showed that the seam thus far had dropped, and that the continuation was to be looked for at a higher level. Mining upward through the soft material, the coal had been again struck at an elevation of 16 feet, but not the full thickness of the seam, and not in its true position; but after following it upward 4 feet more the seam was found in its natural state.

There seems to be no slate in this seam, but occasionally there is found in it a ball of "nigger-head," or hard sulphurous matter, from the size of a man's head down.

An experiment of coking this coal in a small pit at the mouth of this bank was made by Mr. Kirke and his coal-bank manager, with as satis-

Also good coking coal.

factory results as could be expected from so imperfect a trial. I found pieces of the coke lying near, and saw better samples which have been brought from here. While, of course, the coke thus made is not the best quality, it certainly promises well.

Seam No. 2, descending :

Large and valuable bed.

Roof, fine-grained Sandstone, under which is seven inches Black Slate.		FT.	INS.
Coal		0	6
Slate		2	0
Coal		0	7
Slate		0	4
Coal		0	5
Slate		0	5
Argillaceous and Ferruginous Rock		1	7
Coal		0	1½
Bone		0	5
Coal (main bench) of good quality		7	0
Nigger-head		0	2
Coal		1	0
Slate		0	1½
Coal, good		0	6
Slate and Clay		0	7
Lignite (brown coal)		2	1
Bituminous Slate		1	8
Coal		0	½
Nigger-head		0	4½
Clay and Bony Slate		0	7
Coal		0	1
Nigger-head		0	1½
Coal		0	¼

	FT.	INS.
Bituminous Slate	1	2
Coal	0	1
Slate	0	7
Coal	0	7
Slate and Sandstone bottom.		
Total	23 ft.	1 $\frac{7}{8}$ in.

Seam No. 1 is only partially exposed, the workings having caved in; but enough of the seam was visible to show that it was a bright, soft, friable, bituminous coal, of good quality, containing some slate and nigger-head. Its fracture would be called *dicey* by some geologists, because it breaks readily into small cubes, even smaller than dice. The seam is probably about five feet in thickness.

Another good bed.

This group probably corresponds geologically with the Kirke Mines, on Green River; but, judging by the eye, it is a more bituminous coal and better suited to coking. The large bed here may correspond with one of the large beds at the Kirke Mines.

Geological relations.

I fear that faults are numerous in the coal rocks of this group, which, of course, would add to the expense of mining. But if, as expected, it furnishes a good smelting coke, the field will be extremely valuable from its contiguity to the magnetic ores of the Cascade Mountains and the scarcity of coking coals.

This property was for sale when I visited it, and would have been sold but for a claim of ownership set up by the Northern Pacific Railroad, which, however, in the opinion of good lawyers, had no foundation.

This the bottom group.

This is the bottom group of the Washington Territory coal field. It will be seen that, taking the Gilman group, the Raging River group, and the Snoqualmie group on one line, and the Cedar River, Carbon River, and Green River group on another line, it may be fairly claimed that there are at least fifteen working seams of three feet and upward in the Washington Territory coal field.

e. The Yakima and Wenatchie Group. This field lies on the east flank of the Cascade Mountains, on the waters of the Yakima and its tributaries, Cle-ellum and Teanaway. It is believed to extend also into the Wenatchie Valley, although the area here is probably disconnected from the Yakima area. I purposely refrained from visiting this region, and for my statements I am indebted chiefly to Bailey Willis, F. H. Whitworth, Charles Burch, and Mr. Jamieson of the Kirke Mines.

Yakima or Roslyn coal field.

The Yakima area lies north of the Yakima River, near to the Northern Pacific Railroad, and to the projected line of the Seattle, Lake

Shore and Eastern Railway, and extends about sixty miles east and west, and six miles north and south. Its dip is gentle, say twelve to twenty degrees. It holds three coal seams of 2 feet 6 inches, and 5 feet and 5 feet respectively. There is not much evidence of fracture in any part of the field. The total thickness of the coal-bearing rocks is estimated by Bailey Willis to be 1,000 feet. This is evidently the lower part of the coal series, the upper part having been carried away. The best seam is mined at Roslyn, four miles north of the Northern Pacific Railroad, in the interest of that railroad.

The seam here furnishes upward of four feet of good coal. The coal is bituminous, dull black, firm, and free burning. Mr. Jamieson thinks it will not make good coke. Others, however, think that it will, and these are supported partially by the laboratory test in Washington City, D. C. (See Table of Coal Analyses, page 107.) It is called in the table Roslyn coal.

This coal is used chiefly in the locomotives; but the popular demand for it is very great in the plateau country of East Washington.

I have no knowledge of the coal on Wenatchie River except what I obtained from Mr. Burch, who says that there are two seams of

Coal on the Wen-
atchie.

coal exposed in that valley, one of eight feet and one of three feet. The coal-bearing rocks extend for thirty-five miles up the river, and have a width of ten miles.

Coal under the
Great Bend
country.

The coal is reported by Mr. Burch to appear east of the Columbia River, opposite to the fields just described, and to disappear under the basalt. If so, here is a resource for the future. Concerning the importance of this coal field to the Seattle, Lake Shore and Eastern Railway, I will speak in another connection.

The first mining
on Bellingham
Bay.

f. Bellingham Bay, Skagit River, and other Coal Fields. The first shipping of coal from Washington Territory was done from the Seahome Mines, on Bellingham Bay, Puget Sound, about twenty-five miles south of the Canada line. The mines were very badly managed; they took fire on several occasions. The coal was of the lignitic grade, but not of the best quality, and when other mines of better coal were opened the Bellingham Bay mines were closed. It is reported that coking coal has been found some distance back from the bay.

Coal on Skagit
River.

Coal has also been found on Skagit River, which, I suspect, from a sample which I saw and from what I heard (some of it), is good, and possibly might coke well. One of the

coal properties is held by A. Ford and others. The following description is furnished by Mr. Norman B. Kelly.

It is found about three miles north of the Skagit River, and about five miles from Sedro. The country is hilly. There are at least six or eight coal seams, perhaps more. Those examined run from eighteen inches to thirty inches, and are thought to be clean coal. The seams lie between sandrocks. The outcrops begin near the level of the valley, and continue in a series to an altitude of 550 feet above the valley. The highest outcrops are those of the lowest seams geologically. The strike is north sixty degrees west. At the foot of the hill, the seams dip forty-five degrees to the southwest, but the angle becomes steeper on the mountain side, until finally they are vertical. All the outcrops are within 1,500 feet horizontal distance. Blacksmiths use the coal and pronounce it equal to Cumberland. It cokes readily in the open fire; burns with a bright, hot, but small flame, and seems to leave but little ash.

Of course, the thinness of these seams is an objection. There is coal, also, upon the south side of the river; but there has been but little development in this field. An analysis of this

coal is given in the table preceding, but I cannot say from what seam the sample was derived.

The following analysis of coal of the Crystal Mine, near Sterling, is said to have been made by Mr. Wm. G. Tenne, assayer, of Portland, Oregon :

Coke	71.31
Combustible gases	23.17
Ash	5.31
Moisture	.21

A very fine showing.

Coal south of
Puget Sound.

It has long been known that there are considerable areas of coal south and southwest of Puget Sound. But they have not been very highly esteemed, the coals being lignite of not the best quality. There are at least two seams of seven to twelve feet thickness, and they lie at an angle of five degrees, with good roof and floor. Some effort is now making on Skookumchuck and Chehalis rivers to develop these seams.

Governor Semple, in his report for 1887, gives as the total shipment for the year ending June 30, 1887, the amount 525,705 tons. And he gives as the total output of coal from all the Washington Territory mines from the beginning of shipments to June 30, 1887 :

Total shipments
of coal
from Washing-
ton Territory.

MINES.	TONS.
Newcastle	1,308,178
Franklin	46,272
Black Diamond	148,418
Renton	35,015
Talbot	10,000
Cedar River	64,816
Carbonado	402,207
South Prairie	139,792
Wilkeson	10,372
Bucoda	4,550
Roslyn	40,987
Bellingham Bay (estimated)	250,000
Clallam Bay	500
Total	2,461,108

I have now given a sketch of all the coal mines and coal areas of Washington Territory, and will conclude with a few words on the coal of Vancouver's Island.

g. Coal Seams in British Columbia. The productive coal field is on Vancouver's Island, on the east side of the Gulf of Georgia. There are three mines in operation as given below :

Coal on Vancouver's Island.

ANNUAL OUTPUT.	SHORT TONS.
Nanaimo Colliery	112,761
Wellington Colliery	185,846
East Wellington Colliery	28,029

This coal is marketed chiefly in California. The coal is lignitic; and yet it is said

to coke well. It is also good stocking coal. The beds dip from 5° to 30° southward. The cost of transportation to San Francisco is about the same as from Seattle, and the cost of delivering on board ship about the same as from the Newcastle mines. The tariff of 75 cents per ton on foreign coal is regarded with satisfaction by the coal men of Washington Territory. The repeal of this tariff would inflict a heavy blow upon the mining industry of the Territory.

The Iron Ores. II. IRON ORE.—The iron ores of Washington Territory consist of Bog ore, Brown ore (Limonite), some Red, or Specular ore (Hematite), and Magnetic ore (Magnetite). The bog ore has been found in considerable quantities underlying the flats bordering Puget Sound, and has been worked in a furnace on Bellingham Bay. These ores, no doubt, come from the decomposition of the limonites, the magnetites and the basaltic rocks of the high lands, especially on the Cascade Mountains. These Bellingham Bay ores generally have an excess of phosphorus, and yield about 42 per cent. of metallic iron. Brown ore is reported on the Skagit River, sufficiently abundant, perhaps, but not containing more than 40 per cent. metallic iron. I saw a remarkable deposit of brown ore on the Willamette, near Portland,

Oregon. It is a horizontal stratum varying from 4 to 20 feet in thickness, lying between masses of basalt. It has been worked in the Oswego furnace, but yielded only about 40 per cent. metallic iron. I did not see any specular ore in place in Washington Territory, but saw samples, said to have been brought from near the Middle Fork of Snoqualmie River.

But unquestionably the most important, as well as the largest, are the magnetic ore beds on the Cascade Mountains. These ores are found 1,000 to 1,500 feet above the chief water-courses on those high ridges and peaks which make up the Cascade Range along the headwaters of the Snoqualmie, on the west side of the mountain, and of the Yakima on the east flank of the mountain. These ores are underlaid by syenite and quartzite, and overlaid by limestone. The ore itself is found in conditions similar to that of the Cranberry ore in the Unaka Mountains of North Carolina; that is, it lies in pockets of various sizes in hornblende, porphyritic and epidotic rocks.

The great magnetic ore beds of Cascade Mountains.

Resembles the Cranberry ore deposits.

I visited two exposures of this ore, one on Mount Logan and the other on Mount Denny. These are only a mile or two from the line of the railroad. On Mount Logan there was only one large outcrop of iron-bearing rocks,

Guye Mine on
Mount Logan.

but float was seen at numerous points on the mountain. The main exposure showed an ore-bearing rock, presenting a horizontal front some sixty feet in length, and forty to fifty feet in height or thickness. At one place a considerable area in this space seemed to be pure ore. For the rest, the pockets were smaller, and, of course, the amount of rock proportionally larger. What is to be found on going in from the surface can never be told in advance in ore beds of this sort. In working the great mine of Cranberry, North Carolina, the largest body of ore was reached 100 to 200 feet from the surface.

This bed of ore is known as The Summit, or Guye Mine. Its elevation is 1,250 feet above the grade of the Lake Shore Railroad, and about 1,000 feet above the small stream at the foot of the mountain. There would be no difficulty in building an inclined plane from the ore bank to the small valley below. The snow in winter might interfere with mining.

Ascending the mountain above the main exposure, I found what seemed to be another level of iron ore 100 feet higher ; but possibly it may be the same bed displaced. Still higher appeared to be a third level of ore, and higher still, I observed a little float ore at a point nearly 2,000 feet above the grade of the railroad, on what

may be called the summit of Mount Logan, at a point which my barometer made 4,700 feet above Puget Sound.

The Denny Mine is on a different mountain, somewhat farther to the west, but about the same distance from the railroad. It is reached also by a narrow valley from which a steep ascent of nearly 1,100 feet is made to the main exposure, which shows an edge of pure fine-grained magnetite, about twenty feet thick, with limestone above, and also beneath, apparently. Fragments of epidote, porphyry and flinty quartzite lay around. The limestone did not show so large here as on Mount Logan. The ore dips steeply toward the south, and seemed to encrust the mountain for a distance of, perhaps, 225 feet, but with a somewhat broken surface. It then passed with its limestone under quartzite cliffs which crest the mountain. The bed might have been followed around the mountain, where it is said to show at a number of places. It seemed to pass into a matrix of chert.

Denny Mine.

I did not visit the Chair Peak, or Kelly Mine, which is some miles distant; but I conversed with probably every man who ever saw it, some half a dozen, including Mr. Whitworth, who made a survey of the property. It is

Chair Peak, or
Kelly Mine.

reported as probably the largest and purest of all the deposits of magnetic ore, and lies at about the same height on the mountains. This ore would come out by way of the Middle Fork of Snoqualmie.

Middle Fork
Mines.

I did not visit Guye's other mine, which lies high, perhaps 3,000 feet above Middle Fork. Mr. Guye represents it as similar in character to the bed elsewhere, with the addition of some brown and red ore. The other deposits mentioned I received no description of.

None of these mines have been developed beyond the uncovering of a face. As yet there is no furnace for smelting them, and no means provided for bringing them off the mountains. There is no difficulty about reaching them with spur railroads and inclined planes. It has occurred to me as possible that a narrow gauge railroad might reach all of these mines, without heavy grades, by starting at the highest point of the Lake Shore road and following the divides from mountain to mountain. This, however, can only be determined by a special reconnoissance.

All easily
reached from Se-
attle, Lake
Shore and East-
ern Railway.

There are large deposits of iron ore also on the east side of the Cascade Mountains, not far from the crest line, on the waters of the Cle-ellum River. Three distinct beds are reported. They are all in the valley of the Cle-

Cle-ellum ore
beds.

ellum River. The upper bed is situated about eight miles above Cle-ellum Lake, on the main and east fork of the Cle-ellum River. This bed has been described to me by Mr. Whitworth and Mr. Burch. The distance from the Northern Pacific Railroad is twenty-five miles, following the Cle-ellum valley. It is within sixteen miles of the most distant location made of the Seattle, Lake Shore and Eastern Railway; and by another route which has been spoken of, this railroad would pass close to the ore bed. Mr. Whitworth says concerning it: "The ledge is well defined, and is traced and located about two miles, its course being nearly north and south. It is apparently from forty to sixty feet in width, and pitches at about an angle of 20° to the west. The casing rock is porphyry. The deposit is evidently extensive. The ore appears rich, is magnetic, and is reported to assay from $56\frac{1}{2}$ to 66 per cent. I obtained samples of the rock, from which satisfactory tests can be, no doubt, obtained."

