CHANGING SPATIAL PATTERNS IN THE LODE-METAL MINING INDUSTRY OF BRITISH COLUMBIA: 1887-1945

by

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The economic geographic evolution of the lode-mining industry of British Columbia between the middle of the nineteenth century and the end of World War II is examined, with the particular aim of explaining changes in the spatial pattern of producing mines. An analysis of spatial change is carried out within a framework of six time periods delimited by rapid shifts in the level of metal production or by major changes in ownership patterns. For each period, the economic performance of the industry and the distribution of producing mines are described, and the factors which account for economic and geographic changes are explored.

The British Columbia lode-mining industry between 1887 and 1945 greatly increased its output and the number of metals produced, and expanded geographically within the province. The performance of the industry was critically affected by the availability and strength of external markets, and by the availability of transport linkages between those markets and the province itself. At no time was local demand sufficiently high to warrant the large-scale development which occurred. Furthermore, despite the scale of response to external demands, the lode-metal resources of the province seem never to have been sufficiently attractive to stimulate major transport construction by themselves, so that large-scale mining occurred mainly near tidewater or existing railways. This handicap is reflected in the relatively limited geographical expansion which took place between 1887 and 1945.

Accentuating the problem of distance from markets was the fact that the industry became increasingly dependent on lower grade deposits,
which required sizeable applications of capital and advances in
technology for successful exploitation. These conditions led to
an early domination of the industry by major mining corporations,
whose financial strength and technical expertise were crucial in the
subsequent course of development. Examination of their influence
leads to the major concluding thesis of this study, namely that
further empirical study of mining geography and any restatement of
location theory for mining activities should take the corporate
organization of the industry as a starting point.

The evolution of the lode-mining industry is compared to that of
other export-oriented resource industries in the province, and is
shown to conform to the major periods which have been identified in
other studies as characterizing the evolution of the provincial
economy as a whole. Finally, some suggestions for further research
are made, the most important being a closer examination of the role
played by major mining corporations in the development of the industry.
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CHAPTER I

INTRODUCTION

The development of the lode-mining industry in British Columbia from its beginnings in the middle of the nineteenth century to the end of the Second World War has been characterized by a greatly increased output, by a diversification in the number of metals produced, and by a geographic expansion into many areas of the province. This thesis is concerned specifically with changes that have taken place in the spatial pattern of producing lode-metal mines during this period, and with the major factors that account for these changes.

By focusing on the locations and changing patterns of producing mines, this thesis follows a central theme of mineral production geography. Moreover, by focusing on a wide range of metallic minerals, the thesis goes beyond the small number of minerals whose production has dominated much past research. Given the broad areal and temporal scales with which the thesis is concerned, the level of analysis is necessarily broader than that suggested recently by Wilson as being desirable for research in the field of mineral production geography. Nevertheless, given the almost total absence of geographical research on the mining industry in British Columbia, the thesis attempts to provide a needed geographical reconnaissance survey of metallic mineral production in the province and
Previous Studies

The empirical literature dealing with the geography of minerals is considerable. For the most part, however, the empirical studies can be grouped into a number of general types.

Firstly, there are a number of studies focusing on the regional impact of the mining industry. The majority of these studies deal with the economic impact of the industry, as in Deasy and Griess's work on anthracite coal in Pennsylvania, or Goodridge's examination of the once important tin mining industry in southwest England. A few impact studies, such as Doerr's work in Oklahoma, focus on the effects of mining on the physical environment, and on the cultural changes associated with the rise and fall of mining activity.

There are, secondly, a considerable number of studies which concern themselves with the delimitation of mineral producing regions and with changes in the relative positions of these regions over time. Miller's study on the mineral economy of the United States between 1939 and 1954, the early work by Tryon and McKenny, and later work by Roepke on regional shifts in coal production, are of this type.

Zimmermann's influence on the concept of resources--frequently cited as "Resources are not, they become"--can be seen as providing a third major focus for several studies on minerals. Studies such as that
by Hefford and Smith, Lloyd's work on iron ore mining in Norway, and Kohn and Specht's examination of taconite mining in the Lake Superior region, all illustrate an attempt to trace the relationships between mineral exploitation and changes in human needs, objectives, and technology.

The fourth major type of study, and the one to which this thesis belongs, is that which focuses on a particular mineral commodity and attempts to trace its development over time and space. The temporal and spatial scales of these studies varies considerably. While the majority deal with the mining of a particular mineral from its beginning to the present, a number focus on this activity over a segment of past time, and there are several studies concerned with "recent changes" in the spatial distribution of the mineral examined. In their spatial scales, studies of this type exhibit a similar variability, ranging from the world scale to the very local area.

All of the above types of studies, as well as some others, could be placed in the field of mineral production geography, as that field was defined by Murphy in 1954. Recognizing that mineral production is of interest to workers in several disciplines, Murphy noted that the geographer in the field "focuses on the spatial patterns and associations of mineral production. He is responsible... for the examination of mining as a part of the total geographic complex of particular regions."
In assessing the nature of research done in the field of mineral production geography since the publication of Murphy's paper, Wilson makes several important points. He notes, for example, that because the geography of mineral production has traditionally been regarded as a branch of economic geography, we might therefore expect to find concern with location and production somewhere near its core. Furthermore, in view of recent developments in geography generally, we might also anticipate some progress in the development of concepts and principles or the formulation of theory. By comparison with agricultural, manufacturing, transportation or marketing geography, however, mineral geography is conceptually underdeveloped, location is too frequently treated in a naive and jejune fashion, and the study of mineral production per se is meager in the extreme.  

Wilson also comes to the conclusion that studies of mineral production and of mineral producing regions have advanced little, if at all, beyond the stages of observation and description. "Rarely has there been any penetrating analysis of mineral production in its various aspects or of changes in production patterns which must lie close to the centre of mineral geography."  

In addition to Wilson's call for a greater emphasis on mineral production, for a greater concern with location, and for a generally deeper level of analysis in studies of mineral geography, there is a need also for a broader scope with regard to the specific minerals to be examined. In the empirical studies noted earlier, geographers have exhibited a wide range of interests in terms of areal and temporal foci.
Their concern for particular minerals, however, has been much narrower. The empirical literature on mineral geography is dominated by studies on iron, coal, and more recently, petroleum. Given the relative importance of these three minerals in the process of industrialization, this emphasis is perhaps understandable. It does mean, however, that geographical research on other minerals has been scarce, except in texts dealing with the geography of economic activity in general, or in regional texts where the study of minerals often does not go beyond the level of inventory.

Empirical work on the geography of mineral production of British Columbia is virtually non-existent. A few studies, such as those by White and McKechnie make passing references to major geographical shifts that have accompanied the development of the industry, but the emphasis in these studies is not geographical. A number of sources present maps of producing mines at given points in time, but to the author's knowledge, there are no studies concerned with the documentation and analysis of producing mine locations or with changes in these locations over time.

Methodology

Many economic geographers who have dealt with the historical-geographic development of a particular industry have divided the period of time over which such development occurred into a number of segments. Many have used what can be called a "periodization" technique to arrive at a set of time periods within which industrial and locational change...
can be examined. These periods, as Lukermann points out, should be seen as phases in the development of an industry within a larger economy, specified as to time and place.  

Frequently this periodization technique involves the segmentation of a study period on the basis of measures which indicate the performance of the industry. A variety of measures can be used, such as the volume of production, the number of producing units, and employment levels. On the basis of such measures, periods of major change or periods of stability may be isolated and the spatial distribution of the industry examined at the beginning or end of the periods, or at some point within them. In several studies, the use of single or multiple measures of industrial activity has yielded a set of periods which provide a meaningful framework for the description and analysis of industrial and geographic change.

In addition to or in place of the above measures, a number of other factors have been used for the selection of time periods. Major technological changes in an industry, for example, may lead to significant changes in the performance of the industry and can, therefore, serve as period breaks. This focus on technological change is used by Lewis in a study of the paper-making industry in the Maidstone area. Here, the development of the industry is divided into three technical phases on the basis of changes in the paper-making process and in the type of
raw material used.

Phases in the development of an industry may also be selected on the basis of shifts that have occurred in the dominant good produced by the particular industry. In his study of the mining industry of the Norte Chico, Chile, Pederson discusses mining development in four phases, the boundaries of which have been selected on the basis of the metals which dominated production from the industry.  

Organization or institutional changes may also be used to delimit periods in the development of an industry. In Waller's study of the North American aluminum-smelting industry, for example, the termination of monopoly conditions in the 1940's provides a meaningful starting point for an examination of later developments in the industry.

In short, a number of measures of, or major changes in, the development of a particular industry have served as a basis for periodization. Time-series graphs of production figures are, in many cases, sufficient to yield a number of development periods. In some cases, however, other measures can be used in conjunction with production data in order to support the choice of periods, to alter slightly the period boundaries, or to yield periods not revealed by the production figures alone but which were important in the development of the industry.

One of the major problems involved in using this periodization technique has been succinctly stated by Pounds in his study of the French iron and steel industry. Pounds noted that
It is difficult to divide the span of history into periods, each with its characteristic geographical pattern of distribution, because in each period there survived some elements of earlier patterns. A similar problem is expressed by Rodgers in terms of the Soviet pulp and paper industry. Here, he points out that post-war locational changes in the pattern of paper production were largely the result of the war and its aftermath, but that these changes "reflect locational trends that were already in evidence in the late thirties." One must realize, in other words, that boundaries in time can be periods of transition, just as boundaries in space can be zones of transition.

Despite this difficulty, the periodization technique can be justified as a means of ordering information for examination. Moreover, as Lukermann suggests, the purpose of this procedure is "to isolate 'phases' and 'gradients' of the developmental process in order to better identify and segregate causal factors and conditions ultimately influencing the location pattern of the industry."

In order to examine the historical development of the British Columbia lode-mining industry and the locational changes that have accompanied that development, the period of time encompassed by this thesis has been divided into six segments, each of which forms a separate chapter. Most of the periods covered in this thesis were selected on the basis of changes which took place in the production levels of the major metals. Most of the chapters, in fact, cover periods of time
bounded by years in which major changes occurred in the volume output levels of lead, zinc, silver, copper, or gold. These production periods were then examined in the light of major changes in the industry, such as technological advances, corporate organization, and availability of markets. With one exception, shifts in the volume of production provided meaningful periods in which to examine the development of the industry. In one case, where production levels of the major metals changed gradually, the formation of a major corporation was used as a chapter break. The periods used in the thesis are discussed in Chapter II in the context of a brief historical summary of the industry.
FOOTNOTES


17. M.G.A. Wilson, *op. cit.*


20. Some of the recent work by Odell on petroleum is worth noting. His study of the political factors involved in relations between the major oil companies and the producing nations is particularly interesting. See Peter R. Odell, *Oil and World Power: A Geographical Interpretation*, Penguin, Harmondsworth, England, 1970.


28. Peter Waller, *op. cit.*


30. Allan Rodgers, *op. cit.*


CHAPTER II

GEOLOGICAL AND HISTORICAL BACKGROUND

It is the purpose of this chapter to provide some geological and historical background to the study of the lode-mining industry which follows in Chapters III through VIII. The first section of this chapter indicates those areas where the potential for discovering different types of metalliferous deposits may be considered good, and where the bulk of productive mining may be expected to take place. The second section of the chapter presents a brief history of the lode-mining industry of British Columbia in order to indicate the periods within which the discussion of changes in the industry will be framed.