The elevation of the iron ore outcrop is estimated at 3,000 feet, which would place it nearly on a level with the summit of Snoqualmie Pass; but it is only about 200 feet above the local water-level.

Mr. Burch says concerning this ore bed, which

has now been bought by Mr. Kirke for the Moss Bay Company, that the strike of the bed is northeast, whilst the outcrop runs northwest. The ore is in five or more separate beds, each bed being on an average forty to fifty feet thick, and the beds separated by rock. The ore can be followed but a short distance along the strike.

Burch's ore bed.

Burch's iron ore bed approaches the Clellum River about four miles below the Kirke bed, and extends in a northeast direction to the headwaters of Boulder Creek, a distance of five miles. The outcrop crosses three high ridges. The dip is south, at an angle of 45° . The width is at least twenty feet. A ferruginous limestone lies against the ore on the south side. The limestone is 300 or 400 feet thick. It seems to overlie the iron bed. Its outside or top layers are pure blue limestone.

A gray sandstone, rather soft, overlies the limestone, and over this comes a coal-bearing rock in which are dykes of gray iron ore, some of them standing out of the ground 80 or 100 feet. The magnetic iron ore is associated with hornblende and quartzite. All rocks dip south. Mr. Burch says that this ore resembles the Kirke ore, but has some of the characteristics of hematite. Mr. Guye talks in the same way about his iron ore on Middle Fork.

At one point, not far from Cle-ellum River, a bed of gray iron ore crosses the magnetic ore at right angles. This gray ore is not well understood. It may be an altered copper lode. The main ore bed is more strongly magnetic near the intersection than it is elsewhere.

I may here remark that Mr. Burch reports considerable float of rich magnetite on the shores of Lake Chelan.

I have no description of the Dudley iron ore bed, but it is said to be large, and of the best quality. Its location is also in the Cle-ellum valley, between Burch's bed and the lake, and within four or five miles of the lake. This information I get through a letter written from Cle-ellum to Mr. Whitworth. I have no personal knowledge of these Cle-ellum beds.

Dudley ore bed.

There can be no doubt as to the existence in the Cascade Mountains along this line of superior iron ore in large quantities, the most of which is suited to the manufacture of steel.

Undoubtedly
large beds of
steel ores.

There can be no doubt as to the superior quality of the Snoqualmie iron ores. Analysis shows that they rank with the best steel ores in their large percentage of metallic iron and small admixture of deleterious impurities. Of the following tables, the first gives all the reliable analyses I could obtain of the ores of the Sno-

Of superior
quality.

ANALYSES OF SNOQUALMIE IRON ORES.

Kind.	Locality.	Silica.	Metallic Iron.	Sulphur.	Phosphorus.	Authority.
Magnetite.	Mt. Logan.	Summit.	71.17	.00½	.04	Dewey (chemist). Reported by Kirke.
		"	68.56	.02	.03½	
		"	69.40	.00¾	.03½	
		"	70.18	.01¼	.03	
Bog Ironstone. Micaceous. Hematite.	Average	1.67	67.00	0.05	0.02	Reported by Kirke.
		1.96	69.26½	.0116	.03½	
	Middle Fork (Guye).	9.37	45.50	Traces	0.08	
		6.03	64.50	0.05	Trace	
		22.32	59.50	0.05	Trace	
		3.33	67.80	0.03	Trace	
		11.77	60.90	0.02	Trace	
	Denny Mt.	No. 1	69.39	0.042	0.035	
		No. 2	71.17	0.005	0.039	
		No. 3	68.56	0.019	0.035	
		No. 4	67.17	0.041	0.031	
		No. 5	69.40	0.008	0.035	
Magnetite.	Average	No. 6	70.18	0.013	0.031	
		2.47¾	69.31½	0.021½	0.034½	

qualmie region of the Cascade Mountains. Those reported from Mr. Kirke and Mr. Dewey are of high authority. Those from Mr. Jenner are given in Governor Squire's report for 1885, and are probably equally reliable.

By way of comparison, I next introduce a table of analyses, which begins with what Mr. Phineas Barnes, in his report on the steel industry of the United States (1885), gives as a typical steel ore from the best American mines. The second analysis gives the average of fourteen analyses of the best Lake Superior steel ores. The third is a typical steel ore from the Iron Mountain of Missouri. The fourth is the average of all the analyses of the magnetic ores of the Snoqualmie Valley, which name I give to them to distinguish them from similar ores on the east side of the Cascade Mountains, of which I have no analyses :

Proved by analysis to be unsurpassed, if equalled.

COMPARATIVE ANALYSES OF STEEL ORES.

	Metallic Iron.	Sulphur.	Phosphorus.	Silica.
Typical Steel Ore	59.24 $\frac{2}{3}$	.20 $\frac{2}{3}$	.03 $\frac{2}{3}$	6.17 $\frac{2}{3}$
Lake Superior	68.48	—	.053	2.07
Iron Mountain	65.500	.016	.040	5.750
Snoqualmie	68.80 $\frac{8}{11}$	.023 $\frac{4}{11}$	.028 $\frac{2}{11}$	2.61 $\frac{1}{11}$

This showing places the Snoqualmie ores in the front rank of American steel ores; indeed, it shows a little higher in metallic iron, and a little lower in phosphorus, than any of the others. These analyses are, of course, made from the ore proper; *i. e.*, without any addition of the matrix, or gangue-rock, in which the ores are imbedded. With all magnetites of this type it is only in exceptional spots that much of the ore can be gotten, free from the enclosing rock. Under ordinary circumstances something like 20 per cent. of the ore sent to the furnace will be gangue-rock. There is reason to hope, however, that ere long there will be a practical method for separating the rock from the ore, and at the same time getting rid of most of the sulphur. At Cranberry, N. C., the ore is now roasted and stamped into small bits, and an experiment has been made of passing the ore through a jigger, whereby the hornblende and other enclosing rocks were separated by the pulsations of the water, as in coal washing.

Improved processes.

The Lackawanna Iron and Coal Company, Pennsylvania, has been separating the ore from the rock with good results. The same has been done at Crown Point, N. Y., Lion Mountain, near Plattsburg, N. Y., Negaunee, Mich., and Beach Glen, N. J.

The process is really one of concentration, in some respects similar to that pursued with the refractory ores of the precious and base metals. The ore is first calcined sufficiently to make it friable. It is then crushed, by a Blake or other rock-breaker, and is finally sluiced, or jigged, or both. The aim is to produce a Bessemer concentrate which would yield 60 per cent. or more metallic iron, and at the same time get rid of whatever phosphorus might be in the gangue-rock. In the best experiments the object was more than accomplished. The concentrate contained 63 per cent. of metallic iron, the middlings 55 per cent., and the tailings 16 per cent. This experiment was made with a refractory Adirondack magnetite, which was so intermixed with hornblende, quartz, mica, etc., that the ore might be described as a hornblendic gneiss, carrying a large proportion of magnetite. No doubt experience will teach some way of saving the ore that is now wasted in the tailings.

Thus we may hope to see removed in a short time the only practical difficulty in working the crystalline magnetites, such as those of Snoqualmie, and many others.

III. GRANITE, LIMESTONE AND MARBLE.—
What is here called granite is really syenite. It

Granite.

is found high on the mountains, associated, as already intimated, with the magnetic iron ore, and with hard quartzite, porphyry, epidote, hornblende, and limestone largely marbleized. This group of rocks forms the core of the Cascade Mountains, and hence underlies all the coal-bearing rocks to the westward. The group has been assigned by some geologists to the Archæan age; but it is possible that they are metamorphosed strata of the Silurian, or some subsequent period. Some of this syenite has a large proportion of quartz, which gives it a light appearance; but in other places the hornblende crystals are of good size and in full proportion, and the feldspar is of the orthoclase variety, which gives a mixture of three colors, and makes fully as handsome a stone as the Quincy granite.

Limestone is reported as existing in some of the islands in Puget Sound, where it is burnt into lime; but I have met with no particular account of it.

Marble and limestone.

The limestone and marble associated with the iron ore on the Cascade Mountains has already been alluded to. It is of fine quality, very abundant, and easily quarried. It will have great value for flux and commercial lime. It is also beautiful in color, varying from the

purest white to blue, and mixtures of the two colors. In texture it is sometimes exceedingly fine grained, and in others crystallized into a true and beautiful marble, which, so far as can be judged by eye, would be well adapted to both inside and outside finishing and statuary. On Mount Logan the limestone deposit almost covers the mountain above the lower line of the iron ore, and is so exposed as to be quarried with the greatest ease.

The same association of limestone in heavy beds with iron ore seems to exist also on the Cle-ellum, as mentioned by Mr. Burch. This gentleman spoke to me, also, of a very beautiful and easily burned limestone in the Wenatchie Valley. Large beds of limestone also exist in connection with the precious and base metals, which are next to be described. In the Colville country limestone seems to abound.

IV. THE PRECIOUS AND BASE METALS.—In the Cascade Mountains, and in the mountains north of the plateau country of East Washington, and in the Cœur d'Alene Mountains, within the border of Idaho, occur numerous veins bearing gold, silver, copper, lead, sulphur and iron. Discoveries on Cascade Mountain proper have been made on both sides, chiefly in the region of the iron ore. Those at the Denny and Chair

Precious metals
on Cascade
Mountains.

Peak mines have been most spoken of. Professor Mason, of the "Rensselaer Polytechnic Institute," Troy, New York, gives the following assay of two samples sent from the Chair Peak claim of Kelly, Wilson & Co.:

1st. Silver	.	.	13.9 oz. per ton.
2d. Silver	.	.	12.4
Both	.	.	14% copper.

Professor Price, of San Francisco, also assayed a sample from the same vein.

Silver	.	.	\$3.63 per ton.
			12% copper.

On Cle-ellum River. Metallic veins are found also in connection with iron ore on Cle-ellum River. Mr. Burch reports a copper and silver lode, and also two lodes of gold and silver, in this neighborhood. He reports the ores as high grade, of good, workable thickness, and outcropping for several thousand feet. There is a gray ore in the same region, the character of which has not yet been determined. This has already been mentioned as lying close to the iron ore, and may possibly be metamorphosed chalcopyrite. Mr. Burch thinks that the silver ores will run from forty to eighty ounces, while in some spots the richness is very extraordinary. The lead ore in association ranges from fifteen to forty per cent.

The same gentleman, who is a resident of the Okinagane region, reports a remarkable lode of copper ore running due south across Stevens County, from the Canada line to the Columbia River. It shows a plain outcrop for about forty miles. The vein carries both native and gray copper and a small percentage of silver.

Large copper
vein in Stevens
County.

Reports, apparently authentic, are made of numerous other veins of metal in the same region, particularly in the valley of the Methow River and the valley of the Okinagane River. The Colville region, beginning fifty miles north of Spokane Falls, is well known as a rich mining centre.

Precious metals
on Methow
River.

What I know of these regions I learned from the oral or written testimony of men who had seen what they described, and some of them residents of the localities.

The basin of the Methow River has been but little prospected, and although I gathered many favorable items concerning the mineral deposits there, I met but one man who had personally examined the country, and he confirmed the favorable reports. He said the ores were similar to those on the Okinagane, but were more abundant.

The Okinagane country is well known, hundreds of men having been at work there last

The rich mines
of Okinagane

summer, and some of its mines, particularly the Ruby and Arlington, having become notable for their richness. Among my informants are Mr. Burch and Mr. Thomas Lothian, who both reside on the Okinagane River; and also Mr. J. E. Clayton, mining engineer, who made a professional report on the country, which was printed in the Spokane Falls *Review*.

The mining district is on Conconnully Creek (misnamed Salmon River), which enters Okinagane River from the northwest, about twenty miles from its mouth. There are two wagon roads to the Conconnully, one from Spokane Falls, with a branch from Sprague, distance 150 miles, on which stages ran last summer. Another road starts from Ellensburg on the Yakima, and is 195 miles long. With an expenditure of a few thousand dollars on the channel of the Okinagane, the mouth of the Conconnully could be reached from the Columbia by light-draught steamers, from which a railway fifteen miles long would reach the mines. Mr. Burch says that he and his father sounded the river, and also the Columbia, and that steamers can start at Rock Island Rapids and go to the mouth of the Conconnully, and, in flush water, can ascend the creek. Mr. Clayton makes the same statement as to the river. The country

rocks in the mining districts are of the same character as those associated with the iron ore on Mount Logan and the Denny Mountain—hard metamorphic and plutonic rocks.

The principal mineral lode is described by Mr. Clayton as “composed of true quartz gangue carrying the silver ore in disseminated grains of black sulphurets of silver, with some copper-silver glance, and a brittle sulphuret, resembling tennantite, giving a dark, red, powdery streak, approaching the characteristics of dark antimonial ruby silver. In addition to this is found galena and zinc-blende.”

Assays made by Mr. Wm. H. Fuller, of Spokane Falls, gave for first-class ore from this lode: Silver, \$186.45, and gold, \$4.50—\$190.95 value per ton. Second-class ore assayed \$34.16 silver and 45 cents gold. Mr. Slater thinks that one-third of the vein will yield first-class ore. It is a rich vein, averaging eight feet so far as opened. There are two or three lodes in the district. Years will be required to ascertain their limits. But all the indications point to large mining operations in the Okinagane country as soon as the transportation can be supplied.

My chief authority for the following statements concerning the Colville region is Mr.

Kearney, one of the firm of Kearney Brothers, owners of the two largest mines of that country, namely, the Old Dominion and the Daisy. I incorporate some statements also from two articles published in the *Spokane Falls Review*, one by W. E. Sullivan, and the other by J. B. Slater.

The mines in
the Colville
region.

The Colville region is the east end of Stevens County, the part lying east of the Columbia River and north of Spokane Falls. Its chief town (500 inhabitants) is called Colville, from the fort of that name which was situated there. It is ninety-one miles north of Spokane Falls. Between the two points there is almost a continuous valley of great productiveness. The mineral region begins at Chewelah, fifty miles north of Spokane Falls, and continues at least forty miles north of Colville. Granite, porphyry, and limestone are found here, as in the other metalliferous regions. In some cases the ores are in slate and quartz; in others, in granite and porphyry; in still others, limestone. Some of the ores are iron carbonates, carrying silver, gold, and lead in paying quantities. In other cases, as at the Old Dominion mines, the ore exists in the form of a chloride and black sulphate in limestone walls.

Rich mines of argentiferous galena were dis-

covered last summer three or four miles east of Chewelah, and vigorously developed at numerous points. Seven miles west of Chewelah shafts were sunk on a rich vein, three feet wide, of gray copper and silver chloride. The Eagle Mine was the first discovery, and is the most noted. It is black metal, containing galena, silver, and gold. Altogether, there are said to be two hundred mining claims, more or less developed, in the district around Chewelah.

The mines in the Colville district are very numerous. The Old Dominion Mine is six miles east of the town. It is on an 8-foot fissure vein, which assays 150 ounces silver, 25 per cent. galena, and \$7.00 gold to the ton of ore. There are ten mines in the Old Dominion group; and Mr. Slater states that the \$80,000 worth of silver reported as the product of Washington Territory in 1886, all went from the Old Dominion group.

The Old
Dominion Mine.

The Daisy Mine is twenty-four miles southward from Colville. The vein here is 25 feet wide, with a streak of ore in it 18 inches wide, which widens to 11 feet 8 inches at the bottom of the shaft. This shaft is 127 feet deep. Seventy-five feet from the top of the shaft, a tunnel has been run off horizontally in five feet of ore. The assay reported for the Daisy ore

The Daisy
Mine.

gives silver 50 ounces, gold \$2.00, lead 30 per cent., and iron 25 per cent. It is self-fluxing.

Young America
Company.

Sixteen miles and a half northward from Colville, near the Columbia River, a rich discovery of silver-lead ore has been made by the Young America Consolidated Company. The vein averages five feet, runs northeast and southwest, and has been shafted through ore to the depth of 180 feet. A test showed 90 ounces of silver and 40 per cent. of lead. A number of other openings have been made on the lode.

The Little
Dalles.

The Little Dalles, thirty-eight miles north of Colville, is another neighborhood rich in mineral. The ores are galena and lead carbonate, with silver. On Bruce Creek, and east of Bruce Creek, twelve miles north of Colville, are similar veins. A smelter of twenty tons capacity has been erected at Colville, which affords encouragement to mining; but it is not satisfactory to the largest owners. Smelting should be done on a large scale, and in a centre of large business. There can be no doubt that here, also, will be a region of great activity and large production as soon as it is connected by rail with Spokane Falls.

I have indicated the mining localities on the map accompanying this Report as nearly as my

information would allow, but only an approximation is expected.

The region that just now is attracting most attention is the Cœur d'Alene country, because the mines are more developed; and they are more developed because the miners have better transportation than exists in the Colville and the other mineral regions. Some thousands of men were at work last season on the streams entering the lake, particularly on the South Fork of the Cœur d'Alene River.

Cœur d'Alene
Mines.

At Spokane Falls I was able to get reliable information concerning the region, and would mention as chief among my authorities Mr. S. S. Glidden, at one time well known in Alabama as an able iron manufacturer, now proprietor of the Tiger Mine, on Canyon Creek, which empties into one branch of Cœur d'Alene River. By reference to the map, the following description may be readily understood:

The Cœur d'Alene Mountains, River and Lake are in Idaho Territory, near the line of Washington Territory. The drainage is through Spokane River into the Columbia. The distance from the nearest point on the lake to Spokane Falls is twenty-five miles. The Cœur d'Alene River has two branches, on both of which mining has been done, but most largely

on the South Fork. Previous to 1886, all the mining on this fork was done at Eagle, Beaver, Delta, Murray, etc., and was chiefly gold placer mining, which was not particularly remunerative. Placer mining has also been done on the South Fork; but the chief ores on this branch are argentiferous galena, with some gold in quartz. A large number of claims have been worked into since the beginning in 1885, and the increase of mining population has been going on rapidly. Mr. Glidden thought that there were ten thousand people last fall in the Cœur d'Alene mining country. The veins are accessible and very thick, some of them as much as forty feet. The ores usually carry 40 to 60 per cent. of lead, 5 to 50 ounces of silver, and often about \$3.00 in gold to the ton of ore. The veins are true fissures, and strike across the country rocks, which are principally porphyry and quartzite. The strike of the main veins runs parallel to the river, and at a distance of two to six miles from it. There are many cross gulches which cut the veins at right angles, and thus present vertical faces which offer the best facilities for prospecting and for mining.

The veins have been opened at so many places as to put beyond doubt their continuity on long lines, and their great abundance. In

fact, the indications point to a development resembling that made near Leadville.

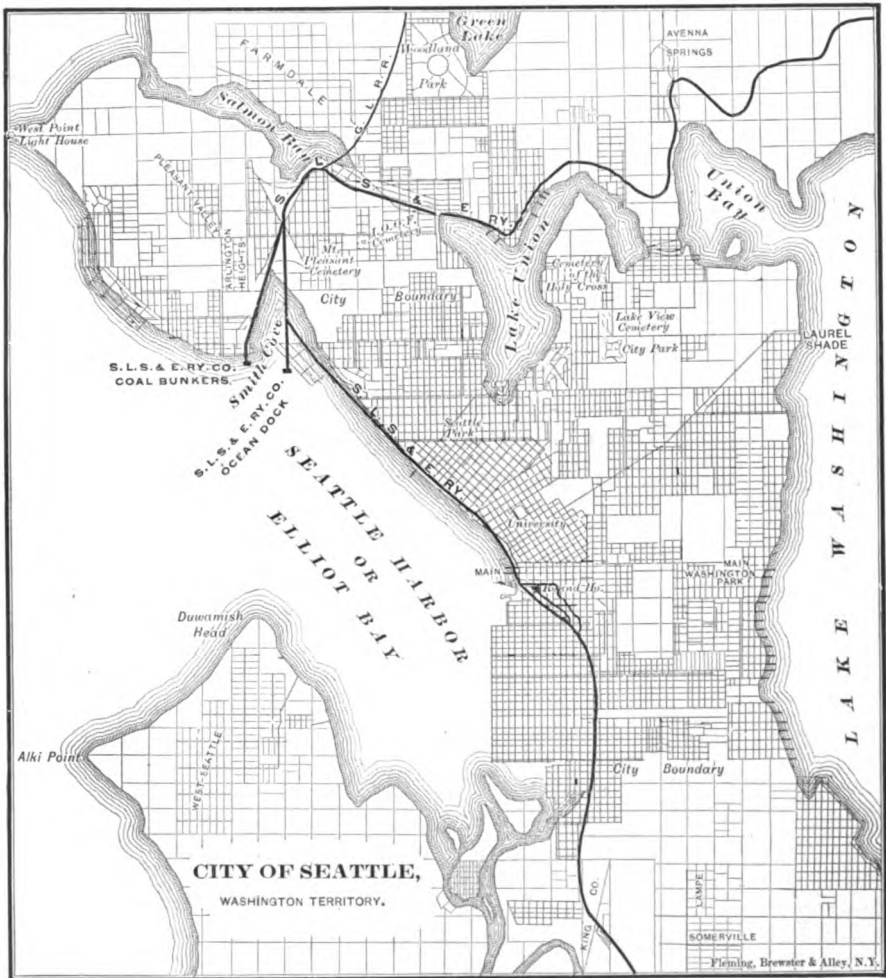
Some of the ore must be concentrated, and much of it must be shipped in bulk to the reduction works. Such tonnage is considered the best possible for a railroad. The ore can be carried in any kind of car, and is not subject to theft or any sort of damage; and yet its precious character enables it to bear higher freight rates than pig-iron. There are no fluxes in the country outside of the ore itself, and it will be more economical to carry the ore out than to bring in fluxes. The smelting of the ores on the ground would be further embarrassed by the difficulty in getting fuel. The timber is in patches, and often inaccessible; hence charcoal would be costly, and there is no coke to be gotten anywhere near. The smelting of mixed ores of this sort is a very complicated process, requiring quite a number of different elements, and can be most economically conducted on a large scale, and by the mixture of various different ores. Hence the advantage of having these works at some great centre where ores of many kinds may be brought. In the establishment of such a centre, of course, reference should be had to commercial and trading facilities. A large mining community

The large tonnage from and to the mines.

in one place and a large commercial and manufacturing community in another, involves large transportation of crude materials, and of manufactured products, of food, and of passengers.

As yet, the Cœur d'Alene mining is in its early infancy. Means of transportation are partially furnished by means of water and short narrow-gauge railroads, but they are insufficient. Shipments now are small, but they will rapidly increase, and Mr. Glidden thinks that in three years 2,000 tons of ore will come out *daily*, and as many tons of freight go in—certainly a splendid outlook for business.

In *concluding*, as I have now done, the general statement in regard to the physical resources of Washington Territory, I would remark, that all the facts stated heretofore have a close relation to the interests of the Seattle, Lake Shore and Eastern Railway and its friends, and that the remainder of this report will consist in practical applications of the facts to the railroad and personal interests involved.



**SPECIAL REMARKS ON THE COUNTRY
AND ITS RESOURCES ALONG THE LINE OF
THE SEATTLE, LAKE SHORE AND EASTERN
RAILWAY.**

SEATTLE.

CONCERNING this city of 15,000 to 16,000 inhabitants, I need not repeat what has been so well said in the reports of Governor Squire, and of United States officers who have examined and reported to the Government with regard to this location—notably, Gen. Isaac I. Stephens, Gen. George B. McClellan, Gen. Nelson A. Miles, and others; also by the Seattle Chamber of Commerce. Its location, its harbor, its people, its commerce and manufactures, its solid and rapid growth, and its local relation to all the great natural resources of the Territory, give to Seattle advantages which cannot be equalled by any other port on the Sound. Its climate, as to temperature, both in winter and summer, is remarkable. It is pleasantly cool in summer, and in winter rarely severe. Its only drawback is an excess of moisture for perhaps

Commercial and
manufacturing
advantages.

Good climate.

four months of the winter season. But this is preferable to the violent storms and deep snows and extreme cold to which the Eastern plains and the upper Mississippi country are subject, and which sometimes attack New York and the New England States. On Puget Sound there are no blizzards nor cyclones, and rarely so much as an inch of snow. The medical testimonies give a very favorable bill of health.

The industries of city and country are prosecuted with less interruption from weather than in any of the States east of the Rocky Mountains. The annual rainfall is not greater, not so great, indeed, as in some parts of the Atlantic seaboard. It is not so well distributed among the months as it is eastward ; but outdoor work rarely stops on Puget Sound.

Good population

The population of Seattle struck me as exceedingly good. Her controlling classes are men of character, intelligence and substance. The appearance of the stores, the streets, the offices, and factories, would do credit to an old city. Water, electric lights, street railways, good fire companies, well organized police, handsome residences, churches, schools—all attest the progress of her civilization. Her wharves and railroad depots are crowded with business. The special pride of the city seems

High civilization.

to be her schools, public and private. Her large and handsome school buildings seem purposely to have been placed in the most prominent positions. Her public school system is well organized and supported. The University of the Territory is located here, and in full operation. These things, considered together, augur most favorably for the future of this young city.

Her growth will be rapidly accelerated by the extension of her railroads. Besides her coal roads, she will soon be practically the connecting point of certainly two, and perhaps three, transcontinental railroad lines. She now has railroad connection with the Northern Pacific, and will shortly be connected with the Canadian Pacific by the West Coast road. But the road that will do most for Seattle, indeed, the road which of itself would make a city at its Sound terminus, is the Seattle, Lake Shore and Eastern Railroad. This will be true if the road never crosses the limits of Washington Territory; but no doubt it will ultimately cross the continent, or at least have close transcontinental connections.

Railroad lines.

When these roads are thus extended, they will bring vast quantities of lumber, and of mineral and agricultural products, and carry in exchange foreign and domestic products for

the supply of the rural and mining population, to say nothing of the great Eastern trade. Her coastwise and foreign trade have already been discussed.

The chief ship-building centre.

Puget Sound must also become the chief ship-building centre of the continent, and the possession by Seattle of the great fresh-water lakes so close to the Sound, and the fact that here will be the point where the Bessemer pig-iron and its products will be manufactured, will give this point advantage over all others on the Sound. Seattle will build ships for England, New England, South America, Asia, and the Islands of the Ocean ; and just here will first be seen the dawning of the new day which will come to our American merchant marine, of late so depressed. And the Government itself must sooner or later establish on Lake Washington a navy-yard where ships can be built of the best material at minimum cost ; and where her ships out of commission can lie landlocked, secure from the teredo and the corroding effects of sea-water, and can at once get rid of their barnacles.

Seattle better located than San Francisco.

Seattle can have no rival on the Pacific Coast except San Francisco, which has the only good harbor and entrance outside of Puget Sound, but which has no coal, nor iron, nor timber,

and whose back-country does not equal the Snoqualmie valley of East Washington for agricultural and mineral capabilities.

THE TERMINAL PROPERTY OF THE SEATTLE, LAKE
SHORE AND EASTERN RAILROAD.

The city and suburban property which the railroad has secured is singularly valuable, and will afford every facility for city and foreign business. It is correctly described in the documents of the company. No future road can acquire such facilities. They approach a monopoly of great value.

Unrivalled terminal property.

SUBURBAN INTERESTS.

There can be practically but two railroad entrances to Seattle, one from the south, and the other from the north, owing to the bluff ground on which the city is built, with Puget Sound in front and Lake Washington in the rear. The roads from the existing coal mines and from the Northern Pacific enter from the south; the Lake Shore road enters from the north. Suburban improvements will no doubt be extended both north and south. But it seemed to me that for residences and amusements the northern end has the advantage, as the high lands

But two entrances by land.

Superiority of the northern suburbs.