Geological Background

Lode-metal mining in British Columbia has been restricted to that large part of the province lying within the Canadian Cordillera. This region, made up of many physiographic units, has three major subdivisions, the Western, the Interior, and the Eastern Systems. (Map 1). These three systems are themselves broadly different in geological structure and in topographical character. The Eastern system, formed almost entirely of sedimentary strata, comprises the Rocky Mountains and the Rocky Mountain Foothills. The Interior system, made up of a mixture of volcanic, sedimentary, and metamorphic rocks, invaded by
numerous intrusive bodies, is a region of plateaus, low basins, highlands, and rugged mountains. The Western system, "though exhibiting a broad similarity to that of the interior areas, is dominated by great bodies of intrusive rocks lying mainly along its eastern flank."¹ This system includes the mountain ranges that extend along the entire coast of British Columbia, as well as the mountain ranges of Vancouver Island and the Queen Charlotte Islands.² Together, the Western and Interior systems comprise the Western Cordilleran Region, while the Eastern system forms the Eastern Cordilleran Region.³

On the whole, the Eastern Cordilleran Region, within which the Rocky Mountains are the dominant physiographic feature, has not been a significant area of metallic mineral discovery. The origin of many mineral deposits is traceable to igneous activity, and such deposits are usually found in mountainous areas or in the eroded bases of geologically ancient mountains; in the vicinity of igneous rocks; and commonly in older sedimentary or igneous rocks that have been metamorphosed and deformed.⁴ The Rocky Mountains, composed almost entirely of folded and faulted sedimentary rocks, are geologically the youngest in British Columbia. Thus, while igneous rocks may exist far below the surface of these mountains, the scarcity of such rocks at the surface indicates "that at the present stage in erosional history the Rocky Mountains are as a whole not favourable for the discovery of many mineral deposits."⁵
Only near Field, where one of the few surface exposures of intrusive igneous rock occurs, has there been any significant lode-mining activity. With the exception of this area near Field, "essentially all known metalliferous occurrences are in the western Cordilleran region." Mineral deposits are widespread, but metal mines and prospects have been particularly numerous in the areas that skirt the large body of granodiorite and related quartz-bearing plutonic rocks known as the Coast Range batholith. They have also been numerous in areas close to the two eastward projections of the Coast Range batholith. One of these projections includes the many stocks and smaller batholiths that extend along the Skeena and Bulkley Valleys towards Pinchi Lake: the other includes the major intrusions that extend from the Lower Fraser River through Nelson nearly to the Rocky Mountains. Most of the productive mines discussed in this thesis are located in the above areas. It should be noted, however, that a few prospects and productive mines have occurred throughout much of the remainder of the Western Cordilleran region.

The northeastern corner of British Columbia, lying east of the Rocky Mountain foothills, is physiographically a part of the Interior Plains Region. This segment of the province, comprising about 10 per cent of the provincial area, is underlain by sedimentary rocks very largely of Cretaceous age. Although this region has recently become important for oil and gas, it has never been important for lode metals.
BRITISH COLUMBIA
DISTRIBUTION
OF
GRANITIC PLUTONS

This broad general picture can be filled in by indicating the areas in British Columbia which are especially favourable for the discovery of particular metals. Discussion will be limited largely to the major metals such as copper, lead, zinc, silver, and gold, since the bulk of this thesis centres on those metals.

All of the known important copper deposits in British Columbia are in the central and western segments of the Western Cordilleran region, particularly along the coastal mainland and islands and in the southern interior west of Nelson. On the whole, these deposits, which are the most numerous of all metallic deposits in the province, lie close to large intrusive bodies such as the Coast Range and Nelson batholiths.

Gold is the most valuable associated metal in these copper deposits, and a considerable amount of the gold produced in British Columbia has been from replacement lodes and irregular bodies commonly associated with copper. The most typical gold ore-bodies, however, are quartz-filled fissure veins. Such lode-gold deposits occur throughout the Western Cordillera, although only a few minor occurrences are known east of the Kootenay and Upper Arrow Lakes.

Most of the silver-lead-zinc deposits in British Columbia "lie within a northwesterly trending eastern belt, near and beyond the eastern margin of the main zone of large intrusions such as the Nelson batholith." North of the Big Bend of the Columbia River, however, lead-
zinc deposits are sparse. The bulk are found in a lead-zinc mineralization zone in southeastern British Columbia. East of Kootenay Lake, most lead-zinc deposits are of a concordant replacement type, of which the Sullivan orebody near Kimberley has been the most important. Silver and silver-lead-zinc vein deposits, on the other hand, are localized in the Slocan area west of Kootenay Lake. These latter deposits usually carry a higher content of silver than the concordant type.

In addition to the above major metals, the Western Cordillera contains a number of other metalliferous deposits, the distribution of which can be indicated briefly. The distribution of molybdenum deposits is similar to that of copper deposits. Indeed, the two are commonly associated. Molybdenum deposits are spatially and genetically related to the Nelson batholith, and to other intrusions in central British Columbia. Many iron ore occurrences, in the form of contact metamorphic magnetite deposits, are known along the coast and islands and in southern British Columbia. Bog iron ore, or limonite, deposits are known in several localities, but particularly along the eastern flank of the Coast Mountains.

Mercury deposits, on the other hand, occur largely in two areas, one extending southwestwards from the Kamloops Lake area to the Bridge River district, and the other along the Pinchi fault in central British Columbia. Nickel deposits in British Columbia are highly localized
along the Fraser Valley. The only production of this metal has come from a deposit near Hope. 21

A number of minor metals have also been produced in the Western Cordillera, many of which are constituents of the ores of the major metals. Bismuth, cadmium, and tin, for example, are all produced as by-products from the treatment of lead-zinc ores, notably from the Sullivan mine. Antimony, though largely from the same source, is also obtained from stibnite-bearing veins. 22

This section has indicated, largely on the basis of known mineral deposits, those areas of British Columbia which are geologically favorable for the occurrence of metalliferous deposits in general and those areas in which the major metals of the province are most likely to be found. However, as Rostovtsev correctly points out, "for a given distribution of natural sources, there may be totally different location patterns of extractive industry depending on economic conditions." 23 The framework within which options can be exercised having now been set, the chapters dealing with the development of the mining industry will attempt to outline which options were in fact exercised and whether the choices made can be explained in terms of economic conditions.

It should be noted, however, that the geological information presented above has been drawn from a number of current sources and, hence, represents recent knowledge of these geological conditions.
While the geology of British Columbia has not changed over the period with which this thesis is concerned, the knowledge of that geology has altered considerably. In other words, the options available to entrepreneurs in the late 1800's were considerably fewer than those which existed in 1945. Major extensions of geological knowledge will be pointed out where appropriate in the following chapters.

The Periods Used in the Thesis

The following periods have been used in this thesis as a framework within which to discuss changes in the development of the lode-mining industry.

1. Early Attempts at Lode Mining: 1851-1886
2. The First Mining Boom: 1887-1905
3. Corporate Consolidation and the Impact of External Conditions: 1906-1921
4. The Second Mining Boom: 1922-1929
5. The Depression and the Growth of Gold Mining: 1930-1939
6. The Second World War: 1940-1945

The first mining of lode metals in what is now British Columbia dates from about the middle of the nineteenth century when small quantities of lead were taken from an outcropping of galena in the West Kootenay and a small amount of lode-gold was extracted from a gold-quartz vein in the Queen Charlotte Islands. After 1858, interest in lode-mining
was supplanted by the discovery and winning of placer gold. Throughout the 1860's and much of the following decade, placer miners invaded almost every area of the province. In their search for the rich alluvial gold deposits, the miners frequently reported ledges of gold quartz and surface exposures of other metals. As the yield from placer mining began to decline, attempts were made in several areas of British Columbia to work the lode deposits of this and other metals. For the most part, as Chapter III indicates, these early attempts at lode mining were unsuccessful.

By the late 1880's, at least partial solutions to some of the major problems that had impeded the earlier development of the lode-mining industry were achieved, particularly in the areas of southeastern British Columbia that were close to the newly-completed Canadian Pacific Railway and to the booming mining region of the northwestern United States. The year 1887 has been selected as the beginning of the truly productive lode mining industry in British Columbia. In that year, the first sizeable quantities of lead and silver were produced in the province.

During the better part of the next two decades, 1887 to 1905, the lode-mining industry experienced a tremendous boom. This period is covered in Chapter IV. The production of lead and silver rose rapidly, and the mining of gold, copper, and zinc was begun. Following White, the year 1905 has been taken as the end of this great lode-mining boom,
partially because the output of the industry in general had begun to level off, but more importantly because a corporate consolidation that was of far-reaching significance in the subsequent history of the industry took place in the following year. The year 1906 saw the formation of the Consolidated Mining and Smelting Company of Canada, a company whose role in the mining industry of British Columbia was of considerable importance.

The years between 1906 and 1921 are dealt with in Chapter V. This was a period in which considerable technological advance took place in the lode-mining industry, but a period in which production of the major metals fluctuated considerably in contrast to the relatively steady growth which characterized the industry in the previous period. It was a period, in fact, which saw the impact that world events such as the First World War and the post-war depression could have on the mining industry. The chapter ends in 1921 when the lode-metal producers in British Columbia still faced uncertain world markets overstocked with supplies of the major metals.

In 1922, the lode-mining industry in British Columbia began a recovery which paralleled the return to more normal conditions in world metal markets. Chapter VI covers the 1920's, a decade in which the industry experienced another boom. It was also a period in which technical advance continued, led by the expansion and extension of treatment facilities at the Consolidated Mining and Smelting Company's Trail smelter.
The decade of the 1930's, covered in Chapter VII, might well be called the golden decade for the lode-mining industry. Throughout the 1930's, the lode-gold mining segment of the industry increased its output substantially under the impact of depressed prices for labour and supplies and a rising price for gold. Prices for base metals, on the other hand, were low for much of this period, and the base metal mines of the province "languished in the depressed markets of the '30's".25

The years during the Second World War are dealt with in Chapter VIII. The outbreak of war in late 1939 saw a greatly increased demand for a number of metals. In British Columbia, the production of lead and zinc rose to record levels in the early 1940's, and a number of metals such as mercury, tungsten, and tin were produced in sizeable quantities for the first time. Throughout the war, however, the mining industry in British Columbia was adversely affected by a shortage of labour that was, at times, critical. Production of gold, silver, and copper declined steadily over the war years as, after 1942, did the output of lead and zinc. The war years were characterized also by a considerable decline in the number of producing mines, especially in the "non-essential" gold mining industry. Mine closures were, however, general throughout the industry in this period, and in 1945 there were only 36 shipping mines in the province, the lowest number since before the turn of the century.
The end of the Second World War is a meaningful point at which to conclude this examination of the lode-mining industry. In terms of production, the termination of the war marked the end of a long period in which the output of major metals such as lead, zinc, and silver exhibited considerable fluctuation. In the post-war period, the output of these metals was considerably more stable than it had been in previous periods. Following the war, moreover, increases in demand led to the large-scale mining of metals such as iron, molybdenum, and nickel which had been produced only intermittently and in small quantities prior to the war.

In the post-war period as well, two new trends in the progress of the industry emerged; namely, the reassessment of known mineral belts and mining camps with past records of production, and primary prospecting in less accessible areas of the province.  

The performance of the lode-mining industry in the years after the Second World War was, in short, considerably different from what it had been in earlier periods. The span of years between 1945 and the present may, in fact, be considered the modern period of lode-mining development in British Columbia. It is a period to which this thesis will provide some background for a larger and more detailed study.
FOOTNOTES

1. H.S. Bostock, Physiography of the Canadian Cordillera, with Special Reference to the Area North of the Fifty-Fifth Parallel, Canada, Department of Mines and Resources, Mines and Geology Branch, Bureau of Geology and Topography, Geological Survey Memoir 247, Ottawa, King's Printer, 1948, p. 4.


5. Ibid., p. 13.

6. Ibid.

7. Stockwell, op. cit., p. 349.


16. Ibid., p. 368.


19. Ibid., p. 514.


25. Ibid., p. 25.

26. Ibid.
CHAPTER III

EARLY ATTEMPTS AT LODE MINING: 1851-1886

The period between 1851 and 1886 saw several attempts to establish a lode-mining industry in British Columbia. Hampered by a lack of capital and transportation facilities, and possessing only limited knowledge and crude equipment, the early miners were largely unsuccessful. This chapter examines some of these early attempts to mine lode metals and details the major factors behind their failure.

Prior to the discovery of coarse gold at the mouth of the Nicoamen River in 1857, little activity in metallic mining had occurred in what is now British Columbia. The Hudson's Bay Company had taken some gold in trade from the Indians, but expressed little interest in its source. In fact, as Ormsby notes, until 1856 "the amount the Company procured was small, and it was only then that most of its officers learned to recognize gold in its natural state." The Company was also aware of a rich galena vein on Kootenay Lake, probably discovered by Archibald McDonald, Chief Factor at Fort Colville. Although this deposit would later become the famous Blue Bell Mine, the Hudson's Bay Company, "realizing full well the effect that any mining development would have on its fur trade," made no attempt to develop the ore-body, and for several years the vein would serve only as a source of lead for bullets used by Indians and fur-trappers.
The first authenticated discovery of lode-gold in British Columbia, according to Dawson, occurred in 1851 on the Queen Charlotte Islands. A gold nugget found on the southwest shore on Mitchell Harbour was brought to the attention of the officer in charge of Fort Simpson, and was subsequently sent to the Hudson's Bay Company headquarters in Victoria. The Company sent an expedition to the island and succeeded in finding a quartz vein seven inches wide, "reported to contain 25 per cent gold in some places." The mining of the deposit over the next few months yielded a quantity of ore which has been variously estimated at between $20,000 and $75,000 in value. Yet, while the discovery created considerable interest at the time, the quartz vein was quickly exhausted, no further gold was found, and by the end of 1852, the rush to the Queen Charlotte Islands was over.