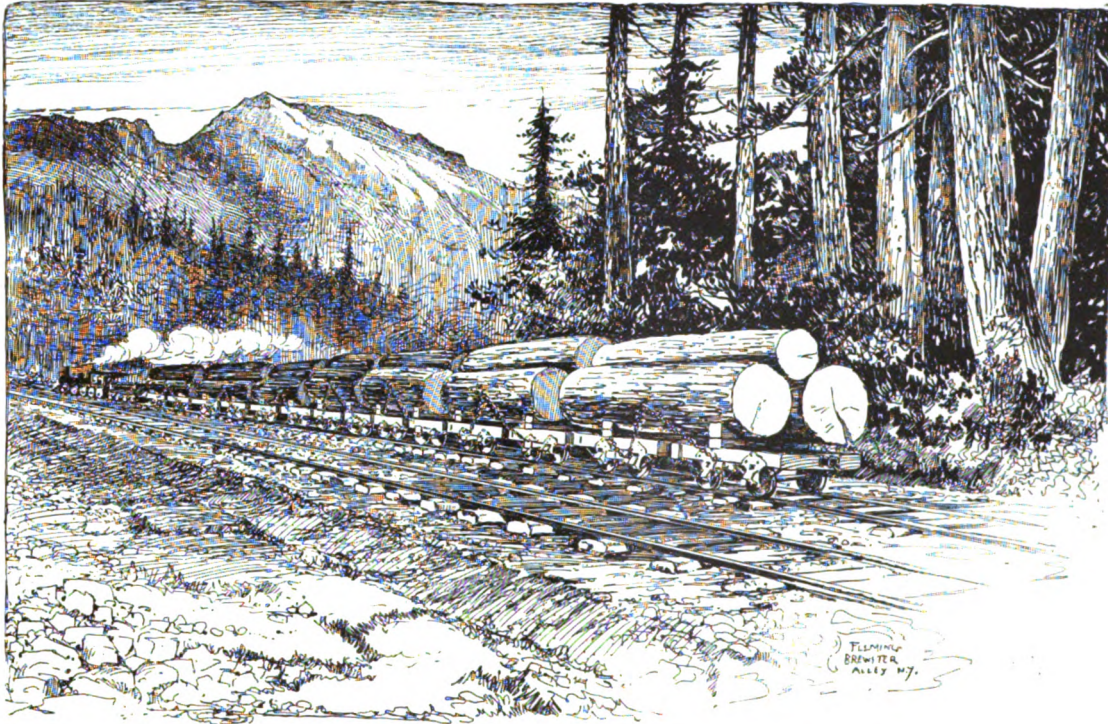
are more convenient to the railroad, and command fine views of those beautiful lakes on the east, and of the Sound on the west. Here will be the pleasant drives, the place for sailing, rowing and swimming; for open-air games, picnics, etc. On the east side of Lake Washington will be vegetable and fruit gardens and dairies, whose products will reach the city by this railroad; to all of which have been added the powerful influence of the Moss Bay operations.

The logging business begins in sight of the city, and a number of logging camps were already in operation along the first twenty miles of the railroad. After the loggers, follow the farmers. Already a surprising number of people have established homes in this direction.

Factories of the future. Near the Sound and a little distance from the city will be great saw-mills, grain elevators, canneries, and, in time, fish-oil and fertilizer mills, tanneries, smelting furnaces, sulphuric acid and other chemical works. And here will be the ship canal connecting the lakes with the Sound, and the shipyards of the future.

TIMBER.

The great lumber interest will have a larger and richer field on the Seattle, Lake Shore and Eastern Railroad than on any other through



A TRAIN-LOAD OF LOGS ON THE SEATTLE, LAKE SHORE AND EASTERN RAILWAY.

line in Washington Territory. On the line of the Northern Pacific Railroad the timber is abundant, but too small for the mill, except in a very few spots. The other roads show but little left close by, and the trees never had the size of those of Snoqualmie Valley. The West Coast road, which will be tributary to the Lake Shore Railroad, will pass through good forests; but, according to my information, the forests on the line of the Lake Shore road are the very best in Washington Territory.

Superiority of
the timber on the
Seattle, Lake
Shore and East-
ern Railway.

The forest of mill timber beginning in sight of Seattle, continues with some intermissions to the top of the Cascade Mountains. It increases in size and quantity to a point far up on the mountain side, and the trees continue of good size all the way to the top. Crossing the Cascade Mountains, on the east side the trees are quite numerous, but smaller than on the west side, though some of them can be sawed. Continuing eastward, the trees get fewer and smaller, and change from fir to ordinary yellow and bull pine. In the plateau country of the Great Bend there are only scattered groups of stunted trees to be seen, and, excepting a few skirts along the bluffs of the Columbia, no forests of mill timber are to be met with until after passing the Idaho line.

The forests described.

I will now review this timber belt with more particularity. After leaving Seattle, there is a somewhat elevated country between the lakes and Puget Sound, which is largely covered with mill timber of medium size. Perhaps two feet and a half would be about the average diameter of the logs. Here, as everywhere, the principal timber, and that most cut and valued, are the Douglas fir and the white cedar.

Forests of Raging River.

Continuing along Lake Samamish, and up Squak Creek, these forests continue on both sides at some distance off. A large body of moderately sized timber runs off toward the northeast, covering the hills which lie in front of the mountain range. Passing the Gilman mines, we meet but little large timber until we enter the valley of Raging River. Here there is an almost unbroken forest of splendid timber, extending from near the mouth as far up as I went, namely, ten miles from the mouth. The mill timber here would average from six to ten inches more in diameter than that we passed near Lake Washington; and there seemed to be a vast body of it in this valley. As far up on the hill or mountain side as I went, or could see, the trees retain their large size.

At the upper coal mines I found this to be the case to the mountain top, 800 or 900 feet

above the river. The trees were not only large, and thick on the ground, but extremely tall and free from knots. I was told that the heavy forest continued a considerable distance above the upper coal mines.

In the Snoqualmie Valley proper are to be found the largest forests and the largest trees. The farmers and hop-growers have destroyed thousands of acres of the finest timber trees on the continent, but many, many thousand acres still remain unbroken. Between Falls City and Hop Ranch the wagon road passed through two or three miles of this magnificent timber. Turning from the road, I ascended the Snoqualmie Mountain, and all the way up to the coal openings I traveled in the densest forest of the largest trees I had ever seen. Passing the cleared country about Hop Ranch, I again plunged into one of these monstrous forests, and traveled three or four miles through it without a break. The sun never touches the earth in these forests. The trees rise to the height of 250 feet or upward, and lock their branches together far overhead, shutting out the sunlight and awing the traveler. Their trunks seem to stand absolutely straight and plumb from the ground to the top. I had studied the long-leaved pine forests of Georgia, Alabama,

Forests near
Hop Ranch.

Superior to the
Long Leaf
forests of the
Southern States
and of the Mis-
sissippi Bottom.

and Mississippi. I had traveled for a hundred miles through that marvelous forest on the Yazoo Delta, where it seemed to me that Nature had done her utmost in covering the ground with vast and lofty trees; but here in the Snoqualmie valley I traveled through forests that for the size, height, and number of trees to the acre, as much exceeded the forests of the Yazoo bottom as the latter exceeded all other forests I had ever seen. The Snoqualmie forest also exceeds all others I have known in the immense quantity of its fallen timber, which renders locomotion off of the trails extremely slow and difficult. The railroad ascends the South Fork of the Snoqualmie. I did not go up the Middle Fork, but was told that the timber is fine in that valley also.

Trees ten feet in
diameter.

The little Salal Prairie, five or six miles long, and six miles from Hop Ranch, breaks the continuity of the forests, but with that exception, it continues to the pass of the mountain. As to the size of the trees, I feel sure that I saw hundreds that would average ten feet in diameter. I measured two that were by no means singular, and one gave a circumference of thirty-three feet (equal to eleven feet diameter), and the other not much less. There is no doubt that many of these trees are 300 feet in height. I

think it likely that the average height of the mill timber on the line of the road from Raging River, for two-thirds of the way up the main mountain (a distance of over twenty-five miles), is 250 feet, and 150 feet of this clear of limbs, and hence of knots. And I think that the average diameter of the butt-cuts of the mill timber would be near five feet. I found my greatest difficulty in estimating by the eye the average number of trees to an acre. I can only say that I not only never saw so many, but I never conceived it possible for such a number of large trees to be supported by the soil of an acre of ground. It was not unusual to see many trees of six to eight feet in diameter standing within ten feet of each other. I knew, of course, that there were single trees in California, and elsewhere, larger than any single specimens to be found here, but I did not know before going to Washington Territory that such forests as these were to be found on the face of the earth.

Average nearly
five feet in
diameter and 250
feet high.

I shall leave to men better versed in the details of the lumber business than I to estimate the quantity of sawed lumber which would be yielded by an acre of such timber, and by the many thousands of acres which lie on, or near, the line of this railroad. Somebody published

Lumber product
per acre.

that the average yield of the Washington Territory forests would be 30,000 feet to the acre, and this may be, because there is much small and scattered timber; but if this amount be multiplied by six, it would not do justice to the forests I saw in the Snoqualmie valley. There are single trees that would make 30,000 feet of lumber. It is fortunate that the fir and cedar timber are preferred by the lumbermen, as these varieties constitute the larger portion of the forest. Undoubtedly the hemlock will all be wanted at an early day, and so of the larch and the less abundant trees, both evergreen and deciduous.

The bearing of these facts on the interests of the railroad are obvious. Such bodies of timber, standing close to the road for a distance of eighty miles, would of itself guarantee the success of the road for a generation to come.

And there is everything favorable in the position of the timber with reference to the track, especially if the track, in ascending the mountain, can be kept near the river. It is to be hoped that the timber along the right of way will be saved for sawing. It would be no small item in paying for the road.

There will promptly spring up along the whole line both logging-camps and saw-mills.

Besides those already in operation, I heard of some large new enterprises projected. The demand for lumber is so insatiable, and the profits of the business so good, that an extensive fresh field like this will be entered with avidity by an army of lumbermen.

AGRICULTURAL PRODUCTS.

The agricultural interest is not so large at present on the west side of the Cascade Range, as the timber, coal and iron interests, but it is growing, and will become exceedingly important. East of the Cascade Mountains this will be the chief railroad interest in the beginning, though ultimately it will be surpassed by the tonnage of the mines. I have heretofore described the soils and vegetable products of West Washington, but would say specially with regard to the belt we are considering, that it is destined to be a fine agricultural region. The bottom lands of Squak Creek, and of Snoqualmie River, including all its branches and tributaries, are extremely fertile, and suited to produce the largest crops of grass, oats, barley, hops, and roots of almost every sort, besides most of the overground vegetables.

Agricultural
freights.

At my request, Mr. Wilson, the manager, and one of the owners of the Hop Ranch, fur-

Produce of Hop
Ranch.

nished me the following written statement concerning that estate, which, although larger than any other on the route, is not richer than many other places of smaller size.

MR. WILSON'S LETTER.

SNOQUALMIE, W. T., Nov. 3, 1887.

DR. RUFFNER.

Dear Sir: In response to your request, I make the following memoranda. Our Hop Farm consists of 1,500 acres of rich alluvial soil; 300 acres in hops, which produce from 1,800 to 2,000 pounds per acre. We also raise 150 acres of oats, producing sixty to seventy-five bushels per acre. From 100 to 150 acres in hay, producing about three tons to the acre. Also large quantities of vegetables, such as potatoes, carrots, turnips and onions. All kinds of root vegetables are prolific except sweet potatoes. Fruits, such as apples, pears, prunes, plums, and berries of all kinds, are in abundance. Last year we had over 5,000 bushels of apples.

At present we ship in about 500 tons per year of merchandise and supplies, and ship out, in the way of hops and other things, from 400 to 500 tons per year. This we could double if



HAY-MAKING IN WASHINGTON TERRITORY
ALONG LINE OF SEATTLE, LAKE SHORE AND EASTERN RAILWAY.

we had railroad facilities for shipping. We employ during the winter—that is, in November, December and January—about forty men; the rest of the year, from 75 to 1,200 men and women. The keeping up of this supply of labor, which all comes from Seattle, would be quite an item to the traffic of a railroad. I presume you know that where there are a large number of people employed, they are continually coming and going. In speaking with a railroad contractor the other day, he told me that in order to keep 500 men at work, he had to keep 1,500 on the road. This will also be an important item when the mines are working above here. There are a great many items of interest to which I might call your attention, but I will confine myself to the above at present.

Yours, very respectfully,

T. G. WILSON,

SECRETARY AND MANAGER OF THE
HOP GROWERS' ASSOCIATION.

Besides the bottom lands, there are large areas of what might be called table-lands, north and northeast of the lakes, which are top-dressed with glacial drift, but which will be well adapted to the crops of the country, and espec-

Farming, fruit
and grazing
lands.

ially to fruits. And besides the table-lands, the smaller mountains are generally adapted to agriculture, and especially to grazing. My impression, as heretofore stated, is that, ultimately, West Washington will become a great grazing region, though it is generally supposed that East Washington is to be the chief cattle country. But the mild and equable climate, and the abundance of rain, ensures abundant forage summer and winter in West Washington. This will be important for the feeding of cities farther south, as well as for sending canned and refrigerator beef far and wide over the Pacific Ocean. The growth of vegetables, especially of root crops, is something phenomenal on both sides of the Cascade Mountains, and will furnish a large item of commerce, as is shown already by the large shipments of potatoes from Seattle, and the multiplication of canneries.

Hops, barley and
beer.

The hop interest is a large one, but the low prices of the last year or two have checked the progress of this industry. Breweries have already been established at Seattle, and elsewhere on Puget Sound, and, as the chief materials for beer (barley and hops) are produced here so cheaply and abundantly, we may expect Puget Sound beer to become quite a large item of commerce.

The Snoqualmie and Squak valleys have as yet but a scattered agricultural population, but ultimately farms will be opened along all the streams, and even high up on the Cascade Mountains.

On the east side of the Cascade Mountains the Seattle, Lake Shore and Eastern Railway will closely parallel the Northern Pacific Railroad for a short distance in the Yakima River valley, but will probably leave it soon after entering the most productive part. The route, however, may be varied to suit circumstances, and as to this point no doubt would be if the talk of making Ellensburg the State capital should become serious. The remark may here be thrown in that this meeting of the two railroads in the Yakima valley will be no disadvantage to the Seattle road, as the distance to Puget Sound is about the same, and the incidental advantages are in favor of Seattle.

The two great
railroads.

Crossing the Columbia River, the railway will enter the great plateau which has been so fully described, and if the passage should be made at Rock Island Rapids, it will cross the plateau at its widest part. Nothing more need be said as to the great agricultural capabilities of the plateau country. The Great Bend, or northern limb of the plateau, is more extensive

The Great Bend
country.

Douglas County.

than the southern division, but it is a much less settled country, owing partly to want of transportation, and partly to want of water. This scarcity of water in Douglas County was formerly thought to be incurable without a resort to artesian wells; but experiment has shown that wells of good water can be obtained at moderate depths, as I was informed by Mr. Smith, a resident of the county, and by Mr. Nash, the lawyer, who owns property there. The population and, consequently, the business of this large county is limited at present, but it has a large body of good land in it, which will attract settlers before long. Its soil is of the same character as that of other parts of the plateau; but the general impression seemed to be that it was not quite equal to the land of the Snake River Basin, or to the adjoining county of Lincoln, owing in part to a larger proportion of rough land. I do not, however, consider this question by any means as settled. The best area for wheat is supposed to be that which borders on Lincoln County. If the route for the Seattle railway which is preferred by Mr. Mohr, should be adopted, it would pass across the northern part of the county, by many persons considered the best part, and leave the great body of the county out of reach to the southward.

Lincoln County, through the length of which the road must pass, is universally admitted to be among the best agricultural counties on the plateau. It is also settling up rapidly, and has become a large producer of wheat, even at the disadvantage of a long haul in wagons. Mr. Curtis, who buys much of the Lincoln County wheat for his mill at Spokane Falls, says that the average yield of wheat is twenty-five bushels per acre, though in 1886 (the year of failure) it fell to sixteen and one-half bushels. Captain McGowan, of Lincoln County, also gave twenty-five bushels as the average crop, and said this would hold good for the whole period since the settlement of the county, including the bad year 1886.

Lincoln County.

By reference of the official map showing the wheat areas, it will be seen that the Seattle railway passes through the middle of these areas in both Lincoln and Spokane counties. The testimony was entirely favorable in regard to horticultural and pomological products, as well as to the agricultural, in the strict sense. The population of the three counties, Douglas, Lincoln and Spokane, was put by Governor Semple at nearly 18,000; about 17,000 of which was in Lincoln and Spokane. Much land has been bought with a view to settlement as well

Spokane County.

Price of farming
lands.

as speculation, and this would be occupied and cultivated *pari passu* with the progress of the railroad, and there yet remains much good land which can be bought at low prices, say from one dollar to five dollars an acre, and will attract settlers. Farming lands here will have market at the mines north of the Columbia River, at Spokane Falls, where there will be a large city, as well as large mills, and at Seattle, where there will be a large demand not only for the city, but for shipping.

Tonnage. No reliable estimates can now be made as to what business this Great Bend country will furnish ten to twenty years hence. We have only this to guide us, namely, that the part of the plateau which lies south of the Northern Pacific Railroad now furnishes 400,000 tons of wheat for transportation annually, besides other freight and passengers; and it has not reached one-half of its producing capacity. Mr. Mohr estimates the income from mail and express as one-fifth the income from freight, and passenger fares as one-quarter of the whole amount from tonnage. Though the country lying north of the Northern Pacific Railroad is much larger in area than that which lies south of it, it may not average as well, and cannot all be controlled by one railroad; but it will certainly

furnish large tonnage ; much more than is common in agricultural regions.

At present the product of wheat in this region is estimated at 100,000 bushels, but this amount would probably be doubled the first year after the railroad comes, and rapidly increased afterward. Much of the mining business already crosses this territory, and will, no doubt, greatly increase.

COAL.

I have, under the head of Economic Geology, described so fully the coal deposits of Washington Territory, especially the beds along the line of the Seattle, Lake Shore and Eastern Railway, that it remains only to show the application of these facts to the interests of this railway. The road passes five, if not six, separate coal fields between Seattle and the Columbia River, namely, the Squak or Gilman mines, 40 miles from Seattle ; the Washington mines, 43 miles ; the Raging River, 46 to 50 miles ; the Snoqualmie Mountain, 56 miles ; the Yakima (or Roslyn), 75 miles ; and perhaps the Wenatchie, 140 miles.

So far as appears at present, the Seattle railway will have a monopoly of all these fields except the Yakima or Roslyn. This it will share

The Seattle
railway passes
five coal fields.

with the Northern Pacific; but it will have exclusive control of the market between the Yakima and Spokane Falls, which will be almost wholly dependent upon coal for fuel. Also, it will furnish whatever of this coal may be wanted by the mining country north of the Columbia. And in the Spokane Falls market it will have the advantage of bringing the coal by a route fifty miles shorter.

The coal on the west side of the Cascade Mountains will go to Seattle for consumption and shipment, except so much as may be wanted for iron making, and other manufacturing purposes along the line of the road. Coke will be in demand for furnaces, foundries, engines, etc., in Seattle, Spokane Falls, and many other places. But its largest consumption will be in iron furnaces which will be erected for smelting the ores of the Cascade Mountains.

Largest shipments from the Gilman Mines.

The largest shipments will be from the Gilman Mines for domestic and steam-boiler purposes. The coal must, of course, come in competition with other coals which are mined within the basin of Puget Sound, but it has an advantage over all competitors in the ease, safety, and cheapness with which it can be mined. This will not, of course, be realized for the first few months whilst driving the entries,

but when the mines shall have been fully opened I think it will be without rival in the cost of production. This will be evident from the following report made to me by Mr. Whitworth, showing the disadvantages in the mode of working the other mines of the Territory. The terrible explosion which has lately occurred in the deep mines of Vancouver's Island shows that the Canadians are also working at a disadvantage.

Superior mining
advantages
of the Gilman
Mines.

MR. WHITWORTH'S LETTER.

"At Cedar River the coal is all hoisted from a slope, and the gangways run at right angles to the slope, and the 'brests' at right angles to the gangways, or parallel to the slope, or nearly so. The angle of the pitch is about 18° . And the cars are run up to the 'brests' to the working face of the coal, and coal shoveled into the cars. A movable windlass or drum allows the loaded car to haul the empty one up to face of coal.

Mr. Whit-
worth's testi-
mony.

"At Black Diamond the coal is all hoisted from a slope; gangways at right angles to slope, and 'brests' at right angles to gangways, and parallel to slope. This pitch is a little steeper, about 20° or 22° , but not sufficiently steep for the coal to run. Therefore it has to

be shoveled down the slope of the 'brest,' or the 'brest' floor temporarily ironed; and is loaded into car from 'brest' chute.

"Franklyn has both systems, hoisting up a slope, and working on a water-level gangway. They have two slopes, one outside and one inside. This pitch is 45° and more. Gangways run on the strike of veins, and 'brests' up the pitch. Coal runs freely on the floor of 'brests.'

"What it costs now to mine at Newcastle I do not know. The cost of coal above the water-level gangway put into the railroad cars varies from 85 cents (one month only) to \$1.50 per ton; \$1.10 about the average. For the first six months I do not think we (at Gilman) can calculate less than \$1.25 per ton.

"The veins which they work or have worked at Newcastle are No. 4—No. 2, as it is called, which is really Nos. 1 and 2 united—and Bagley vein. No. 4 is worked out on two lifts, the water level, and the one below. The third lift they have not cross-cut to it, as the slope is on No. 2. No. 2 is almost closed on third lift east of Coal Creek. First two lifts, of course, are worked out. And west of Coal Creek the working has progressed nearly to the boundary of their land, and passed the division of the vein

into Parts 1 and 2 ; so that they are getting but little coal out of it. But most of the coal comes from Bagley. Bagley is never worked, or but slightly, when the others are furnishing plenty of coal. Bagley there consists of two portions of about seven feet each, with one to two feet of rock and slate between. In the lower bench there is about four or four and a half feet of good coal ; the rest is bony. And in the upper bench there is from three to four feet of good coal, and the balance bony. When they are pressed for coal there is a strong temptation to mine and ship the entire fourteen feet of coal, and bony coal, as it all looks quite well. This temptation, I know, under the old administration, was sometimes yielded to, and I have supposed such was the case now. In fact, in getting that coal some time since for home use, I have several times seen the straight Bagley from top to bottom in the ton. No. 2. The united vein at its best is ten and a half feet, between splendid walls, about one and a half inch mining on the bottom, and a parting near the centre one inch thick. That never disappeared, but increased both ways until the veins were finally separated. No. 2 separate was about five feet clean, at least with no permanent partings. No. 1, about four and a half feet of coal with a three-inch streak of

fine clay eighteen inches from the top, the balance clean."

So much from Mr. Whitworth.

Cost of mining
coal.

Governor Semple puts the prime cost of the coal of the Puget Sound basin generally at from \$2.00 to \$2.30 per ton, delivered at tide-water ; which is, I suspect, below the fact. James F. Jones, in charge of mines on the Northern Pacific Railroad in the Puget Sound basin, reports the cost per ton at the mines delivered on the cars as ranging from \$1.00 to \$2.50 per ton, averaging \$1.75.

The minimum of cost is reached when the seams are of good thickness and comparatively free from slate, and can be entered on the end by a level entry above water and be mined upward ; to which may be added natural pitch enough in the seams for the coal to be self-loading ; that is, to run by gravity from the upper gangways to the cars on the main entry. And to these conditions may be added a number of different parallel seams close together with their bluff ends all coming up to a line in the most convenient way for entry and delivery. It is rarely the case that such an assemblage of favorable conditions can be found, and where they exist the successful future of the property is absolutely assured.

In my opinion, the Gilman coal seams combine all the advantages above mentioned, and if allowed ordinary rates of transportation, can always be mined at a profit. As long as the Newcastle seams could be worked above water-level the average cost per ton was \$1.10, but they never had the same advantages there as at Gilman, and most of their mining has been downward. \$1.00 per ton is certainly high enough for Gilman after the entries are driven in sufficiently for large operations. If Mr. Whitworth succeeds in putting out the coal at \$1.25 for the first six months, as he thinks he can, there need be no fear as to the future.

Cost at Gilman
Mines.

The selling price of coal on Puget Sound has ranged from \$3.00 to \$5.00 a long ton in former years, averaging \$4.00—the price being the same for the product of all the different mines. Mr. Whitworth reports the price this winter at \$6.50 a ton for all (including Newcastle), except Cedar River, which is \$5.00. The distances from Puget Sound to Portland and to San Francisco, the principal markets, are: to San Francisco, between 800 and 900 miles by water; to Portland, 450 by water, and 150 by rail. There is now rail connection all the way to San Francisco. The average cost of sending coal to San Francisco, either from Puget

Prices of coal.

Sound or Vancouver's Island, is \$2.00. The usual price in San Francisco and Portland has been from \$4.25 to \$6.00 for coarse, and from \$2.75 to \$3.75 for small. On the 1st of February, 1888, the cargo price in San Francisco was—for Coos Bay coal, \$9.50; Seattle coal, \$10; South Prairie, \$10; Nanaimo (domestic), \$10; Nanaimo (steam), \$12; Lehigh, \$18; Cumberland, \$12.

These figures make it evident that a good margin of profit may be calculated on from the Gilman coal. Mr. Whitworth will not be able to get his bunkers up until he has his road in operation to the mines; but, with temporary chutes, he can load 100 tons a day from the time the road opens, say March 15th. In six weeks after beginning he expects to increase to 300 tons a day, and one month later he can make the output 600 tons a day. As the headings are driven in the product can be increased to almost any desired amount.

The Washington Mines, on Squak Creek, I did not see; and concerning the Raging River Mines I have no settled convictions. As to the coking coal on Snoqualmie Mountain, we may expect important developments. Undoubtedly the new road will promptly enter upon a large and increasing coal business.

IRON ORE.

The question here respecting iron ores along this road is not as to their quantity, or quality, or as to their utilization, but only as to what road or roads will handle the business that will arise from this source. Naturally the bulk of it belongs to the Seattle, Lake Shore and Eastern Railway, and at one time there seemed to be no doubt that large iron-works would at once be established at Salal Prairie by the Moss Bay Company, of England; but the east shore of Lake Washington has finally been settled upon for the great plant of this wealthy company; which of itself will go far to establish the natural monopoly which the Lake Shore Railway seems to have of the ores on the west side of Cascade Mountains. And in regard to the magnetic ores generally, this road, from its location, would seem to be master of the situation. All the iron ore on the west side of the mountain is owned by men whose interests are identified with Seattle, and with this line of railroad. The best point for manufacture in itself considered, the best chance for fuel, the best line for transportation, the best point for trading and for shipment, are all on the line of the Seattle Railway. Good furnace sites may be found at many

Handling the
iron ores.

Furnace sites

Salal Prairie.

points, but Salal Prairie is a spot which seems to have been set apart by nature for a manufacturing town. It lies near the intersection of the valleys of the South Fork and Middle Fork branches of Snoqualmie River, is about six miles long and three miles wide, is flat, dry, salubrious, and well supplied with water. It has a natural outlet to the South, as well as to the east and west, is convenient to the iron ore and limestone of both the Middle and South Fork, and not far distant from the ores of Clellum. It is less than ten miles from Snoqualmie coking coal, and fifteen miles from the Green River coals. And, what I think is a still better resource for fuel, it is in the midst of the great Snoqualmie forests, where saw-mills will soon be felling the timber, and providing an endless supply of slabs and refuse tree-tops, from which charcoal could be manufactured at very small expense.

Charcoal cheaply produced.

It is well known that charcoal is the best of all fuels for making iron, because of its freedom from damaging impurities. Its expensiveness generally prevents its being much used now, but here the cost need not exceed five cents per bushel, and 100 to 120 bushels would suffice for a ton of iron. The only question concerning the charcoal made from fir timber is as to its ability

to bear the burden in a tall stack. It is becoming common now to utilize the by-products of wood, formed during its conversion into charcoal, by a process which makes the charcoal stronger. But all difficulty on this point can be relieved by conforming the size of the furnace-stack to the strength of the charcoal. This is the only fuel which has ever been used on the Pacific coast for the smelting of iron ores. These enterprises have not been particularly successful thus far, rather because of the inferior quality of the ore, than from any defect in the fuel. The bog ore and the limonites which were used at Irondale, near the Canada line, and at Oswego on the Willamette, were generally low in iron and high in phosphorus, and the bog ores were soon exhausted.

At Irondale, near Port Townsend, recourse has been had to a refractory ore obtained on Texada Island, in Victoria Sound, on which a duty of seventy-five cents a ton has to be paid, and which requires a large amount of fuel for smelting it, perhaps as much as 150 bushels of charcoal. But Mr. H. T. Blanchard, who is interested in the Irondale Works, says in a late letter (November 29, 1887):

“It is perfectly safe to rate charcoal at six cents per bushel, and the quantity necessary to

Quantity of
charcoal to the
ton of iron.

make a ton of pig-metal not to exceed 120 bushels, with a good chance of getting it down to ninety bushels per ton with fair ores."