The more famous rush to the Fraser, however, was yet to begin. News of the placer finds on the Thompson River above Lytton soon reached California where the labour-intensive workings of the late 1840's and early 1850's had yielded to operations requiring substantial capital investment. The influx of miners to British Columbia began in the spring of 1858, and by the end of that year, nearly 25,000 men had started up the Fraser River. After working the bars of the lower Fraser, some of which yielded high returns, the miners pushed up the river in search of the richer deposits which they felt lay nearer the headwaters. In 1860, the first important finds in the Cariboo were made at Quesnel.
Forks, Keithley and Antler Creeks. In the following year, strikes on Williams and Lightning Creeks were made, and still further north, on the Parsnip River.

In other areas of the province as well, the miners moved north in search of the easily-worked placers. Gold was discovered on the Kettle River at Rock Creek in 1860, at Wild Horse Creek in the East Kootenay in 1863, and on the Big Bend of the Columbia River in 1865. On the coast, placer gold had been found on the Stikine in 1861 and on the Leech River on southern Vancouver Island in 1864. The peak of placer-gold production was attained in 1863 when 203,209 ounces valued at $3,913,563 were produced, much of this output coming from the celebrated creeks in the Cariboo. The rich "sack of flour" claims, however, were soon worked out, and the movement of many miners from creek to creek was a response to the rapid exhaustion of surface and shallow diggings in one area, and to the reported discovery, whether accurate or not, of similar finds in other areas. Indeed, as Flucke points out, most of the creeks in the province were not the poor miner's dream for very long. Moreover, the bonanza fields that would support a large number of individual miners were also short-lived. Hence, relatively early in the gold rush, partnerships and small corporate ventures were formed to gain the capital and cooperative effort required to work the deeper diggings and dry bench placers. This was
particularly true in the Cariboo, where the auriferous gravels were deeply buried and expensive to work.¹³

For the three decades after 1863, the production of placer gold declined fairly steadily. The downward trend was broken only by discoveries in Omineca in 1869, in Cassiar in the mid-1870's, and at Granite Creek near Princeton in the mid-1880's. (Figure 1). In 1893, placer production reached its lowest point since 1858 with only 20,950 ounces valued at $356,131 being produced.

As noted earlier, the first discovery and mining of lode-gold in British Columbia predated the gold rush. In the earlier years of the placer period, however, little attention was paid to lode deposits of gold, the energy of the miners being consumed by the alluvial deposits of the metal. Officially, the production of lode gold did not begin until 1893 with the successful milling of gold ore in the southern part of the province.¹⁴ In many areas of British Columbia, however, the existence of quartz veins was known long before this date, and with the decline of the placer deposits, several attempts were made to work these veins.

The most concerted early attempt to develop the mining of lode-gold took place in the Cariboo where, since the early 1860's, considerable funds had been expended in the search for gold quartz in paying quantities. Although quartz ledges were "found in abundance throughout the District," many of which had exhibited good paying prospects, no
success resulted from the attempts to work them.\textsuperscript{15} The failure to develop these veins was, in part, "occasioned by not possessing proper appliances for working the same."\textsuperscript{16} The Government Agent suggested further that the chief drawbacks towards the development of lode mining in the Cariboo were "the difficulties of access, owing to its remoteness from navigation or railways, and the absence of mills for crushing purposes."\textsuperscript{17}

In 1876, steps were taken to overcome the latter of these problems. A 4-stamp mill was erected at Richfield,\textsuperscript{18} and the Provincial Government offered a bonus to the first company which would build a 10-stamp mill in the district. In addition, the government hired R.B. Harper, a quartz expert from San Francisco, to examine the quartz occurrences in the province.\textsuperscript{19} Harper's reports on the Cariboo in 1877 were highly optimistic and led to the recording of 36 quartz claims by October and an additional 82 by the end of the year. Nevertheless, despite the excitement and activity in the Cariboo in 1877-78, by 1880 the only mine still active was the Enterprise.\textsuperscript{20} George M. Dawson of the Geological Survey of Canada noted that this quartz excitement was "premature", being based on "exaggerated ideas of the richness of certain known lodes, and on erroneous views as to the facility with which gold might be extracted from the pyritous ores which these afforded."\textsuperscript{21} Another major reason for the failure of the lode mining of gold at this
time was stated by the Minister of Mines to be simply that "the people of the Province failed to understand that the development of quartz mines involved the expenditure of a vast amount of capital." 22

The problems facing the early gold-quartz miners in the Cariboo were faced, in varying degrees, by miners in other areas as well. In 1872, for example, F.W. Foster located the Big Slide mine on the Fraser River north of Lillooet, and set up a primitive grinding mill (arrastra) for the reduction of the quartz. 23 Although considerable difficulty and expense was involved in opening the mine, the greatest problem was the extraction of the fine gold from the sulphuret ore. As the Gold Commissioner for the Lillooet district reported in 1882:

Science in this particular case is still behind the requirements of the age. The precious metal is, without a shadow of a doubt, in the ore, but the question, how is it to be profitably extracted, still remains unsolved. 24

Expectations that this problem had been solved were expressed in 1886, but by the following year further difficulties in applying a separation process to the ore forced the closure of the mine. 25

In the Cassiar district, J.W. McKay erected an arrastra near Glenora in 1877 to test rock samples from the area. His attempt to develop a lode-gold mining industry at this time was also unsuccessful, owing "to the great expense attending such an undertaking and to the little interest bestowed on it by others." 26
In addition to the efforts the early miners made to develop the lode-gold industry, they also expressed more than a passing interest in silver. This metal had been known to exist in British Columbia since the early years of the gold rush when pieces of virgin silver were frequently found in the pans and sluices of the placer miners. Silver ore was first discovered on the banks of the Fraser River near Hope at the beginning of the placer period, and soon after at Cherry Creek in the Okanagan. In the latter area, the Cherry Creek Silver Mining Company had spent some $20,000 in tracing a vein of ore, samples of which assayed as high as $2000 to the ton. After two years of prospecting, however, the company had lost the vein and abandoned their work.

The most significant early discovery of silver took place in the Silver Mountain area near Hope in the late 1860's. Two mines, the Eureka and the Van Bremer, worked rich outcroppings of silver ore until 1874, and shipped an unknown quantity of this ore to San Francisco. Despite further activity centering on the silver leads between Hope and Yale, however, no further production resulted. In 1877, it was reported that the silver mines in these localities were "lying dormant and intact, for the want of capital or enterprise to work them..."

Given the relatively poor transportation facilities which existed in British Columbia, it is not surprising to find that the majority of the early lode-mining activities were centered on the high unit value precious metals. Yet while gold and silver-bearing ores were the most
intensively sought, other metals had not been totally ignored.

Copper ores were known to occur in many places and were among the first to attract attention at several locations on the coast.\textsuperscript{30} As early as 1859, copper had been discovered in the Queen Charlotte Islands. The Queen Charlotte Mining Company of Victoria had financed some development work, but labour problems and an outbreak of smallpox had led to the abandonment of the claim while still in the pre-production stage.\textsuperscript{31} Efforts were also made to develop copper finds near Sooke in 1864, but the lack of a defined lead had precluded this operation. In the following year, a well-defined lead of copper pyrites, containing some 30 per cent copper to the ton, was discovered at the entrance to Howe Sound. Although this lead was "worked for some time, with excellent prospects of success," the operation was suspended through lack of capital,\textsuperscript{32} and no production took place. A further discovery of copper on the coast was made on a branch of Jervis Inlet about 1874, and three years later, the Government Mining Engineer reported that the ores of the Howe Sound Copper and Silver Mine were the richest he had ever seen" on this Coast or in England.\textsuperscript{33} Again, however, the failure to attract development capital had kept the mines dormant.

Iron ore had also been found from time to time in various areas of the province. In 1871, large deposits were found on Texada Island, which, in 1875, were acquired by the Puget Sound Iron Company.\textsuperscript{34}
Beginning in 1883, this company did considerable development work on their Prescott orebody at Texada, and began shipping ore to a blast furnace at Irondale, Washington in 1885. Small shipments of ore were recorded for the following four years, but in 1890 work on the deposits was discontinued and shipments ceased. 35 Iron mining on Texada was not to begin again until the turn of the century.

As the above early attempts at lode-mining suggest, the transition from placer to lode-mining was not easily made. Although the lack of success in any one particular operation was due to a combination of factors, some of which may have been localized, the above examples serve to indicate some general problems faced by the industry as a whole.

In the first place, there was a considerable lack of knowledge with respect to the geology of lode or vein deposits. The early mining attempts centered largely on outcrops from which assays of the ore were usually made. In many cases, small samples taken from the outcrops were not representative of the entire deposit, leading on the one hand to the mining of an uneconomic vein, or, on the other hand, to the termination of work on a vein which may have been richer at greater depths. In other instances, shafts had been sunk into the outcrop, but the dip of the vein was miscalculated, and the vein lost. 36
Solutions to these and similar problems were aided by the efforts of the Provincial Government in the hiring of experts experienced in lode-mining and in the building of facilities for testing the ores. The reconnaissance work of the Geological Survey of Canada, begun in the early 1870's, was also of aid in this regard. Thus, by the end of the period in question, considerably more was known about the occurrences and geology of lode-metal deposits than at the beginning.

In many cases, the early attempts at lode-mining were ahead of the metallurgical technology required to extract the valuable minerals from the gangue. Relatively simple and high-grade gold and silver-bearing ores could be treated in primitive grinding mills, in stamp-mills, and by the amalgamation process. On the other hand, refractory ores, those which resisted the action of chemical reagents, needed milling processes which simply had not yet been invented.

Another major problem which retarded the early growth of the lode-mining industry was the lack of development capital. The finding of outcrops and the testing of rock samples for metals were not particularly expensive operations; but, in most cases, the subsequent working of these veins was. The early Annual Reports of the Minister of Mines contain frequent references to mining operations which were terminated due to the exhaustion of capital, or to others where mining would occur should capital be obtained.
Furthermore, not only were local individuals and small companies undercapitalized themselves, but they had considerable difficulty in attracting capital from areas outside of British Columbia. In part, this difficulty was a circular one, for outside capital would likely be invested only after sufficient development had been carried out to prove the attractiveness of the property. As G.A. Koch noted in 1886, "Owners of properties must not sit idle and wait for capital to come and buy a quartz boulder or a ten-foot hole in the ground." 37

One solution to this problem was, of course, the amalgamation of companies and the subsequent concentration of combined resources on the more valuable deposits. For the most part, however, such consolidation did not occur in this early period, and the working of separate claims by several small companies was more characteristic of lode-mining activity in most areas of the province.

It should also be noted that another major reason for the difficulty in attracting capital was the general lack of knowledge, in areas outside of British Columbia, of the lode mining possibilities within the province. This was certainly not a factor in southeastern British Columbia by the late 1880's where American capital spear-headed the development of the industry; but throughout this early period, the mineral resources in much of British Columbia were poorly known in world capital markets.
Another series of factors which impeded the progress of the lode-mining industry in these early years was the lack of transportation facilities, the often high costs of transport where such facilities did exist, and the distances from the lode-mining regions in British Columbia to smelters in the United States. The placer miners had covered much of British Columbia and, in response, the Provincial Government had built roads and trails to the major placer camps. The successful transition from placer to lode-mining, however, required more than pack trails and wagon roads. Hence, in 1874, the "difficulty of communication" was seen by the Minister of Mines to stand first in a list of factors restricting the progress of lode-mining.  

This problem applied particularly to the northern areas of British Columbia, where access was difficult to achieve, and the friction of distance clearly greater. Indeed, one of the major causes for the failure of the Cariboo quartz mining boom in the late 1870's had been the high cost involved in transporting machinery to this district. The problem of transport was, on the other hand, less severe in southern British Columbia. On the south coast, for example, the Prescott iron mine had reached the production stage in the 1880's due largely to the availability of marine transport close to the deposit, and the relatively short distance from the mine to the blast furnace in Washington. 

Prior to 1887, then, little success had been achieved in the lode-mining industry of British Columbia. Aside from test shipments,
production in lode metals had been limited to some 4600 tons of iron ore from the Prescott mine on Texada Island, and an unrecorded amount of silver from the Eureka and Van Bremer mines south of Hope. (Maps 3 and 4). Up until 1887, the total value of metal production was $52,808,750, of which $52,798,364 was from placer gold. Production from lode-mining, therefore, accounted for less than one per cent of the total value of metal production.

None of the difficulties which had retarded the development of the lode-mining industry was eliminated by the end of the period. Nevertheless, by the late 1880's, the difficulties associated with transport, capital, and inexperience had been considerably reduced in the southeastern part of British Columbia. It was, in fact, in the Kootenays that the lode-mining industry first emerged from a period which White has so aptly described as the "years of frustration."
MAP 3

BRITISH COLUMBIA

MINES SHIPPING PRIOR TO 1887

(THOUSANDS OF TONS)

- 1,000
- 200-1,000
- 50-200
- 10-50
- Less than 10

- Smelter
- Settlement

For oreo in inset see Map 4.