Bessemer ores
commonly dis-
tant from fuel.

The iron ores of the Cascade Mountains will be taken to some extent to mix with the inferior ores near the coast, but they will be chiefly worked into Bessemer-pig and steel rails. Steel-making ores are not common anywhere, and are widely separated from fuel, which makes them very costly in the States east of the Rocky Mountains. This well-known fact is alluded to by Mr. Swank, in his report on the Iron Trade of 1886, in the following words:

"It is also a fact worthy of notice, for which geologists may find a reason, that nowhere in this country are our best steel-making ores found in proximity to mineral fuel, either anthracite or bituminous, while in some parts of the Lake Superior region, even timber suitable for the manufacture of charcoal is almost wholly wanting."

The most important deposits of steel ores in the United States are on Lake Superior and in Missouri; but these ores are smelted chiefly by the Connellsville coke of Pennsylvania, which is 700 to 800 miles distant. The Cranberry ores of North Carolina are some hundreds of miles from fuel. A late number of the *Iron Trade Review* quotes the prices of ore at

Cleveland, Ohio, the principal receiving point of Lake Superior ores, as follows :

High cost of
Lake Superior
ores.

Specular and Magnetic Bessemer, per ton	\$7.00 to \$7.50
Bessemer Hematites	" 5.75 to 6.70

The same authority gives the cost of the ore and coke necessary for the production of a ton of iron in Mahoning Valley district, at \$9.90 for the ore and \$4.50 for the coke — \$14.40. To this must be added about \$4.25 for flux, labor, management, interest and repairs, making a total of \$18.65 as the cost of producing one ton of pig-metal.

Cost of produc-
ing ore in
Pennsylvania.

Thus the superior advantages of the Snoqualmie Valley are readily seen. Here are steel ores, two kinds of fuel, and the limestone in close proximity. Putting the fuel at more than I think it would cost; putting the cost of mining the ore at the maximum cost at Cranberry, N. C., and freight at double price, and we have as the cost of a ton of Bessemer-pig, as follows:

Cost of Besse-
mer-pig in
Snoqualmie Val-
ley.

Ore	.	.	.	.	.	.	.	.	.	\$3 00
Fuel	.	.	.	.	.	.	.	.	.	6 00
Flux	.	.	.	.	.	.	.	.	.	50
Labor and management	.	.	.	.	.	.	.	.	.	2 00
Interest and repairs	.	.	.	.	.	.	.	.	.	1 50
										\$13 00

Large market
for steel rails.

This is lower than the present cost of producing Bessemer-pig anywhere in the United States, according to the best of my information ; and at the same time the market is better. The demand for steel rails in the Rocky Mountain country and in the Pacific States is, and will be, large and permanent, while the demand in China and other foreign countries will constantly increase. And so will it be with machinery and tools of all kinds, agricultural, mining and manufacturing. This demand will be both domestic and foreign, and constantly enlarging. And it may be safely asserted that no railroad exists, or can be built anywhere in the Pacific States, which will compare with the Seattle, Lake Shore and Eastern Railway in its control of the iron business.

THE OTHER MINERALS.

Limestone.

I have already said so much as to the convenience and excellence of the limestone beds associated with the magnetic ores, that I will only allude to them here as constituting the great resource for furnace-flux, for building-stone, for lime, and for monumental and ornamental marble. This will be an important item for transportation. The granite, also, will be wanted for building, and for paving blocks.

Marble, granite,
sandstones,
slates.

There are, no doubt, quartzites, sandstones and slates which will be in request; some for the supply of silica needed for tempering fire-clay (which latter is reported to have been found on Cedar River in large quantity and of good quality); some for road metal; some for paving; some for building.

In this group, however, the great resource is in the ores of the precious and base metals, which have been fully described under a former head. Too little is known of the silver and lead and gold ores of the Snoqualmie Valley to lay much stress upon them. The indications do not justify us in ranking them with the ores of the Columbia Valley.

Precious
and base metals.

The gold placer mining of the Yakima country makes no large show so far. The silver, lead and copper ores, described by Mr. Burch, may develop largely, but as yet no calculations can be made as to their value in supplying tonnage. This field ranks with the Wenatchie, Chelan, and Methow regions, being undeveloped, and yet so full of promise as to deserve careful attention.

The mines of the Okinagane and Colville regions promise large results. All this mineral region, up to and including the Okinagane, lies fairly within the patronage ground of the Se-

Okinagane, Col-
ville and
Kootenai.

attle Railway as it pursues its course to Spokane Falls. The Colville and Cœur d'Alene, to which may now be added the Kootenai, mining regions, constitute a large area lying north and east of Spokane Falls, and offer themselves as possible routes for the Manitoba Railway, but chiefly as tempting fields for railroad enterprises. The city of Spokane Falls is deeply interested in bringing in the trade of these growing mines, and the Seattle Railway corporation may wisely consider the prizes here offered.

Cœur d'Alene.

Transportation
lines to the
mining regions.

Railroad building has begun in the Cœur d'Alene country. The Cœur d'Alene Railway and Navigation Company have constructed a narrow-gauge road from the Old Mission, near the junction of the north and south forks of the Cœur d'Alene River, a distance of about thirty-five miles. The tonnage is said to be much greater than this narrow-gauge can handle at present.

From the Old Mission, which is now the terminus of the narrow-gauge road, the ores are taken by steamboat and barges down the Cœur d'Alene River, and up the lake to Fort Cœur d'Alene, where connection is made with the Spokane Falls and Idaho Railroad, running from Fort Cœur d'Alene to Hauser Junction,

on the main line of the Northern Pacific Railway. This arrangement enables the mines to send out and bring in their freight, but it is not satisfactory. There seems to be an opening for a line from Spokane Falls directly into that country. It would cost \$20,000 a mile, by Mr. Mohr's calculation, and would be seventy-five miles long. If, however, it be true, as reported, that the Northern Pacific Railroad will make a cut-off from Missoula across the Cœur d'Alene Mountains, this field will be occupied; which, however, is not probable.

The Chewelah, Colville, Summit, Metalline and Kootenai mining districts could all be reached by a line from Spokane Falls by way of Colville and Little Dalles. And by running a spur from Colville to a point below Kettle Falls on the Columbia River, control could be gained, first, of the navigation between Mahkin Rapids and Kettle Falls, and also the long stretch of navigable river from the Little Dalles to Death Rapids in Canada, crossing the Canadian Pacific Railroad at Farwell. It is calculated that 750 miles of navigation would thus be opened by the addition of a piece of track twenty-five miles long, connecting the Kootenai River with Arrowhead Lake.

A new discovery of silver-lead ores, made on

the Kootenai Outlet River, is making a great stir just now. The body of ore is said to be the largest yet discovered. We shall expect the Manitoba people to be looking into this development. There is also some talk of the mining region on both sides of Kettle River, near the Canada line. The Pend d'Oreille district is also promising. All this is suggested as food for thought and investigation.

CITIES AND TOWNS.

THE location of Port Townsend puts that town out of the general competition. The same is true of Olympia. Whatcom, or some possible town near the line between Whatcom and Skagit counties, might grow into consequence if made the terminus of some trans-continental road. This point, however, is involved in the larger question of the course of the Manitoba Railroad. With the present outlook, the only two competing towns on Puget Sound are Tacoma and Seattle. The former has the advantage of being the terminus of the Northern Pacific Railroad, and of having large private capital to advance its interests. These have made the town all that it is. It is handsomely laid out, and well built. It has an elegant hotel, and a population said in Tacoma to be 12,000, and in Seattle to be 7,500. The harbor has water enough, but the landing is bad ; there being no level ground available for wharves or business houses near the water. A mere roadway, cut out of the high bluff, furnishes the only line of communication. The town is one

The only
competition is
between
Tacoma and
Seattle.

to two hundred feet above the water and above the main railroad depot, and must be reached by a long, steep road. Tacoma is twenty-six miles farther from the sea than Seattle, has a back country of inferior resources, and has no advantage in distances from the East.

Advantages of
Seattle.

Seattle has already been described. It has probably double the population of Tacoma, and more than double the business. It has flat ground enough for commercial purposes. In its position, its harbor, its relations to the back country, its materials for trade, commerce, manufactures, its present and prospective railroad connections, it surpasses all present and future competitors on Puget Sound.

There will be mining and trading towns at numerous points between Seattle and Salal Prairie.

Towns of East
Washington.

The towns on the east flank of the Cascade Mountains may have a future; *i. e.*, Cle-ellum, Ellensburg, and North Yakima. They have a chance for the State capital, and there may be manufacturing as well as mining towns near the iron ore, and other mineral beds. Small places will also spring up at the mouth of the Wenatchie and the Okinagane, and at the termini of the steamboat landings.

The county seat of Lincoln cannot remain



VIEW OF THE CITY OF SPOKANE FALLS,
EASTERN TERMINUS SEATTLE, LAKE SHORE AND EASTERN RAILWAY.

at Sprague. Wheatland would have a chance for that.

Assuming that Spokane Falls is the objective point of the Seattle Railway, I will give a somewhat full account of this thriving young city. In 1882 it had 700 inhabitants; in 1887 it had over 7,000. In 1883 the Northern Pacific Railroad reached there, and since that date the town has grown continuously. It will be a large city, as will be obvious if its advantages be considered. These are chiefly: I. Its water-power; II. Its agricultural relations; III. Its mining surroundings; IV. Its railroad prospects; V. Its good ground for building.

Spokane Falls
and its
fine prospects.

I. ITS WATER-POWER.—The value of this water-power arises partly from the volume of water and its great fall, and also its uniformity, and its freedom from disturbing causes. The river falls in a succession of cascades amounting to 156 feet within the limits of the city. Mr. Paul F. Mohr has published an intelligent article on the subject, from which I quote the following statements:

Mr. Paul F.
Mohr's article.

“To arrive at the available number of horse-power which the Spokane River could furnish at this point, assuming 90,000 horse-power as the gross power of the river, and deducting 60 per cent. therefrom, would leave 36,000 horse-

power as a most conservative and minimum estimate.

"The City of Minneapolis used in 1880, as nearly as I can ascertain, about 20,000 horsepower, and Minneapolis is probably the largest flour-milling point in the world.

"The industries requiring most power are, in their order, as follows: lumber, flour, iron and steel, paper, woolen goods and worsted goods, with several industries consuming a comparatively small amount of power, not necessary to mention. Of the industries above named, all but the iron and steel industries can be followed at this point, and, in fact, the flouring, paper and woolen industries belong to this section of the country."

It is claimed that the Spokane River at the falls never rises more than six feet, and never freezes. The river here has cut so deeply into the basalt, that there must be combination among the riparian owners in order to draw the water to good mill sites, and invite manufacturers to use the power. Mr. Mohr urges this.

Two flour-mills are now there turning out about 450 barrels of flour a day; also saw-mills, and, I think, a dynamo for electric lights, etc.; but, of course, these use but a small part of the power, which, if fully utilized, in such ways as

are suggested by Mr. Mohr, would of itself create a large city.

II. AGRICULTURAL RELATIONS. — Spokane Falls has a promising agricultural country on all sides. The Pend d'Oreille region has good agricultural capabilities, though the best lands there are in the Indian reservation.

The country north of Spokane Falls, in the direction of Colville, is spoken of as a fertile valley, having more rain than the plateau country, much of it limestone soil, specially productive in hay and wheat. The wheat is harder than the plateau wheat, and contains a larger proportion of gluten ; hence it is desired as a mixture for the wheat that is usually brought to the Spokane Falls mills.

Turning to the great plateau, we find that the rich Palouse River country, since the construction of the Spokane Falls and Palouse Railroad finds its readiest market at Spokane Falls. And now that the Seattle, Lake Shore and Eastern Railroad is striking out through the Great Bend, another portion of this great producing region will be brought within easy reach.

III. MINING INTERESTS.—I need here only refer to the fact that Spokane Falls is situated centrally with regard to the mines of precious and base metals heretofore described. Evi-

dently the business from the mines of Chewelah, Colville, Little Dalles, Kootenai, etc., must come here except so far as it may be diverted to a tide-water city which would smelt their ores and sell them goods. No doubt the Canadian Pacific will handle some of the business of the Kootenai mines. Similar remarks may be made with regard to the mines of the Cœur d'Alene country, with the qualification that a road crossing the mountain, say to Missoula, would divert some of the trade to Helena or Butte City.

The miners of Okanogan, Methow, etc., would be nearest to Spokane Falls, but would be 100 or 150 miles on the way to Puget Sound, which would divide the trade.

IV. RAILROAD PROSPECTS. — The Northern Pacific Railroad, a transcontinental line, already passes through Spokane Falls. If the cut-off through the Cœur d'Alene country should be made, it would be equivalent to an additional road. The Spokane Falls and Palouse Railway joins the Northern Pacific at Marshall, only nine miles from the city, and its general course points directly toward it.

The road across the Great Bend has been commenced. The road to Colville, Little Dalles, etc., will inevitably be made at an early day.

This would make it really the centre of six roads, counting the Northern Pacific as two.

V. BUILDING GROUNDS.—The city is built and building on both sides of the river, and stands on a level, dry, gravelly plain, a mile or more in width, rising into wooded hills. In other words, it has all that can be desired for situation.

Sprague, Colfax, and Lewiston claim attention as indicating the points in a proposed branch line of railroad, leaving the Seattle, Lake Shore and Eastern Railway somewhere in the Great Bend country.

Sprague, Colfax,
and Lewiston.

Shops of the Northern Pacific Railroad are in Sprague, which fact is an endorsement of the locality. Its population is over 1,500. The town standing in a coulée, there are no indications of fertility of soil in sight. Here the timber belts seem to end, and no trees are seen for 100 miles eastward. It occupies an intermediate position between the great wheat areas of Whitman County on the south and of Lincoln on the north. Stage lines leave here for Colfax (south) and for Davenport and other towns in the Great Bend (north), and also for the Okanogan mines.

Colfax is about forty miles southwest from Sprague. It is on the Palouse River, in a

narrow valley where there is scarcely room for a town. The bordering hills are steep; the surrounding country is some 400 or 500 feet higher than the town. It is claimed, however, that there are good grades to be had for railroads going in any direction. The town has a population of 1,800 to 2,000, and is evidently prosperous. It has water-power and wheat-mills. The railroad agent in the town says that his cash receipts for freight average \$1,200 a day. Knapp, Burrell & Co. told me that they brought in 672 carloads of freight annually in the regular course of their business. I felt surprised at the statement. This firm does a farmers' business in barbed wire, wagons, all sorts of agricultural machinery and implements, grain-bags, etc., etc.

Mr. Hamilton imports groceries to the amount of \$75,000. Coal is \$12.00 a ton. Lumber is scarce and high, and freights enormous. A citizen told me that he had paid \$64.30 freight from Portland on a lot of lumber that cost \$34.90 in that city. Another marvelous story was that a citizen paid \$5.00 a ton for coal in St. Paul and \$20.00 a ton to bring it to Colfax.

Notes on the
Colfax country.

In asking about the surrounding country, I made the following notes: One-half the country is arable. The non-arable land is grazed by

horses, sheep and cattle. Wool, an important item. Of the arable land, one-tenth is under the plough; of this, three-fourths is put in wheat, and one-fourth in oats and barley—more barley than oats. Very fine root crops. Average of wheat, 30 bushels per acre; oats, 50 to 60 bushels. Price of wheat, 45 cents; freight to Portland, 20 cents, making \$6.60 a ton. Peaches mature. Can raise corn, but it does not pay to shuck it. There is a continuous wheat area of 70 townships, equal to 2,520 square miles, taking in a little of Idaho.

Lewiston, in Idaho, came into being during the days of placer mining, and now depends on agricultural business. It has about 1,000 people, and may become important by reason of its location at the junction of the Clearwater and Snake rivers. The transcontinental line that may some day be built through Wyoming might pass through Lewiston.

Lewistown.

Walla Walla is the oldest, and was long regarded the best of all the towns of East Washington. It is beautifully situated in a fertile country; has about 5,000 inhabitants; is well laid off and built, and has a more staid and settled population than any other town there. This is true, also, of the farming population around Walla Walla, many of whom have comfortable

Walla Walla.

homes. The town has some water-mills; and an astonishing amount of "truck" is raised and shipped in this neighborhood. The city has not grown much of late, and, except its agricultural surroundings, there is nothing especially to give it prosperity.

BRANCHES AND ROUTES FOR THE SEATTLE, LAKE
SHORE AND EASTERN RAILWAY.

Railroad
branches.

The building of the West Coast Railroad will be a happy circumstance for the Lake Shore road. Skagit County, and especially Whatcom County, have large resources, and the preoccupation of this ground may discourage other parties from any attempt to build up a commercial city on Bellingham Bay. A branch from the Northern Pacific at the Common Point to Salal Prairie would not hurt, and might help the Seattle, Lake Shore and Eastern road.

Besides the short spurs to the mines on the west side of the Cascade Mountains, there may be needed branches up Cle-ellum, and other rivers, to mines. I cannot see the wisdom of a branch to the Walla Walla country, which could be reached only by paralleling the Northern Pacific down the Yakima River, or else by striking off in the Great Bend, and crossing the

Northern Pacific and its Palouse branch, and then Snake River, to reach a country already occupied by the Oregon Railway and Navigation Company, and lying over 100 miles nearer to the tidal market along a down grade, than by the Seattle road with its mountain crossing.

A branch into the Palouse country would have more to recommend it. It is nearer, and competition will be on more equal terms. There are now three railroads in the Palouse country: namely, the Oregon Railway and Navigation Company's road from Palouse Junction to Moscow, Idaho, passing through Colfax; the Farmington branch of this road, from Colfax to Farmington, and the Spokane and Palouse, which runs from Marshall, on the Northern Pacific, to Genesee. But a road passing through Sprague and Colfax to Lewiston would cross some rich, unoccupied territory, and everywhere would compete for business on fair terms.

The Palouse
country.

Whilst I was in Colfax, at my suggestion, the town was canvassed as to the annual amount of its freight. The aggregate amount paid by fifteen firms reached \$200,000, and the balance was estimated at \$25,000, making \$225,000. Five firms claimed to handle annually 2,075,000 bushels of wheat, making 62,250 tons. These

figures seem large for so small a place as Colfax.

The length of this branch would, of course, be affected by the location of the main line across Great Bend. If the main line should take the route preferred by Mr. Mohr, Wheatland would probably be the nearest starting-point. This would be all the better for Spokane Falls; but for the long haul to Puget Sound, it would seem to be more desirable for the junction to be farther west.

Arguments for
the Polouse
branch.

To my mind, the chief arguments for building this branch are, first, that it would be a start for the transcontinental road across Wyoming and Nebraska, and then, so to speak, it would be stretching out one wing of the bat with a view to catching the Manitoba bug.

The other wing of the bat would be the Colville branch. The eccentric bug would inevitably hit one or other of these wings, and when once caught, would be held.

Manitoba rail-
road.

Concerning these Manitoba people, we may assume that they will think with regard to the routes according to the facts of nature. The direct line across the Kootenai country would strike the Colville branch, but in the opinion of able engineers the difficulties are so nearly insurmountable, that this is least likely to be

chosen of all the routes. The cut-off from Missoula to Spokane Falls by way of Lake Cœur d'Alene, seems manifestly the best route for this road, that is, if it be not already pre-empted by the Northern Pacific; but strong reasons are given to show that the Northern Pacific will not, and cannot, make this cross line; in which case, we might almost conclude that the Manitoba will cross here, and inevitably join the Seattle road.

The only other crossing left would be the Lolo Pass, which would be still more out of their direction, and would give them no better chance for an independent line to tidewater than the more northern routes. The fact is, that the late strategic movement of the Seattle railway in seizing upon the key to the Great Bend country made it master of the situation.

SUPPLEMENTARY CHAPTER, GIVING LATEST INFORMATION.

Rapid growth
of Seattle
and
Spokane Falls.

It is now just one year since I left Washington Territory, and I am glad to be able to report, on the best authority, that the great interests heretofore described have progressed, some of them with accelerating speed. The city of Seattle has added 10,000 to her population, and Spokane Falls 5,000 to hers.

Mining has spread its area, multiplied its diggings, and gone forward at every point amazingly. Agriculture during the past year has not advanced with equal rapidity. This is easily accounted for by the influences of the mines and cities. The crops were fair, but not as large as in some former years; but no fears need be entertained with regard to this great interest.

Change in
the location of
the railroad.

The trunk line of the Seattle, Lake Shore & Eastern Railway will cross the Cascade Mountains at Cady's Pass instead of at Snoqualmie Pass as originally designed, and reach the Columbia River by the Wenatchie Valley. Crossing the great river near the mouth of the Wenatchie, where it is thought that a city will be developed, and passing along the northern limb



VIEW OF SEATTLE AND THE HARBOR, WASHINGTON TERRITORY, SHOWING DOCKS
OF THE SEATTLE, LAKE SHORE AND EASTERN RAILWAY.

of the Great Bend country, it will connect with the other end of the road which is now under construction to Wheatland.

A report from Paul F. Mohr, chief engineer, in regard to this new line, is embraced in this chapter. Something is said about the Wenatchie Valley, also, by Mr. Whitworth.

But the original line is by no means abandoned. It has probably reached Hop Ranch before this time, and will be continued through the great timber belt, passing Salal Prairie, at least as far as the iron and marble beds on Mt. Logan. No doubt in time the road will cross Snoqualmie Pass, and continue to the mineral beds on the Cle-ellum and elsewhere.

I have obtained the following interesting and valuable reports from Mr. Whitworth, who has been frequently mentioned in this report, Mr. Routhe, president of the Board of Trade of the city of Spokane Falls, and Paul F. Mohr, Esq., chief engineer.

REPORT FROM F. H. WHITWORTH, ESQ., CIVIL AND
MINING ENGINEER ON SEATTLE, ETC.

SEATTLE, W. T., Oct. 2, 1888.

I now proceed to answer your questions.

1. Present population of Seattle, and commercial growth?

Population of
Seattle.

New manufac-
turing estab-
lishments.

A census was taken in June of this year, and the total enrolled was 19,700. I presume it was safe to say that the population then was 20,000, and that now it is from 22,000 to 25,000, for although houses have been built very rapidly, there is not a house, or a room hardly, that is not occupied. There are now seven brick-yards in operation, each manufacturing from 10,000 to 50,000 per day. Two boiler-works have been added to the manufacturing interests since you were here. Three saw-mills, besides four on the line of the Seattle, Lake Shore & Eastern Railway between here and Gilman, have been built, and all have more than they can do.

A new fish-canning establishment has been started, and is in successful operation. A pile-creosoting works, an extensive shipyard works, a shingle mill, and a timber-preserving works and saw-mill are all under way on the north side of Salmon Bay.

New steamers.

The *Alaskan* and the *T. J. Potter*, two magnificent steel steamers, and the *Harry Bailey* and *Hassalo*, good-sized passenger steamers, besides three or four tugs, and an extra steamer on the Alaska route, as well as an extra steamer every second or third week for freight from San Francisco, have been added to the Seattle fleet since you were here.

2. The Moss Bay Company.

There seems to be no question but that the location on the eastern shore of Lake Washington is definite. A contract has been made with Denny, and with those holding with Guy, but not with Guy himself. I understand that no contract has been made with, or for, any other one, although Mr. Kirk has been and is still examining all other places.

The
iron company
at work.

Mr. Kirk, and Mr. Williams, another of the firm, are living on the grounds at Kirkland, and have a force of men preparing the grounds, the position of the different buildings having all been located. Brick and other material is being placed on the ground.

They have entered into contract to roll for the Seattle, Lake Shore & Eastern Railway 30,000 tons steel at Kirkland, to be delivered within the next twelve months. They, however, will bring the blooms from Moss Bay for this.

Coke is the fuel Mr. Kirk wants, and thinks he will have. But I do not think that the question of coke supply is settled yet. Mr. Kirk's property that we visited (Section 2) is, so far, not developing as they had hoped. Mr. Kirk has disposed of his interest there. The Smith coking ovens that we visited at Wilke-

Coking coals.

son are still producing a small amount of coke. One or two other veins have been opened at Wilkeson recently, and the company opening are proposing to put up ovens, and work and coke their coal. It probably will make about the same quality of coke as the Smith mine. The only coal that has been analyzed and stands that test for coke, is Section 34, near Kirk's Section 2. We got some samples of it, you remember.

The Snoqualmie coal has been taken possession of by a Mr. Niblock, who talks now of going to work to open. That, you know, cokes well in the open air.

The following is the cross-section of our best veins at Ruffner, or Raging River, Section 16. Roof, sandstone :

	FT.	INS.
Mixed Coal and Slate	1	2
Coal (clean)	3	1
Rock		3
Coal		6
Rock		6
Coal	1	3

Total, coal, 4 ft. 10 in., rock, 9 in.; which seems to be very strong coking coal. This bench can be worked to advantage, I think.

We have another, also, of about three feet of coal, clean, and it is underlaid with three feet of

fire-clay, which probably will be as valuable as coal. I have burned some of the brick, and sent some away to be tested.

No further discovery has been made in the neighborhood of the Denny or Guy mines. At the "Chair Peak" Iron Mines, owned by Mr. Wilson, Kelly, *et al.*, as they have examined further, the deposit has shown itself much larger than at first supposed. It is about two and a half miles from the Guy lode, on Mt. Logan.

Some quite extensive iron deposits have been discovered on the west side of the Sound, nearly due west from Seattle. They have not yet been analyzed.

New discoveries
of iron ore.

What is thought to be a very rich deposit of iron has just recently been found on one of the islands in the San Juan group, within the territory of the United States, said to equal the Texada deposit in British Columbia, which the iron works at Irondale, near Point Townsend, use. The Irondale furnace commenced work again about a month since.

In regard to the precious metals: there have been no developments of importance on this side of the mountain.

The Okanogan, Salmon River, Cœur d'Alene and Colville mines promise richer and richer as they are more developed.

Lumber business
growing.

4. The activity in the lumber business is unabated—is on the increase. The increase of the lumber mills, that I have mentioned in the first part of this letter, indicates *that*.

The traffic on the railroad, both in logs and manufactured lumber, is much larger than had been anticipated, and is increasing. In July the road hauled 2,843,464 feet of logs. September log haul was about ten per cent. greater. I could not get the exact figures to-day.

Population and
freights in-
creasing.

5. Spokane Falls is still growing very rapidly, and now claims 12,000 to 15,000 inhabitants, and is building very substantially. Along the line of railroad on this side of the mountain the country is filling up, of course, with small ranches or home-makers, and those already on the line are making increased clearings, and will therefore have more to ship.

The following shows something of what is being done in July: "Coal freight, 2,750 tons; miscellaneous, 3,090; passenger traffic, \$6,150; and the advance has been about the same as in logs, except on coal."

Labor strike at
Gilman Mine.

[6. Mr. Whitworth next gives an account of certain difficulties and troubles, chiefly with miners, which ended in a "strike" that was somewhat prolonged, but he thought the men would soon go to work on the company's terms.

Of course, the high hopes concerning these mines (Gilman) had not been realized. Mr. W. proceeds as follows :]

On the Smith, or No. 4 vein, we had just got the gangway driven far enough to turn rooms. The Andrews vein we were driving the gangway entirely in the coal, but were not yet far enough to turn rooms. Nos. 1 and 2 veins had gotten, with the gangway, well in under the hill, and was looking very fine, and turning out good coal. With the prospect of No. 4, or Smith vein, and Andrews vein, I am still well pleased. On the vein in Section 26, just across the valley, I have started in a tunnel to open it; have already driven about sixty feet through the rock, and have about seventy feet still to go. This tunnel is still going on, not having been stopped by the 'strike.'

Gilman coal
seams.

The West Coast Railroad is completed to Snohomish City, and trains run regularly, the bridge across the river being completed only about ten days ago. Both passenger and freight traffic is much larger than anticipated. They are grading, and expect to have ready for service yet this fall, five miles beyond Snohomish. Along most of the entire line the timber is very fine and abundant, and a great deal of the land adjacent is rich agricultural.

Progress of the
West Coast
Railroad.

Resources
of the country
along the new
line across
Cady's Pass.

7. Concerning the new line across Cady's Pass and down Wenatchie Valley.

[After some remarks respecting grades, etc., Mr. Whitworth proceeds as follows :]

On this [west] side of the mountain [Cascade] the timber reaches right up nearly to the summit, as in the Snoqualmie, and the reports are this region is rich in coal, and probably also in iron, with some indications of precious metals. Soon after crossing the divide the line will reach the very rich agricultural valley of the Wenatchie, which is called "the garden of Eastern Washington," and traverse its entire length. And it will pass within a comparatively short distance of the mineral districts on the northern slope of that range called Mt. Stuart.