Source: Annual Reports of the Minister of Mines, 1874 - 1886.
SOUTHEASTERN BRITISH COLUMBIA

For explanation of symbols, see main map legend

Rock Creek
FOOTNOTES


2. Considerable controversy exists over the date and discovery of this deposit. See the appendix to Elsie Turnbull, "Old Mines in the West Kootenay." British Columbia Historical Quarterly, Vol. 20 (1956) pp. 147-163.

3. Turnbull, op. cit., p. 149.


7. Ormsby, op. cit., p. 140.


11. In the terminology of the early placer miners, the phrase "sack of flour" indicated a deposit or claim that needed no labour or money to work. See British Columbia, Annual Report of the Minister of Mines, 1880, p. 427, (These annual reports will be cited hereafter as Annual Report of the Minister of Mines.)


16. Ibid.

17. Ibid.


20. Galloway, op. cit., p. 6; See also Annual Report of the Minister of Mines, 1880, p. 245.

21. G.M. Dawson, op. cit., p. 56R.


23. For a definition of this, and other mining terms, see Appendix A.


29. Ibid., p. 407.

30. Dawson, op. cit., p. 101R.


CHAPTER IV

THE FIRST MINING BOOM: 1887-1905

The period between 1887 and 1905 encompasses a mining boom that is well known in the history of the British Columbia mining industry. The discovery of high-grade lode-metal occurrences in the West Kootenays in the 1880's, together with a series of developments which made the mining of these occurrences feasible at that time, created a rush to the West Kootenay that was not unlike the early placer rushes in its magnitude. From this original centre, mining activity spread first throughout much of the Kootenays and then westward along the southern part of the province to establish the Kootenay-Boundary area as the major focus of mining activity. Later in this period, successful lode-mining began in the south coastal region.

This chapter will describe these developments in some detail and will attempt to outline the major factors which account for the general spread of mining activity and the patterns of production that emerged.

The Kootenays Before 1887

Placer gold had been discovered in the Kootenays in the early 1860's and, by 1865, the banner year for the placer mines, there were
some 1500 to 2000 men in the district. With the exhaustion of the known placer deposits in the mid-1870's and the failure, despite government aid, to find additional deposits, the region had been virtually deserted. Prospecting parties sponsored by the provincial government had reported the country to be literally full of quartz ledges, but assays on these veins had proved so poor that no interest in them had been generated. In 1878, the Gold Commissioner reported that the quartz ledges in the district were in "perfect quiet."

In the next decade, however, the level of mining activity in the Kootenays would increase considerably, due largely to improvements made in the transport network serving the region, to the discovery of rich mineral deposits in the area, and to the interest, capital and expertise which flowed north across the border from adjacent American territory.

In 1880, the Kootenays were served only by several pack trails and riverboat routes, the majority of which ran north-south across the international border into the American areas of Montana, Idaho, and Washington. Transport costs along these routes were high, and the consequent price of goods delivered to the Kootenay region had been a major factor in the slow development of the district. The completion of two trans-continental railways by the mid-1880's greatly increased accessibility to the Kootenays, although the Northern Pacific did not enter the region and the Canadian Pacific only crossed its northern
limits. These main lines, however, were sufficiently close to provide, in conjunction with the river, lake and pack-trail routes, the beginnings of an integrated network to serve the region, and more important, improved connections with eastern and western markets. Furthermore, as Meyer notes, "water transport in the area was definitely stimulated by the completion of the transcontinental railways." 

The increased accessibility to and within the Kootenays aided in stimulating exploration and development of the lode-mining prospects in the region, particularly along the major water routes. In 1883, the year in which the Northern Pacific Railway was completed, nineteen mineral claims were staked in the Kootenay Lake area, and in the following year this figure increased to 49. To the north, in close proximity to the main line of the C.P.R., 135 mineral claims were staked in 1884 in the Kicking Horse region.

For the most part, however, exploration and claim staking outstripped development in the 1880's, the work carried out on many claims rarely exceeding that required to hold the claims under the provisions of the newly-established Mineral Act. Nevertheless, the discoveries made in the early part of this decade served to draw considerable attention to the Kootenays. Unlike the Cariboo in the late 1870's, however, the Kootenays in the late 1880's were bordered on the south by a region where much was known of the geology, technology, and economics of lode-mining. Indeed, in the American Northwest, lode-mining had begun in the 1860's, ore from the Owyhee district silver veins being shipped to
eastern United States markets as early as 1865. The profitable treat-
ment of silver ores in the Butte district began in 1876, and two years
later almost $900,000 worth of bullion was produced. Gold quartz in the
Coeur d'Alene was first successfully worked in 1879. In the same year,
the Colorado and Montana Smelting Company erected a smelter at Butte,
thereby establishing a local market for both the silver and copper ores
of the district. By the early 1880's, then, lode mining in the adja-
cent American areas was well established. Thus, once it was known that
the mineral belts of the Kootenays were direct extensions of those in the
booming districts of Montana and Idaho, the region began to attract not
only prospectors, but also experienced American mining men armed with
abundant risk capital and seeking new investment opportunities.

In short, it was the combination of rich mineral deposits, im-
proved transport, a geographical proximity to an established mining area,
and the availability of development capital that provided the basic sti-
mulus for the beginnings of productive lode-mining in British Columbia.
That this favourable combination of factors was first achieved in the
Kootenays largely accounts for that region's early prominence in the
history of the industry.

Mining in the Kootenays: 1887-1892

The year 1887 has been selected as the beginning of the lode-
mining era in British Columbia. It was in this year that silver and
lead were first produced from the lode-mines of the province. It was in 1887 also that W.A. Hendryx began development on the low grade silver-lead-zinc ores at Kootenay Lake, later to become the famous Blue Bell mine; and that the Hall Brothers began active work on their claims at Toad Mountain near Nelson, the first of several important lode metal camps to be worked in the province.

In addition to the above discoveries, two other major mineralized areas were located in the late 1880's and early 1890's. In 1889, gold-copper ores were found on Red Mountain near Rossland, and in the following year, a number of important mines were established in the district, including the Le Roi, War Eagle, and Center Star. In the autumn of 1891, the high-grade silver-lead ores of the Slocan were discovered, leading to the staking of 140 claims around Slocan Lake by the beginning of 1892.

Although the pace of exploration and discovery was rapid in these early years, the level of production was relatively low. Between 1887 and 1892, the production of the lode mines of the Kootenays was only $363,678, comprised of silver ($285,087) and lead ($78,591). The major reason for the low level of output was the high transport costs between the mines and American smelters, costs which tended to restrict shipments to those from high-grade mines which were relatively close either to existing water routes, or, in the northern section of the district, to
the main line of the Canadian Pacific Railway. Another significant factor restricting development in these early years was the imposition in 1891 of an import tariff of $30 a ton on the lead content of ores imported into the United States. This tariff, when added to the cost and difficulty of transportation, prohibited shipments of silver-lead ore from the West Kootenay in 1891, although a considerable quantity of ore was mined and available for treatment.

The Spatial Pattern of Production: 1887-1892

The mines shipping in the years between 1887 and 1892 are indicated on Maps 5 and 6. The tonnages shown represent the total quantity of ore shipped over the six year period. None of the mines shipped in every year, however, and the bulk sent ore to smelters in only one year.

The main centre of production in these early years was in the southern portion of the West Kootenay, particularly in the Hot Springs Camp (Ainsworth) where a number of mines produced silver and lead ore for shipment to smelters in Montana. Another major area of activity was in the vicinity of Toad Mountain south of Nelson, where the Silver King, one of the celebrated Hall mines, began shipments of silver-rich ore to Helena, Montana, in 1889. The Poorman mine, in the same general area, crushed a sizeable amount of gold-quartz in 1890 and 1892, and produced about 1000 ounces of gold.
MAP 5

BRITISH COLUMBIA
MINES SHIPPING
1887 - 1892
(THOUSANDS OF TONS)

Source: Annual Reports of the Minister of Mines, 1887 - 1892.
MAP 6

SOUTHEASTERN BRITISH COLUMBIA

For explanation of symbols, see main map legend
The availability of rail transport in the form of the C.P.R. stimulated mining activity in the northern part of the East Kootenay. The most important operation was the Monarch mine at Field which produced a considerable quantity of silver and lead in 1888 and 1890.

The distribution of mines shown on Map 5 indicates also that very little productive mining took place beyond the Kootenays between 1887 and 1892. The Prescott mine on Texada Island continued to ship small amounts of iron ore to Irondale, Washington until 1890 when one of the main ore masses had been almost completely removed. Iron ore was also produced at the Glen Iron mine situated close to the main line of the Canadian Pacific Railway west of Kamloops. Most of the tonnage from this mine went to Washington and Oregon, but a small amount was shipped to the Revelstoke smelter for fluxing operations. 20

The smelters on Maps 5 and 6 reflect largely a response to the high transport costs characteristic of this period. As Hughes has noted, only the ores highest in silver, lead and gold values could withstand the high freight charges involved in shipping to American smelters. 21 At this point in the history of the British Columbia mining industry, it was generally held, by both private investors and government officials, that the establishment of a local smelting industry was essential for the further development of the many prospects being uncovered in the Kootenays. 22 The Provincial Government, urged on by
the reports of its local representatives, aided in the construction of these smelters by passing, in 1886, an "Act to encourage the erection of Smelting Works." Further assistance was given by the Federal Government in the form of land grants to the companies involved.

Smelters were blown in at Vancouver (1889), Woodbury (1889), Revelstoke (1891), and Golden (1891). The plant at Vancouver, operated by the British Columbia Smelting Company, was unable to treat successfully the sulphurous ore from the company's Monarch mine near Field, the only ore available to it, and was closed two weeks after it began. The plant at Woodbury ran for one day, but "cracked under the heat and died a quiet death." A lack of sufficient ore to justify operation of the Revelstoke smelter led to its abandonment in 1892. A similar fate terminated operations at the Golden smelter, where only one "lonesome car-load of ore" ever reached the plant.

The period between 1887 and 1892, then, saw considerable increase in mining activity, mainly in the West Kootenay, but only limited production. The construction of smelters, seen by many as a prerequisite to mining development was, in most cases, premature, given the small amount of ore available at the time.

Mining in the Kootenays: 1893-1905

The real boom in lode-mining in British Columbia may be said to have begun in 1893 in which year the total value of metals produced
was more than 80 per cent of that produced in the preceding six-year period. Lode-gold appeared in the official records for the first time in 1893, and copper a year later.

Despite the world-wide depression of 1893 and the subsequent fall in the price of silver, the value of that metal produced in British Columbia doubled every year between 1893 and 1896. Values of gold, lead and copper experienced similar rises.

The rapid rise of lode-metal production was accompanied by an equally spectacular rise in rail transport. Indeed, investments in mining and railways were to a large extent mutually dependent. Without railways, the only means by which large tonnages could be shipped profitably, mining development was restricted to the stage of shipping high grade ores that could absorb the high costs of rawhiding, pack-trails and other primitive means of haulage. These latter modes of transport were, furthermore, highly unsuitable for the importation of heavy machinery to the mines. On the other hand, adequate tonnages to justify local railroad construction in the high-cost, non-agricultural areas of the Cordillera could come only from the mines.

The later years of the nineteenth century also saw the continued construction of local smelters, the operations of which were, on the whole, more successful than those which had been attempted earlier. In 1896, smelters at Nelson and Trail were blown in, the former to treat the ores from the Silver King mine on Toad Mountain, and the latter to handle the gold-copper ores of the Rossland Camp. These two operations,
originally successful because of large tonnage contracts with major producing mines, were able subsequently to expand operations as custom smelters, thus benefitting not only their owners but also the general progress of mining in their districts. A lead furnace added to the Nelson smelter in 1897, for example, provided a relatively low cost market for many of the silver-lead mines of the Slocan which previously had faced the high transport and treatment charges associated with shipping their crude sulphide ores to smelters in Montana.  

Much has been written on the history and development of the smelter at Trail since it and the Sullivan mine formed the major pillars on which the Consolidated Mining and Smelting Company was later built. In the early years the Trail copper smelter drew its ores from the Rossland area, but in 1900 a lead blast furnace was added to the plant enabling it to treat a portion of the Kootenay silver-lead ores. In 1902, refined lead was produced by the smelter, this being the first application in the world of an electrolytic method for refining that metal.

The only unsuccessful smelter built during this period was the plant at Pilot Bay on the east shore of Kootenay Lake. Built in 1891, the plant began operations in 1895, but was closed by 1896. A lack of dry ore, high costs of fuel, and difficulty in obtaining fluxes all contributed to the failure of the smelter.
The final major developments which furthered lode mining in the Kootenays took place in 1898, with the opening of the Crow's Nest Pass coal mines, the completion of the Crow's Nest Pass Railway to the southern end of Kootenay Lake, and the extension of the railway from Robson to Trail. Forthwith, a cheap supply of coke for the smelters at Nelson and Trail was made available, and by 1899, the Kootenays received almost all the required coke from the Crow's Nest Pass mines. The price of coke at Nelson was now over 36 per cent lower than coke supplied from the Comox mines on Vancouver Island, the major source of supply prior to 1899.32

In terms of the lode mining industry, the early years of production clearly belonged to the mines of the Kootenays. By 1900, of the metals produced in British Columbia the Kootenay mines had accounted for 87 per cent of the fine gold, 95 per cent of the copper, 99 per cent of the silver, and 100 per cent of the lead.33

Much of this production had come only from West Kootenay. The East Kootenay had, however, made its contribution, particularly from the area along the C.P.R. mainline and from the region around Fort Steele. The discovery of argentiferous galena ores in this southern portion of the district had led to the development of the North Star, Sullivan, and St. Eugene mines, the last-named being the largest lead producer in British Columbia by 1900.34 The emergence of a silver-lead producing centre in this area had been stimulated by the expansion of rail
facilities into the region. However, the aid of a Federal bounty on lead production was of major importance in the successful working of low grade ores at this time. In fact, as the Annual Report of the Minister of Mines for 1905 indicates, "these mines could scarcely be operated without its aid."

Expansion Into the Boundary Country

Productive lode-mining in the southern interior west of the Kootenays was insignificant in the later years of the nineteenth century. The only major exception was the output from the Cariboo-Amelia mine at Camp McKinney in the Osoyoos District. Free-milling gold had been produced here since 1894, the output of the mines largely accounting for the lode-gold not attributable to the Kootenays. Yet while productive mining was limited largely to the Kootenays, prospecting for and development work on lode deposits in other areas was going on, particularly in southern British Columbia and at various places along the coast. Around the turn of the century, production from these areas began to appear in the records.

The real impetus to productive lode-mining in southern British Columbia west of the Kootenays was provided in 1898-99 by the extension of the Columbia and Western Railway from West Robson through Grand Forks to Midway, and the construction, in 1900, of two spur lines to Deadwood and Phoenix. This extension of rail services to and within the Boundary district, together with the introduction of large-scale
machinery, made feasible the mining of extensive low-grade copper ore bodies, on which claims had been staked in 1891. In rapid succession, smelters were built at Grand Forks (1900) by the Granby Mining and Smelting Company, at Greenwood (1901) by the British Columbia Copper Company, and at Boundary Falls (1902) by the Montreal and Boston Copper Company.

Unlike the earlier low-capacity smelters at Nelson and Trail which produced a low-grade copper matte that required further treatment, the smelters in the Boundary country were of larger capacity and produced a relatively pure blister copper from the self-fluxing ores of the district. The impact of the Boundary mines on copper production in British Columbia was immediate. In 1900, the output from the mines represented over 50% of the provincial total, and by 1905, this figure had risen to over 73%.

In other districts of the southern interior, exploratory work was carried out in the 1890's, but poor transportation facilities still limited development. In the Hedley area of Similkameen, for example, the first mineral claim was recorded in 1894, and considerably more in the late 1890's. At this time, however, the only connection with other areas was by horseback, the nearest railway being at Penticton. With the construction of a private and government wagon road into the area, and the proving-up of the ore at the major claim, the Nickel Plate, a
40-stamp mill and cyanide plant were built. The production stage at the Nickel Plate mine was finally reached in 1904, after an expenditure of almost one million dollars.

Mining on the South Coast: 1893-1905

On the coast, prospecting and development work of the 1890's also led to productive mining around the turn of the century. On the coast too, it was copper mining, made attractive by high-grade ore finds and relatively high price levels for that metal, that led production. On Texada Island the Marble Bay mine, discovered in 1898, began to produce its copper-gold-silver ores in the following year. On Vancouver Island, the high-grade copper ores on Mt. Sicker near Duncan were discovered in 1895, the two most successful operations being the Tyee and Lenora Mines. By early 1900, the latter mine was in full production and ranked as the fourth largest shipping mine in British Columbia. In 1898, copper ores were also located in Howe Sound north of Vancouver, ores that would provide the basis for the Britannia Mine which began production in 1905. Copper properties on the Alberni Canal were also producing around the turn of the century.

These developments on the coast led to the construction of local smelters. The first was built at Van Anda on Texada Island in 1899, and treated local ores including those of the Lenora. By 1901, however, most of the ores from both the Lenora and Tyee Mines were shipped to the
Tacoma smelter of the American Smelting and Refining Company. This trade pattern was altered in 1902 when local smelters at Osborne Bay (Crofton) and Ladysmith were blown in. Further refining of the copper matte was, however, still carried out at Tacoma. Lower copper prices and a drop in the grades of ore of both major mines terminated operations at the mines and in the smelters. The Crofton operation would, however, be rejuvenated later once it was purchased by the Britannia interests. The lower copper prices also adversely affected the mines on the Alberni Canal. These properties, unlike those in the interior of the province, worked ores with little gold and silver, and so were more seriously affected by the fluctuations of the copper market. 45

The Spatial Pattern of Production: 1905

The major changes in the pattern of metal production between 1893 and 1905 — the intensification and expansion of activity in the Kootenays, the expansion of mining into the Boundary country, and the emergence of copper mining on the south coast—are clearly revealed in Maps 7 and 8. Each of the major centres of activity in 1905—the Ainsworth-Slocan area west of Kootenay Lake, the southern part of the East Kootenay, the Toad Mountain area south of Nelson, the Rossland camp west of Trail, the Boundary region near Greenwood and Grand Forks, and the southern coast—represents an area where a favourable combination of geology, transport, and smelting facilities was achieved, and to
SOUTHEASTERN BRITISH COLUMBIA

For explanation of symbols, see main map legend

MAP 8
which considerable capital had been attracted. The mines in the southern part of the East Kootenay were also aided, as noted earlier, by the Federal bounty on lead production.

Elsewhere in British Columbia, little productive mining was taking place. A few mines in close proximity to the mainline of the Canadian Pacific had reached the shipping stage, as indeed other operations in this general area had done as early as 1887. On the whole, however, lode mining in British Columbia was restricted to the southern interior of the province and to the south coast.

Conclusions

By 1905, the lode-mining industry of British Columbia had advanced considerably since its beginning in 1887. In this period, $102,328,735 worth of metals had been produced, some 72 per cent of this total coming in the years between 1900 and 1905. In the latter year, silver, lead, gold, copper and zinc had been produced. Zinc, in fact, appeared in the official records of the Department of Mines for the first time in 1905, although the first shipments actually took place in 1899 from the Slocan. In the earlier years, zinc was passed over in the mines whenever possible since there was no market for zinc ore in the United States and, as a constituent of silver-lead ores, it was a detriment to their value. The contribution made by the above metals to total production for 1905 is indicated in Figure 2.
FIGURE 2

COMPOSITION OF LODE-METAL PRODUCTION

BRITISH COLUMBIA 1905

Total Value of Production - $15,319,365.00

Average Prices 1905

- Copper 15.59 cents/pound
- Lead 4.24 cents/pound
- Zinc 1.80 cents/pound
- Silver 51.33 cents/ounce
- Gold $20.67/ounce

The total lode-metal production in 1905 came from 167 mines, a substantial increase over the eleven mines which shipped in 1892. This growth had been brought about by a number of interrelated factors. Of major importance was the continued improvement in the transportation network in the southern part of the province. Improved transportation not only opened up new areas for exploration and discovery, but also made feasible the mining of deposits hitherto uneconomical because of high haulage costs. The Provincial Government had aided in these transport developments in providing aid for, or constructing access road to mines, and in granting charters to railways. The expansion of the rail network westward from the Kootenays, and the increased density of the network in the Kootenays themselves, aided the development of small mines; but, more important, allowed the development of large-scale mines whose tonnages were far in excess of that which wagons and steamboats were capable of handling. Quite simply, as Innis points out, "Large-scale operations necessitate railways."

Another major factor accounting for the growth of the industry between 1887 and 1905 was the relative abundance of capital. Unlike placer mining, lode-mining was, on the whole, highly capital intensive. This was less true for very small operations where high-grade, easily-worked deposits could be made to produce annually a few tons of rich ore with returns high enough to support an individual or small group of miners. For intermediate to large-scale mines, however, an abundance
of capital was as necessary as railway facilities. In the late 1880's and early 1890's, much of this capital had come from the United States, but as the fame of such mining centres as Rossland and the Slocan spread, capital was also attracted from Eastern Canada and Europe. By 1905, the lack of capital which had plagued the industry in earlier years was not a limiting factor in lode mine development, at least in those areas where accessibility had been improved by the railways, or where marine transport was available.

The third major factor accounting for the growth of the lode-mining industry in this period was the erection of local smelters, and the subsequent expansion of facilities at some of these operations. Some of the early smelters had been unsuccessful for reasons noted earlier. The major operations, however, were a definite stimulus to the industry in certain parts of the province. They not only facilitated the large-scale development of the mines with which they were first associated, but also provided a local market for many mines which had not been brought to the production stage, or which had shipped to more distant American smelters.
FOOTNOTES


8. *Ibid*.


19. British Columbia, Department of Mines and Petroleum Resources, Production Records for Nelson Mining Division, Victoria, n.d. This production of lode-gold is not noted in the published records of gold production for British Columbia which date the first gold production to 1893.


22. See, for example, the report of G.M. Sproat, the Gold Commissioner for the northern division of the Kootenay district in Annual Report of the Minister of Mines, 1886, p. 204.

23. The government also felt that ores other than those which required smelting might be found. Hence, in 1887, the Legislature passed "An Act to aid the Development of Quartz Mines." See S.S. Fowler, "Early Smelters in British Columbia," British Columbia Historical Quarterly, Vol. 3, No. 3 (July, 1939), p. 186.

24. Ibid., p. 200.

25. Ibid., p. 198.

26. For a detailed examination of railway development in the Kootenays, see Ronald H. Meyer, op. cit.

27. Flucke, op. cit., p. 11.


32. Ibid., Table XII, p. 283.


34. Flucke, op. cit., p. 15.


38. White, op. cit., p. 22.


40. The output from the Kootenays (i.e. Trail and Nelson Districts) in 1905 amounted to 15.5 per cent of the provincial copper production.


42. Texada Centennial Committee, Texada, Texada Island, Texada Centennial Committee, 1960, p. 2.

43. British Columbia, Department of Mines, Index No. 3 to Publications of the British Columbia Department of Mines, Victoria, Queen's Printer, 1955, Table I., p. 205.


48. The *Annual Report of the Minister of Mines*, 1905, states that there were only 146 mines shipping during the year. The total of 167 was arrived at from the 1905 reports of the Gold Commissioners, Mining Recorders, and other government officials contained in the *Annual Report of the Minister of Mines*, 1905, together with a list of additional shipping mines compiled from the unpublished production records held by the Department of Mines and Petroleum Resources, Victoria.

49. For a discussion and maps of the expanding rail network in the Kootenays, see Meyer, *op. cit.*


51. See E.S. Moore, *op. cit.*, pp. 71-83.

52. White, *op. cit.*, p. 22.
The period with which this chapter is concerned is between 1906 and 1921. The year 1906 has been selected as the beginning of this period not because it represents a significant change in the production levels of the lode-mining industry, but rather because it marks the beginning of a corporate organization that would have a long-term effect on the mining industry of British Columbia. In 1906, the Canadian Pacific Railway effected a consolidation of its Canadian Smelting Works at Trail with a number of mining companies in the Kootenays, including the War Eagle and Center Star mines at Rossland, and the St. Eugene mine at Moyle.\textsuperscript{1} This new organization, originally known as the Canadian Consolidated Mines Limited, but later named the Consolidated Mining and Smelting Company of Canada, represented a consolidation in the mining industry that paralleled consolidations in the other major industries in British Columbia in the pre-war period.\textsuperscript{2} The formation of Consolidated Mining and Smelting was hailed by the press at the time,\textsuperscript{3} and its increasing importance in the non-ferrous sector of the industry from 1906 to the end of World War Two is a theme that will recur throughout this thesis.
The year 1921 is representative of the post-war period in which lode-metal producers faced uncertain world markets still overstocked with supplies of the major metals. In 1921, the production of lead and copper was below that of the immediate pre-war period, while the output of silver was the second lowest since the turn of the century, and that of gold, only slightly above its second lowest output recorded in 1920. In 1922 and 1923, all the lode-metals produced in British Columbia would experienced rapid expansion, in concert with the renewed prosperity in North America in the early 1920's.