I have heard that there were numerous indications of coal near the mouth of the Wenatchie on both sides of the Columbia. This, too, will be the nearest main line to the rich mineral district of Salmon River, or Okanogan, as well as all that northern mineral belt which extends to the Rockies, and will strike the heart of the Big Bend wheat-fields. It will also be eighty miles shorter than the other line. True, Ellensburg and the Cle-ellum district will be missed, but I think this will be more than compensated for by those I have spoken of.

8. Of the progress of the work.

On this side of the mountains no work except surveys has been done on this line. At Spokane Falls the bridge across the river, and about forty miles of track is finished, and they are now operating, I believe, with very encouraging prospects. On the Snoqualmie line they are pushing on. The trains now run regularly to Raging River. The bridge across that stream is not yet completed, but will probably be by the 1st of November, and it is expected that the trains will be running to the Hop Ranch by December 1st.

Progress
in building the
road.

The branch or spur up Raging River to the Ruffner mine, on Section 16, is located, and some little work has been done, but it is not being prosecuted at present, so I do not expect we will be able to get out any coal from there before next spring or early summer.

Another item showing the prosperity of Seattle, is the opening of a five-mile circuit of cable road to Lake Washington, which occurred last Saturday. I will send you some papers giving some items that may be of interest.

Cable Railway
in Seattle.

A syndicate of men prominent in the Southern Pacific Railroad management purchased Milton Point, the land directly west, across Seattle Bay, from the town, and are clearing it

Southern Pacific
Railroad sup-
posed to be com-
ing to Seattle
Harbor.

off, and say they will make extensive improvements over there in the near future. They are building a large ferry steamer, and have a franchise to run a ferry hourly between town and the front. It is to be on the route by December 1st. Report says that the Southern Pacific is coming in there.

At Smith Cove quite a little town is building up, and property is advancing all around there.

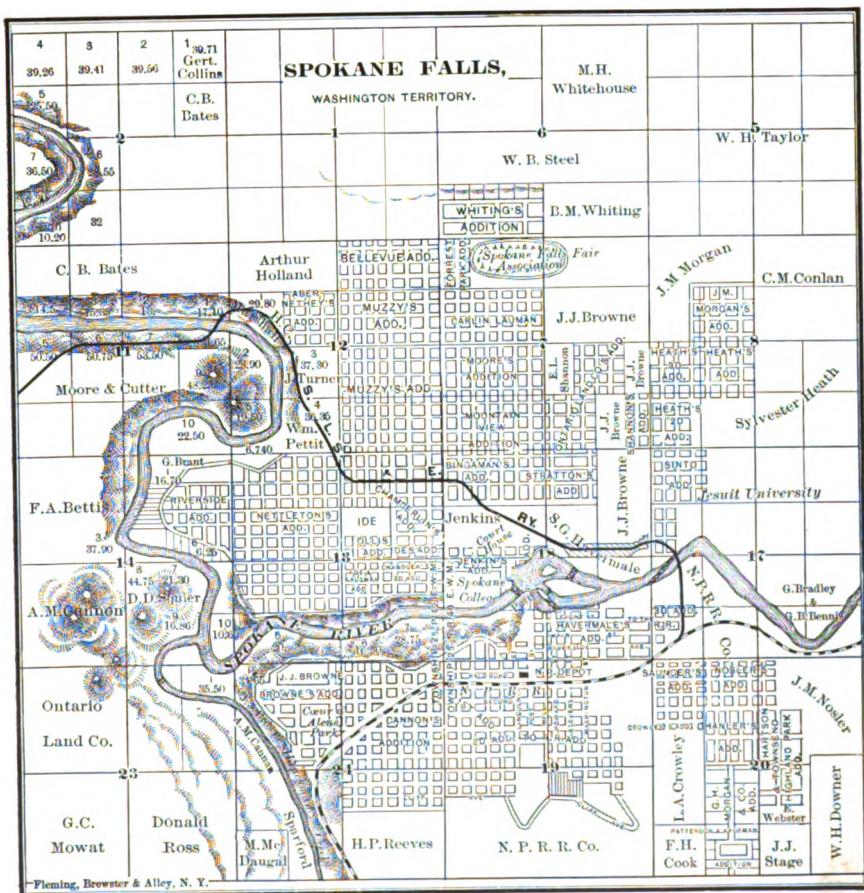
REPORT FROM E. A. ROUTHE, ESQ., CONCERNING
SPOKANE FALLS, ETC.

SPOKANE FALLS, Oct. 17, 1888.

Growth of Spo-
kane Falls.

Our city has progressed in growth splendidly since you were here. There are now fully 13,000 inhabitants. The census of July 1st showed 12,000. About \$1,500,000 have been expended in buildings this year. Eight business blocks of brick and granite have been built this season. One of these cost \$150,000. Four of these blocks are three stories, three are four stories, and one five stories.

Forty miles of the Seattle, Lake Shore & Eastern Railway will be completed between here and the Big Bend by December 1st. The iron,



engines and cars are nearly all here, and the farmers in Lincoln County are greatly rejoiced at the opportunity for shipping their grain and stock to market.

The development in the mines this year has been greater than all the work done heretofore. The gold mines near Murray, Idaho, have yielded beyond the hopes of all interested in them. I saw four gold bricks, at the First National Bank, said to contain \$37,000. These were from one mine, a South Fork mine of the Cœur d'Alene.

Prodigious
development of
the mining in-
terest.

The Kootenai country is now reached by steamer after leaving the Northern Pacific road at Sand Point. A good deal of development work is progressing, and the ore is being shipped out daily. It is mostly silver-bearing galena. A new town just above the British line on the Kootenai Lake has been started. It is called "Nelson." I shall send you some formulated data at an early date.

The crops have been good, though not so good as last year. Emigration to the farming sections does not come in as fast as we would like—in fact, not as rapidly as to the towns. I think it will be better after the election.

REPORT FROM PAUL F. MOHR, ESQ., CHIEF ENGINEER
OF THE SEATTLE, LAKE SHORE & EASTERN RAIL-
WAY, CONCERNING THE CADY'S PASS AND WENAT-
CHIE ROUTE.

SPOKANE FALLS, W. T., Dec. 3, 1888.

The following is a report of the proposed line
from West Coast Branch to mouth of We-
natchie River :

I. ENGINEERING FEATURES.

Engineering
details of the
new route.

The proposed line will leave the West Coast Branch at a point six miles south of Snohomish City, running east, crossing the Snohomish River on drawbridge at the junction of the Snoqualmie and Skykomish rivers: thence up the right bank of Skykomish on a 1 per cent. (52.8 feet per mile) grade, a distance of forty miles from point of beginning. Thirty-five miles of 2 per cent. (105.6 feet per mile) grade carries the line to Cady's Pass and mouth of tunnel. The tunnel will be 3,500 feet long, in granite rock; probably little or no lining will be necessary.

Descending to the east by a 2 per cent. grade, following the Wenatchie River, a distance of twenty miles. Descending and level grades alternate for the next twenty-five miles, where 1,000 feet of tunneling will be required in the

divide between the Wenatchie and Chumstick rivers. This tunnel saves eight miles of distance in the following eighteen miles, and avoids entering the box cañon of the Wenatchie, a difficult and expensive piece of work.

The development in the Chumstick valley is especially easy. Thence into the Wenatchie valley again, on a 1 per cent. grade, a distance of twenty-seven miles, to the mouth of the Wenatchie River.

A summary of the distances and grades shows a very prettily balanced scheme for operating cheaply and effectively.

SUMMARY OF DISTANCES AND GRADES.

	DISTANCE.	GRADE.
West Coast Branch to end of 1% grade,	40m.	× 1%
End of 1% grade to tunnel,	35m.	× 2%
Tunnel section,	3,500 ft.	
Tunnel to foot of 2% grade,	20m.	— 2%
Foot of 2% grade to Wenatchie	52m.	— 1% (or less.)

The introduction of 1 per cent. grades, though higher than the water grades of the Wenatchie and Skykomish rivers, is justified as balanced against the 2 per cent. mountain grades and the saving effected thereby in the bench country, which prevails along both rivers mentioned.

While tunnel is being driven, a 4 per cent.

cross-over through Cady's Pass can be cheaply put in if necessary.

II. RESOURCES.

Mr. Mohr's
account of the
resources of the
new route.

West of the Cascade Range the road will pass through a densely wooded district, through which, with the additional aid of transportation facilities by river now existing, an immense logging industry will be created. The red fir and white cedar now being taken out are superior in quality to those of any section of this coast. Each mile as opened will therefore become an immediate source of income. Considerable prospects and discoveries of gold and silver have already been found, and a number of men are now at work making such developments as are practicable in the absence of transportation facilities. With the opening of the road a heavy mineral traffic will be developed in the future.

Near the summit large deposits of iron are sure to be found, judging from the extraordinary local magnetic variations.

Twenty miles west of the summit are iron-soda springs, which will no doubt become quite famous.

East of the Cascade Summit the country tributary to the road is covered with open, fine

forests; the timber is principally second growth yellow and black pine, in tall and straight trees, forming very valuable timber. This prevails for forty miles east of the summit. The remaining country to the mouth of the Wenatchie River is rich agricultural land, fairly well settled up between the Cascade Summit and the mouth of the Wenatchie River.

Very extensive indications of coal and iron are found; and along all of the tributaries of the Wenatchie considerable deposits of precious metals have been discovered, which will no doubt be rapidly developed in the future.

This entire section of country has been well known to miners and prospectors for the past twenty years, but the total lack of transportation facilities has thus far prevented any considerable development of mining properties.

At the confluence of the Wenatchie River with the Columbia River (which will likewise be the crossing point for the Seattle, Lake Shore & Eastern Railway) we find the Columbia River is navigable as far up as the Okanogan country. A large city is destined to spring up at this point, which will control, by means of the Columbia River, a very extensive tributary country.

The valleys of the Entiat, Chelan, Methow,

Okanogan, and other rivers, which drain an extraordinary mineral belt, with occasionally fine districts of agricultural land, will provide an enormous quantity of freight for the road. None of this freight will be able to find an outlet except by this road, by reason of the fact that very swift and rocky rapids, which begin about twelve miles south of our crossing and continue for some fifty miles, will for at least a great many years prevent practicable or profitable navigation to points below our crossing.

III. SCENERY.

The æsthetic side of railroading has undoubtedly a large commercial value, and in this instance it will be secured without additional expense. It will certainly prove a valuable factor in the obtainment of passenger traffic. From the city of Seattle to the Columbia River an ever changing succession of magnificent and surprising views will meet the eye of the traveler. Indeed, I believe that the scenic attractions of the Seattle, Lake Shore & Eastern Railway will stand pre-eminent among all the railroads on this coast.

Mr. Mohr's report opens up a region almost unknown heretofore, which is shown to abound

in the finest timber, to possess superior agricultural lands, and to give indications of rich deposits of coal, iron, and the precious metals.

All the reports I have seen from Washington Territory confirm the impressions I first received in regard to its wonderful resources.

W. H. RUFFNER.

LEXINGTON, VA., Dec. 13, 1880.

SEATTLE, W. T., Jan. 9, 1889.

DR. W. H. RUFFNER.

Dear Sir : In relation to your request for such additional data as may be of interest in connection with your Report, especially such data as relate to the changes in population since the time of your visit here a little over a year ago, likewise relating to new developments in the plans of the Seattle, Lake Shore & Eastern Railway Co. and other matters of interest, I respectfully state the following :

The immigration into Washington Territory since December, 1887, has been very heavy, and while there are no statistics showing the number of immigrants, except such as have

taken up their residence in the towns and cities, I am, I feel sure, not far from the truth, when I estimate their number at 65,000. Of this number,

Spokane Falls has received about	. .	8,000
Seattle	" " "	. . 10,000
Tacoma	" " "	. . 7,000

The remaining number may be assumed to have been distributed about as follows :

To the various small towns east of the Cascade Mountains . . .	7,500
To the various small towns west of the Cascade Mountains . . .	6,000
To the agricultural and mining regions east of the Cascade Mountains .	16,000
To the agricultural, timber, and mining region west of the Cascade Mountains	10,500

The usual proportion between the populations of country and towns in Western States and Territories is as three to one (roughly estimated); this would indicate that the towns and cities have received more than their fair proportion of the entire immigration, and this is true. The consequence will, therefore, undoubtedly be that of the immense immigration predicted for the year 1889 a correspondingly larger percentage will reach the rich agricultural,

mineral, and timber lands of Washington Territory, and thus restore the proper balance.

Since Mr. Whitworth's report and yours, an additional cable railroad and an electric street railway have been started at Seattle, and quite a number of new enterprises have been commenced.

At Spokane Falls considerable terminal facilities for the Seattle, Lake Shore & Eastern Railway have been added, a system of warehouse and mill tracks has been agreed upon between the Northern Pacific Railroad Co. and the Seattle, Lake Shore & Eastern Railway Co. to be built and operated jointly by the two companies, a new cable street railroad has been projected and partly built, and about five miles of street railway has been placed in operation. Extensive improvements in the development of the water power are in progress, several new bridges have been built, and a general air of prosperity pervades the place. To indicate the importance of the business of Spokane Falls it is only necessary to state the fact that this city has paid nearly \$1,750,000 to the Northern Pacific Railroad during the year 1888 for freights and passages.

The Seattle, Lake Shore & Eastern Railway Co. has decided to build a branch line from

some point near the crossing of the Grand Coulee to the Okanogan mines (Conconnully district), about seventy miles, work to be commenced as soon as the main line shall be completed. This feeder will command a very extensive business, perhaps equal to the enormous business of the Cœur d'Alene mines which is now enjoyed by the Northern Pacific Railroad.

Since Mr. Whitworth's last report to you, considerable development work has been done upon the Grand Ridge mines $2\frac{1}{2}$ miles east of Gilman and adjacent to our railroad; the vein developed is four feet thick and furnishes a hard, compact coal, superior for domestic purposes to any coal yet found in that section. Shipments commenced last month, and the prospects for a heavy output are very flattering.

The Spokane Division of the Seattle, Lake Shore & Eastern Railway, extending from Spokane westwardly, a distance of forty-five miles, is practically finished; trains are running regularly, and as soon as our motive-power and cars can be disengaged from the work of "ballasting" we will be able to do considerable business.

Very respectfully yours,

PAUL F. MOHR,

CHIEF ENGINEER.