In the years between 1906 and 1921, the production of some major metals continued to increase, although at a rate considerably lower than in the boom years of the 1890's. The production of some other metals, on the other hand, declined over the period. Moreover, the output of most metals exhibited a degree of instability that was in marked contrast to the steady growth which occurred throughout much of the previous period.

Two factors which had retarded the early growth of the lode-mining industry—a low level of technology and a lack of transportation facilities—were not, on the whole, of major importance in explaining the lessening rate of growth for some metals and the declining output of others after the turn of the century. In fact, considerable advances were made in mining and milling technology between 1906 and 1921. With regards to transportation, the railway boom which accompanied the early growth of the
industry continued, two more Canadian transcontinental lines crossed the province, the railway network in the south was extended and made more dense, and the Provincial Government continued to aid in the construction of roads and trails to serve the mines.

For an explanation of the trends in lode-metal output between 1906 and 1921, two factors were of major importance. In the first place, the easy period of mine finding was nearing an end, and the capital requirements for locating and developing new mines were substantially greater than they had been earlier. As Innis notes, "the 'velvet' was beginning to wear off and mines were no longer able to prosper on the basis of exploiting rich ore at the 'grass roots'." 5 Secondly, a number of the mines which had contributed significantly to the rapid production growth in the 1890's were exhausted during the years between 1906 and 1921.

For an explanation of the fluctuations in output which characterized this period, one must turn largely to conditions external to the industry. It was in this period that the lode-mining industry revealed its high degree of dependence on external markets and its sensitivity to changes in world economic conditions.

In order to examine the performance of the industry between 1906 and 1921, to account for factors affecting that performance, and to outline the changes which occurred, this chapter will deal with the period
in three sections: the pre-war years, World War I, and the post-war years.

The Pre-War Years: 1906 to 1913

The performance of the lode-mining industry in the pre-war period was considerably different from what it had been in the boom years. In the 1890's, almost every year had seen an increasingly higher output for most metals, a steady rise in the number of producing mines had occurred, and a geographical expansion of mining activity had taken place. In the pre-war period, on the other hand, the output of some metals rose, but at a lower rate, while the output of others declined. Between 1906 and 1913 the number of shipping mines declined from 154 to 110, and in the four-year period from 1909 to 1912, an average of only 84 mines shipped ore to the smelters. Finally, in the pre-war years, the old-established districts in British Columbia continued to dominate both the tonnage mined and the production of particular metals.

Lode-gold production remained remarkably constant during the pre-war period, averaging about 240,000 ounces a year. In every year, the largest proportion of lode-gold came from the smelting of gold-copper ores, largely from the Rossland and Boundary districts. The only significant production of gold from stamp-milling came from the Nickel Plate mine near Hedley, a mine which in 1911 was said to be the largest gold producer in Canada.6
Silver production in the pre-war period continued a decline which had begun before the turn of the century, and in 1911 it reached its lowest output since 1895. Silver was produced largely as a by-product from the argentiferous galena ores of the Slocan and Fort Steele divisions. Hence, while the depressed world market for silver was an important consideration in the decline of silver output, the state of lead production was a contributing factor. In several years, drops in the output of lead were paralleled by declines in the output of silver. In addition, the geographical concentration of silver producers in two major areas, the Slocan and Fort Steele, meant that any interruption in the mining activity of these areas would substantially affect the silver production for the province as a whole. The low provincial output for silver in 1911, for example, was almost solely the result of the loss of the ore-shoot at the St. Eugene mine at Moyie, the interruption of service on the Kaslo and Slocan Railway caused by forest fires in 1910, and the loss of the plants at some of the major mines in the district, due to the same fires. Strikes at the collieries which shut off the supply of coke to the smelters were a contributing factor, though the closure of the smelters affected the industry as a whole, and not just silver producers. By 1913, silver production reached its highest output since 1902, a recovery due largely to the general revival of silver-lead mining in the Slocan district.
Between 1906 and 1913, the production of lead was centered in the Kootenays. In most years, the Slocan district and the mining divisions of Fort Steele and Ainsworth accounted for at least 90 per cent of the total provincial production. The lead industry was aided somewhat by the Lead Bounty which was proportionately tied to lead production on the basis of the London price of the metal. The conditions which militated against silver producers, however, were felt even more by lead mines and, in 1911, the output of lead reached its lowest point since 1903. Lead output also recovered by 1913, however, due to the increased output of this metal from the Slocan after 1911, and to the reopening of the Sullivan mine in 1912.

Copper production continued to rise throughout the pre-war years, although it too suffered a setback in 1910-11 with the closures of the interior smelters due to the shortage of coke. The copper output was also highly concentrated, with the Boundary district frequently accounting for 60 to 70 per cent of the provincial total. The coast and the Rossland areas were other major contributors which, together with the Boundary, often accounted for over 90 per cent of total production.

The production of zinc prior to 1905 had been small, for the reasons noted in Chapter IV. The possibility of increased production was good in 1905, however, since enriching plants had been erected to provide a 50 per cent zinc concentrate, a market for the metal existed in the United States, and, being classified as a "crude mineral", the concentrates
could cross the border duty free. In 1906, however, the United States Customs Department ruled that these concentrates were not "crude minerals" and were, therefore, subject to duty. The duty was sufficiently high as to suspend zinc mining for the year. Although this decision was reversed in 1907, continued uncertainty over the duty-free entry of zinc to the United States market, combined with the lack of success in developing a commercially feasible treatment for zinc ores, kept zinc production low in the pre-war years. By 1913, the United States tariff on zinc concentrates and ores entering that country had been lowered and served to stimulate the production of zinc in the latter part of that year. Over 98 per cent of the production came from the Slocan as a by-product from the treatment of silver-lead-zinc ores.

In the pre-war years, little iron ore was produced in British Columbia. In 1907, some 1500 tons of bog iron ore were mined and shipped from Quatsino Sound on Vancouver Island. This deposit, however, was found unprofitable due to its shallowness, and was abandoned. In some years prospecting and development work was carried out on known deposits, but no other shipments took place owing to the lack of a market for iron ore on the Pacific Coast.

This brief review of metal production between 1906 and 1913 has indicated the fluctuations which occurred in the output of several metals due largely to the influence of external conditions, but in 1911
to the influence of local conditions. It has indicated also the relative stability which characterized the distribution of metallic mineral production during the period. The discussion has not, however, revealed a major change which took place in the extent to which major companies were involved in the mining industry over this period.

Increasingly, the established mining districts came to be dominated by the large companies, especially those with interests in both mining and smelting. In their early years, the smelters had relied to a large extent on the ores from a single mine and, to a lesser extent, on the ores from a number of custom mines. In 1905, for example, the Silver King mine was the largest single source of ore for the Nelson smelter, but some 125 smaller mines were also shipping to the plant.11

As the major mines supplying the smelters began to show signs of exhaustion, the companies involved acquired other mines in order to ensure a supply of ore. Both the British Columbia Copper Company and the Granby Company, organizations which dominated the industry in the Boundary country, acquired a number of mines in this period, and were thus able to maintain their respective smelting operations at Greenwood and Grand Forks. The Dominion Copper Company had also attempted such a consolidation, but had closed its smelter at Boundary Falls in 1907. The smelter at Trail, as noted earlier, had also been involved in this type of consolidation, partly as a result of the impending decline of the Rossland
gold-copper ores. After 1907, when the Hall smelter at Nelson closed due to the declining output from the Silver King mine and to a financial depression which curtailed the production from many of its custom mines, the Trail smelter dominated the mining industry of the Kootenays. In 1907, the Consolidated Mining and Smelting Company added more mines to its holdings, and in 1910 it acquired the Sullivan mine. Both the Sullivan mine at Kimberley and the smelter at Marysville had been closed since 1907, when the company which owned and operated them ran into financial difficulties. In 1911, the Consolidated absorbed the Le Roi Mining Company, a large organization in its own right, and in 1912, the company acquired the Silver King mine at Nelson. By 1914, the Consolidated Mining and Smelting Company had indeed become a gargantuan concern and was, as Church points out, "even then almost synomnomous with mining in the Kootenay."

This pattern of regional domination by large companies which emerged in the southern interior in the pre-war years was evident also on the coast, the only other area in the province where significant lode-metal production occurred in the period. With copper remaining the major attraction, several areas were prospected and a few small mines reached the shipping stage. On the whole, however, major development was concentrated in the south coastal area and in the region of the Portland Canal.
In both areas, a major company dominated mining activity. In the south, the Britannia mine, which began shipments in December, 1905, shipped throughout the period, first to the Crofton smelter which the Britannia interests had acquired in 1904, and then to Tacoma. The smelter at Crofton was closed in 1907 because it could recover only 55 per cent of the copper content of the Britannia ores. Active development and continued expansion characterized the operations of the Britannia company. In 1912, it was reported that the company had adopted the flotation process for the separation of its copper ores, a metallurgical development which would have major subsequent effects on the mining industry in British Columbia in general. By 1913, then, copper production in the south coast was dominated by the Britannia mine. This development had occurred largely through the efforts of the Britannia company, although the exhaustion, by 1913, of the formerly important copper mines on Mt. Sicker near Duncan was a contributing factor.

On the northern coast the centre of activity was in the Portland Canal area, where small shipments of copper ore had been sent from one mine to an American smelter at Hadley, Alaska, as early as 1906. In subsequent years much development activity occurred. In 1910, the Granby Consolidated Mining, Smelting, and Power Company acquired the Hidden Creek copper mines on Observatory Inlet for a sum reported at $500,000. By 1912 a copper smelter was under construction in the new company town.
of Anyox, and by the following year the company had spent some $3,000,000 in development. In March, 1914, the Granby smelter at Anyox was blown in, an event hailed by the Gold Commissioner as the most important in the mining history of northern British Columbia. It is interesting to note that the Granby Company was now active not only in the Boundary and Port­land Canal areas, where it owned and operated mines and smelters, but also in Southern Alaska, where it owned and operated a number of mines, the ores from which would also be used to feed the new smelter at Anyox.

World War I

The first half of 1914 gave promise of being an exceedingly fa­vourable one for mining in British Columbia and "it was even expected that its mineral production would exceed that of any previous year." The outbreak of war in Europe in 1914, however, totally upset world metal markets. Quotations for the major metals were unobtainable for several months, leaving no basis on which sales could be transacted or future metal values predicted. By the end of the year, with the temporary loss of markets, many of the mines were shut down and most of the major pro­ducers were restricting their output under a common agreement to do so. Both the Grand Forks and Greenwood smelters shut down in late 1914. The Granby Company did, however, keep its Anyox smelter in operation, a factor which largely offset the lower output of gold and copper from the Boundary district.
Prices for most of the major metals remained much below normal for the early months of 1915. By May and June, however, the great demand for munitions had depleted metal stocks, and prices for copper, lead and zinc rose rapidly. Only silver prices remained low, with adverse effects on the mines of the Nelson, Slocan and Ainsworth divisions whose ores contained, on average, about twice the value in silver that they did in lead. Gold prices were, of course, fixed. The rapid rises in prices for the other metals brought about an increase in output, an increase which came largely from those mines that were already at or near the production stage. Most mining men recognized that the high price levels were temporary and, early in the war, with capital in demand for other purposes, the amount of new development was lower than normal. Nevertheless, by the end of 1915, some 132 mines were on the shipping list, an increase of 35 per cent over the previous year. The metalliferous output for 1915 was the greatest in the history of the province, despite the uncertain conditions which had characterized the first half of the year.

In the following year, another record lode output was attained, due to the increasing demand for war minerals and the continued high price levels. Predictions that the prices would now remain high led to an increase in new development, even though the higher costs of labour and supplies made the cost of such development high. In many areas, old
properties that had been abandoned or closed were re-examined, work was commenced, and in many cases, ore shipments were made. Several new concentrating mills were added and the capacity of others increased. Along the coast, a number of copper properties which had lain idle for years were taken up under option and development begun.

Copper production led the advance, accounting for over 55 per cent of total lode value in 1916. The Granby Company, whose smelters at Anyox and Grand Forks operated throughout the year, alone produced about 60 per cent of the total copper output for the province. Moreover, the high price of copper allowed their Grand Forks plant to handle a large amount of highly siliceous material with low values in copper which had not previously been classed as ore.

The rapid and sizeable increase in zinc production in British Columbia during the war was the result of successful experiments on the complex silver-lead-zinc ores of the Sullivan mine, carried out by the Consolidated Mining and Smelting Company. By 1915, the company was able to put into operation a commercial plant which separated the zinc out of the Sullivan ore. The plant was economically feasible at this time, because of the strong wartime demand for zinc and the attendant high price of the metal. Thus, despite the shortage of smelter capacity for zinc in North America, the output of this metal in British Columbia in 1916
showed an increase of 54 per cent over the quantity produced in the previous year. The high price of the metal also allowed lower grades of ore to be mined at a profit. Most of the zinc production came from the Kootenays, with the Sullivan mine alone producing about 40 per cent of the total output.

The production of lead and silver in 1916 remained centered in the Slocan, Ainsworth and Fort Steele mining divisions, the three areas together accounting for over 95 per cent of the total production in lead, and for over 70 per cent of the silver. The output of both metals remained essentially the same as in 1915.

The output of lode-gold in 1916, and indeed throughout the war years, was considerably lower than in the pre-war period. The high costs of labour and supplies, and the fixed price of gold were major factors accounting for the reduced output, especially in the case of mines that were operating primarily as gold producers.

These adverse economic conditions for gold producers, together with industrial troubles, a reduced demand for lead and zinc for munition purposes, and reduced metal prices late in the year, all led to a decreased lode-metals output for 1917. A protracted strike in the Crownest coal mines forced the copper and lead smelters in southern British Columbia to close for lack of fuel, and stopped mining in many productive areas of the province. Labour troubles also closed the mines at Rossland and the smelter at Trail late in the year.28
High prices for lead early in 1917 so stimulated production that a surplus of the metal developed and prices fell. The subsequent curtailment of lead orders by the Imperial Munitions Board forced the Trail smelter to decrease its output of that metal. This reduced throughput at the Trail smelter also adversely affected the output of silver for the year since a great portion of that metal still came from the argentiferous galenas of the Slocan and Fort Steele areas.

Copper, which accounted for 60 per cent of all metallic production in British Columbia in 1917, also experienced a decline in the year, due largely to the curtailment of smelting activity in the Boundary country that was not offset by increased production in the major mines along the coast (i.e. Anyox and Britannia). In September, the War Industries Board of the United States fixed the price of copper at 23.5¢ a pound but, while this was about 9 cents a pound lower than in February of the year, it was sufficiently high not to affect production levels seriously. 29

Conditions for most of 1918 were essentially the same as in the previous year, although the labour difficulties that had seriously affected production in 1917 were largely eliminated. With the exception of zinc, which registered a fractional decline in 1918, all the major metals recorded slight advances in output. With the signing of the armistice
in November, 1918, however, conditions would change significantly.

During the war, the lode-mining industry had, in general, experienced considerable expansion under the influence of inflated prices and sizeable demand. Between 1915 and 1918, an average of 167 mines shipped every year. The peak in the number of shipping mines (193) was reached in 1917 when the United States entered the war, a total that would not be exceeded until the late 1930's. Copper and zinc production reached new record levels. Silver, under the stimulus of high prices caused largely by increased demands for coinage, attained production levels not equalled since the turn of the century. Both gold and lead declined over the war years, for reasons noted earlier.

The expansion during the war was, moreover, not limited to the major metals discussed above. Indeed, since the beginning of the war, there had been a steadily growing demand for a number of other "war metals. 30 Some of these metals, such as molybdenum, manganese, antimony and chromite were known to exist in British Columbia. From 1914 onwards, attempts were made to mine them, and some shipments were made.

In 1914, molybdenum was discovered at Lost Creek near Salmo and, for two years, small shipments were sent to an American concentrating company at Denver, Colorado. 31 The market requirements were such that molybdenum ore had to be concentrated to about 85 per cent molybdenite
(MoS\textsubscript{2}) before it could be sold, and none of the mines which produced the ore in British Columbia had suitable concentrating mills. In 1916, small shipments were sent from mines at Lost Creek, Alice Arm, Lillooet and Keremeos to a government mill in Ottawa. In the following year, the Federal Government relaxed restrictions on the export of molybdenum ore to the United States, where the price of the metal was double that in Canada.\textsuperscript{32} The change, however, did little to stimulate production. By the middle of 1918, the market had collapsed and molybdenum mining in British Columbia would remain dormant until the 1960's.

Small quantities of antimony were shipped from the Alps-Alturas property on Carpenter Creek in the Slocan mining division in 1915 and 1916, while prices were high. By the end of 1916, however, increased world production, especially from China, brought about a rapid drop in price, and no further shipments were recorded in British Columbia during the war.\textsuperscript{33}

A manganese deposit at the Curle Manganese property near Kaslo was developed in 1917 and, with the relaxation of embargo restrictions on shipping the ore to the United States, some 15 car-loads of ore were shipped. Further small shipments were made from the Curle group and from Hill 60 at Cowichan Lake, but by 1920, the brief history of manganese mining in British Columbia was over.\textsuperscript{34}

A deposit of chromite near Cascade in the Grand Forks mining division was worked in 1918, and about 800 tons of chromite ore were
shipped the following year.\textsuperscript{35} A deposit on Scottie Creek near Clinton was opened in the same year, but the market for chromite disappeared and no further production occurred.\textsuperscript{36}

Aside from a few hundred tons of iron ore shipped from the south coast to a blast furnace at Irondale, Washington, no iron ore was produced in British Columbia during the war years.\textsuperscript{37}

The Post-War Years: 1919 to 1921

The impact of peace on the lode-mining industry of British Columbia was significant. For some time after the armistice was concluded, the market for copper, lead and zinc virtually disappeared. As the Provincial Minerologist noted, "the market for what are commonly called 'war minerals' is practically non-existent, and quotations cannot be obtained as the future demand for such materials is unknown."\textsuperscript{38}

Of the so-called "war metals", copper was particularly hard hit. The end of the war found all the Allied nations with large inventories of copper and no further demand for war supplies. In 1919 it was estimated that the stocks on hand were, in fact, sufficient to supply the demands on a peace-time basis for about two years without further production from the mines.\textsuperscript{39}

This situation was accompanied in British Columbia by the fact that a number of major copper mines, whose ore bodies were rapidly consumed during the war, were nearing exhaustion. Furthermore, with the fall
in copper prices from 26 cents a pound in late 1918 to less than 15 cents a pound in early 1919, and with no drop in mining and treatment costs, a number of major closures took place.

Towards the end of 1918, the Canadian Copper Corporation closed its smelter at Greenwood, the ores at the company's Mother Lode mine being exhausted. The Granby Company's mines at Phoenix were unable to keep the company's Grand Forks smelter operating at full capacity in 1918. In addition, little margin of profit was possible from the low-grade Phoenix mines and, during 1918, the old Phoenix mine had been run "more from patriotism than from hope of profit." Early in 1919 the mine and smelter were closed, after having produced for almost two decades. The company kept its Anyox smelter in operation, but at a significantly lower level of production.

The copper market remained in a "thoroughly demoralized condition" throughout 1919, due largely to delays in settling the peace terms and to the slowness with which the expected rejuvenation of the peace-time industries took place. By year end, total provincial copper production had fallen to some 42,000,000 pounds, a decrease of over 30 per cent from the 1918 output. It is significant to note, however, that some 88 per cent of this output came from the coastal region. With the decreased output and subsequent closure of the Boundary copper mines, the coast had become, and would remain, the centre of the copper-mining industry in British Columbia.
During 1920 and 1921 the demoralized condition of the copper market continued, prices for copper remained low, and the costs of mining and treating ores remained high. For 1921, the copper mines of British Columbia produced some 39,000,000 pounds of the metal, the lowest output since 1911.

Immediately after the war, the world lead market was in a depressed condition similar to that for copper. Stocks of the metal were high, and practically no sales took place.\(^42\) In 1919, lead production fell to its second lowest output since 1903. In 1920, a number of mines throughout the province were forced to curtail their output,\(^43\) although production increased by some 33 per cent over 1919, most of this coming from the increased output of Consolidated's Sullivan mine. Unlike the case of copper-mining, the war had not altered the centre of lead production in the province. In 1921, over 90 per cent of the metal was produced in the Fort Steele mining division of East Kootenay, much of this coming from the Sullivan mine.

In general, the world market for zinc was not as much affected as the copper and lead markets by the transition from war to peace-time conditions. Production of the metal in British Columbia had increased almost steadily since 1911, reaching its highest output ever in 1919. A minor setback, however, was recorded in 1920 and 1921 when some uncertainty as to the production of the metal was felt throughout North
After 1921, however, zinc production would again begin its rise in British Columbia, due largely to the Sullivan mine at Kimberley which dominated the provincial production.

As far as the precious metals were concerned, both gold and silver production declined in the post-war period. The high price for silver which obtained during 1919 aided those mines in which the ore contained a high value in silver, notably in the Slocan. However, the general decline of other metals, from which most of the silver was produced as a by-product, led to a drop in the quantity produced. In 1920, the price of the metal fell from a high of $1.32 an ounce in January to only 65 cents in December. The lower price of silver continued in 1921, and silver production in that year reached its lowest level since 1911.

High costs and a fixed price adversely affected gold output in British Columbia throughout the war and in the post-war years. In 1919 the closure of the Granby mines and smelter in the Boundary District seriously affected gold production since, in former years, the gold values of the copper ores had made significant contributions to total gold production. This decrease was only partly offset by the new Premier mine in the Portland Canal area and by the Dolly Varden on Alice Arm. In 1920 the Nickel Plate mine at Hedley, the major stamp-milling producer in British Columbia, was also closed. In the following year, lode-gold production was only 135,663 ounces, the second lowest output since 1898.
Major Changes Within the Industry: 1906-1921

Having examined the performance of the lode-mining industry in a relatively complex period of its development, it is necessary now to identify the major changes which occurred within the industry during this period. By isolating these changes, it will be possible to explain the spatial shifts which took place between 1905 and 1921, and to suggest why the industry was in a healthier condition in 1921 than indicated by the levels of output for that year.

One of the major changes which occurred between 1905 and 1921 was the decline or exhaustion of several ore-bodies whose output had contributed significantly to lode-metal production in the province. Mines such as the Tyee, the Phoenix, and the Silver King were worked out in this period.

A second major change was the emergence of large corporations in the industry. In the first decade of the twentieth century, the impending decline of major ore-bodies which supported the southern interior smelters led to a number of business consolidations, of which the Consolidated Mining and Smelting Company of Canada and the Granby Consolidated Mining, Smelting and Power Company were of major importance. Over the next decade, the Consolidated Company had acquired a number of mines, expanded operations at the Trail smelter, and transformed the Sullivan mine from a small silver-lead mine into the major silver-lead-zinc producer in the
province. A similar program of expansion was followed by the Granby Company, which acquired several mines during the period and built an additional smelter.

The period between 1905 and 1921 also saw a number of technological innovations in mining and metallurgical practice. Several mines introduced mechanical mucking machines which allowed a large-scale extraction of broken ore. The use of compressed-air drills for underground work and diamond drills for the blocking-out of ore-bodies became more prevalent during this period. The major metallurgical advance during this period was the introduction of the flotation process for ore concentration. The adoption of this process at the Britannia mine in the pre-war years ensured the continued operation of the mine despite the exhaustion of high-grade copper ores. The adaptation of the flotation process to the complex Sullivan ores during the war was the major reason behind the expansion of this mine.

The Spatial Pattern of Production: 1921

The distribution of shipping mines in British Columbia in 1929 (Maps 9 and 10), although representing a point in time when metal markets were highly depressed, illustrates the major spatial shifts which occurred between 1905 and 1921. The reasons for the spatial shifts were, on the whole, closely related to the major internal changes which characterized the industry over the period.
For area in inset see Map 10.

SOUTHEASTERN BRITISH COLUMBIA

For explanation of symbols, see main map legend
A new centre of copper mining and smelting had emerged on the north coast. The development of this complex was due solely to the efforts of the Granby Company who, after acquiring the Hidden Creek copper deposits, vigorously developed these ore bodies and built a smelter on Observatory Inlet.

Another major change was the decline of the Boundary District as a major copper-producing region, a decline hastened by the high levels of output maintained during the war. There was still copper in the deposits of the Boundary area, as their rejuvenation at a later date would indicate, but in terms of the economic and technological conditions which prevailed by 1919 and 1920, the mines were exhausted and production virtually ceased.

The old mining camps at Rossland and at Toad Mountain south of Nelson had also declined over this period. Their low levels of production in 1921 reflected not only poor market conditions, but also the exhaustion of the major mines which had been worked since the 1890's. Indeed, in 1921, the Nelson area was insignificant in terms of output. The Consolidated Mining and Smelting Company continued to operate some of its original mines in the Rossland camp, such as the Center Star, but production was considerably lower than it had been in 1905.

Elsewhere in British Columbia, the southern part of the East Kootenay continued its domination of silver and lead production, and by
1921 it had become the major zinc producing region in the province as well. The Slocan-Ainsworth area continued to yield considerable quantities of silver and lead, for the most part from a large number of small mines. The south coastal area remained an important copper producer throughout the period, largely because of the expanding output of the Britannia mine on Howe Sound. The Belmont-Surf Inlet mine on the coast south of Prince Rupert had become a sizeable producer by 1921, yielding considerable quantities of copper and silver, and about 27 percent of the lode-gold produced in the province during the year.

A comparison of the maps for 1905 (Maps 7 and 8) and 1921 (Maps 9 and 10) also reveals the changes in the spatial pattern of smelters. Some of the plants, such as those at Nelson and in the Boundary district, had closed with the exhaustion of their principal supporting mines. The smelters on the lower coast closed for similar reasons, although the construction of a larger and more efficient plant at Tacoma in 1906 had hastened their demise. The smelter at Marysville closed, as noted earlier, when the ores from the Sullivan mine were diverted to Trail. The only smelter built in British Columbia during this period was the plant at Anyox, blown in in 1914 to treat the extensive copper deposits at the Granby Company's Hidden Creek mines. By 1921, therefore, only two smelters were operating in British Columbia, a situation that would persist until the 1930's.
Between 1905 and 1921, then, there had been a number of geographical shifts in the mining and smelting of lode-metals in British Columbia. With the important exception of the expansion of activity into the north coastal area, most of these shifts were in a relatively narrow belt along the southern part of the province between the coast and the Rocky Mountains.

Conclusions

The period between 1905 and 1921 was one in which the production of lode-metals was strongly influenced by a number of changes which occurred both within and outside the industry. Production of most metals fluctuated under the influence of changes in external markets, a factor evident particularly during and after World War I. By 1921, the generally poor world economic conditions had forced the production of lode-metals in British Columbia to a very low level. The total value of lode-metal output in that year was only $12,925,448, a figure over $2,000,000 below that of 1905. (See Figures 2 and 3).

Some metals had experienced growth over this period, but at a rate lower than in the previous one. Other metals had experienced a decline. Both trends were largely due to the decline of a number of major mines, to an increasing difficulty in finding new mines, and to the greater capital expenditure needed to bring such mines into production.
FIGURE 3

COMPOSITION OF LODE-METAL PRODUCTION

BRITISH COLUMBIA 1921

Total Value of Production - $12,925,448.00

Average Prices 1921

<table>
<thead>
<tr>
<th>Metal</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>12.50 cents/pound</td>
</tr>
<tr>
<td>Lead</td>
<td>4.09 cents/pound</td>
</tr>
<tr>
<td>Zinc</td>
<td>3.95 cents/pound</td>
</tr>
<tr>
<td>Silver</td>
<td>59.52 cents/ounce</td>
</tr>
<tr>
<td>Gold</td>
<td>$20.67/ounce</td>
</tr>
<tr>
<td>Iron Ore</td>
<td>$ 5.00/ton</td>
</tr>
</tbody>
</table>

While the industry was unable to exert control over the fluctuations in external markets, it could, and did, respond to the new conditions of mining in British Columbia which developed between 1905 and 1921. The response took the form of corporate consolidations, the importance of which was considerable. These large, well-managed, and well-financed companies were better able to find and develop new mines, as in the case of Granby and the Hidden Creek complex. The new companies were able to expand production at existing mines through the application of new metallurgical techniques as, for example, at the Britannia and Sullivan mines. Finally, the major companies were better able to withstand, at least over the short-term, the effects of adverse market conditions. The latter point is well illustrated by the activity of the Consolidated Mining and Smelting Company in 1921. In that year, the company produced a record output of lead and zinc at the Trail smelter, despite the poor market conditions which prevailed. This production was in part the result of the metallurgical advances mentioned earlier, but was also due to the ability of the company to finance the carrying of large accumulated metal stocks in times of low market demand.47

In short, the lode-mining industry in 1921, in terms of output, was at a low point. Spatially, the industry was still concentrated in the southern part of the province and along the coast. That little production occurred in the interior of the province, and that the only major
geographical expansion was along the coast, suggests that the role of transport costs continued to be of major importance. Nevertheless, the technological and organizational developments which occurred between 1905 and 1921 placed the lode-mining industry in a strong position for more efficient and large-scale operations in times of steady or expanding demand for metals.
FOOTNOTES


8. When the London market price for lead rose, the Dominion Government bounty on lead was proportionately reduced, and vice-versa. See Annual Report of the Minister of Mines, 1906, p. H21.


13. J.S. Church, op. cit., p. vi.


23. Clearly, wars were not won with silver bullets. Unlike other metals, silver declined in price owing to the effects of the war on the market. The chief demand for silver came from the Far East, and as there were some disturbances in China, the demand was less than normal. Silver for use in the arts was less in demand in Europe than in former years, as a result of the war. On the other hand, there was a greater demand for silver for coinage purposes. See Annual Report of the Minister of Mines, 1915, pp. K15 and K23.


36. Wartime interruptions in shipping forced foreign chromium ores off the North American market in 1917. Because the mineral was essential in the production of munitions, demand became urgent, and in the latter half of 1917 and the first half of 1918, a price of $1.20 a pound ruled for ores containing only 40 per cent chromic oxide ($\text{Cr}_2\text{O}_3$). By October, 1918, more 40 per cent ore was being offered than could be absorbed by Eastern United States markets. The grade of the British Columbia deposit was only slightly above 40 per cent. See Canada, Munition Resources Commission, *Final Report*, Toronto, Industrial and Technical Press, 1920, pp. 40-44.


CHAPTER VI

THE SECOND MINING BOOM: 1922-1929

The period 1922 to 1929 saw a steady expansion of output for most metals in British Columbia, reflecting the recovery of world markets from post-war disorganization. Expansion of output was not, however, paralleled by a geographic expansion of producing mines into new areas of the province. On the whole, those districts, and indeed the same mines, which were major contributors to lode-metal tonnages in the early 1920's were still the major contributors at the end of the decade. Hence, the expansion in the lode-metal mining industry in this period was very much an expansion of major producers, operated by well-financed and well-managed companies such as Britannia, Granby, and Consolidated.

The year 1922 saw a general recovery of the mineral industry throughout the world from the disorganization of markets in the immediate post-war period. Although conditions in Europe were still decidedly unsettled, the consumption of metals did increase slightly. In North America, the greatly overstocked markets which accounted for the depressed metal prices in 1921 were somewhat relieved, and prices for most of the major metals increased steadily throughout 1922. In British Columbia, with the costs of mining declining over the year, all metals except copper registered substantial increases in output. Copper production
would have increased, had it not been for the fact that the Britannia mine, a major producer, was inactive during the year.\(^2\)

The expansion in output during 1922 was, in general, characteristic of the period from 1922 to 1930. In almost every year the major metals recorded new record outputs, reaching by 1929 or 1930 their greatest outputs since the beginning of the industry. Only gold experienced a decline, coming after 1924, for reasons noted later.

The expansion of production which occurred between 1922 and 1929, the major factors which accounted for this expansion, and the geographical pattern which emerged, are best illustrated by treating the second mining boom on the basis of the individual metals produced over the period.

**Lead and Zinc**

During the period from 1922 to 1929, lead and zinc exhibited the greatest growth. Over 302,000,000 pounds of lead were produced in 1929, an increase of almost 350 per cent over its 1922 level. In the same period, zinc output had risen by 200 per cent to a production of over 172,000,000 pounds. This growth in lead and zinc was due almost solely to the efforts of the Consolidated Mining and Smelting Company in enlarging its operations at the Sullivan mine and at the Trail smelter.

Significant production at the Sullivan mine had been possible only after a series of metallurgical experiments had provided the solution to the complex silver-lead-zinc ores of the mine. (See Chapter V).
Prior to 1915, the Sullivan had been primarily a silver-lead producer with ores high in these two metals and low in zinc being mined and shipped to Trail. After the successful separation of the complex ores was achieved during the war, and the differential flotation process for lead concentration was adopted in 1920, the output of the Sullivan increased rapidly and was paralleled by the expansion and improvement of milling and smelting operations at the Sullivan-Trail complex. In 1923, a new concentrator for the preliminary treatment of silver-lead-zinc ores was put into operation at Kimberley, and two years later it was enlarged to handle 4000 tons a day. At Trail the electrolytic zinc plant, first operated in 1916, was expanded in 1924, 1927, and again in 1929. The lead plant also went through a series of expansions, in 1924, 1926, and 1927. In 1926, the concentrator at Trail was itself enlarged, and in the following year a cadmium plant was installed. A bismuth plant was added in 1928, and a slag-fuming plant to recover zinc from the slag of the lead blast furnace was completed in 1930. These and other expansions and additions to the Consolidated operation had, as early as 1925, made the Trail plant the largest non-ferrous smelter in the world, and the Sullivan mine at Kimberley, the world's largest lead and zinc mine.

In 1929, the production of refined lead and zinc at Trail was almost 50,000,000 pounds, the bulk of this coming from the company's
Sullivan mine. The dominance of this one large mine is clearly reflected in the output for lead and zinc for the Fort Steele Mining Division during this period. In almost every year between 1922 and 1929, with production levels rising as noted earlier, the Division produced over 90 percent of the total provincial output of lead and zinc. In 1929, 95 percent of both metals were credited to the Fort Steele Division and, therefore, almost solely to the Sullivan mine. 8

The remainder of the lead and zinc production in British Columbia in this period came almost totally from the Slocan and Ainsworth districts, whose mines were favourably affected by the improvement and expansion of facilities at the Trail smelter. The completion of a customs plant for zinc ores in 1922 was of major importance since it provided a local market for zinc ores and concentrates, many of which had earlier been shipped to American smelters. 9 A further aid to the silver-lead-mines was provided in 1929, when the Consolidated abolished the zinc penalties on lead ores. 10 From 1922 to 1929, the Slocan and Ainsworth divisions together accounted for an annual production of some 5 per cent of British Columbia's lead, and about 8 per cent of the zinc.

Copper

Once the Britannia mine on Howe Sound came back into production in 1923, copper production in British Columbia exhibited an expansion similar to that of lead and zinc. In 1929 the copper output of the mines
was about 101,000,000 pounds, an increase of about 200 per cent over the 1922 level, and the highest output ever recorded. The impetus to this growth was provided by a recovery of markets in Europe, an expansion of markets in the United States, initially spurred by an advertising campaign for the more extensive use of the metal, and by a relatively stable price level.

As in the case of the other base metals, the rise in copper production was virtually synonymous with the expansion of major mines or, at least, of major companies. During the dismal period following the war, the large producers had been forced to make economies "they had not recognized as possible," and, as the market began to recover, such producers were in a strong position to expand. Moreover, throughout the 1920's the large copper mines of the Province were brought up to a high state of efficiency, with modern equipment resulting in lower costs.

Between 1922 and 1929, copper production remained centralized in the north and south coastal regions, although after the mid-1920's, the Copper Mountain mine near Princeton made an important contribution to the total output. The gold-copper ores of the Rossland area, which had significantly added to provincial copper production in earlier years, had by about 1925 temporarily passed into history, despite heroic and unsuccessful efforts by the Consolidated Mining and Smelting Company to achieve an economic concentration of the large tonnages of low-grade ores still
remaining in the company's mines. The dominance of a few major mines in the production of copper is shown in Table 1.

**TABLE 1**

<table>
<thead>
<tr>
<th>Mine</th>
<th>1922</th>
<th>1923</th>
<th>1924</th>
<th>1925</th>
<th>1926</th>
<th>1927</th>
<th>1928</th>
<th>1929</th>
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<tbody>
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<td>54.0</td>
<td>55.0</td>
<td>43.0</td>
<td>41.0</td>
<td>35.4</td>
<td>36.0</td>
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<td>35.0</td>
<td>38.0</td>
<td>42.0</td>
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</tr>
<tr>
<td>Copper Mountain*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5.0</td>
<td>20.0</td>
<td>20.0</td>
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<tr>
<td>Total</td>
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<td>98.0</td>
<td>98.0</td>
<td>99.0</td>
<td>99.2</td>
<td>99.6</td>
</tr>
</tbody>
</table>

*The Allenby Copper Company, operators of the Copper Mountain mine, was merged with the Granby Company on October 1, 1926. Hence, while the Britannia mine was the largest producer by 1929, the Granby interests produced over 58 per cent of the total copper output in the province. See Annual Report of the Minister of Mines, 1929, p. A219.

The output of copper between 1922 and 1924 which did not come from the Britannia or Hidden Creek mines was largely the product of a few mines on the coast and in the Rossland area. The Indian Chief mine on the west coast of Vancouver Island shared the balance of the copper production in 1922 about equally with the Belmont-Surf Inlet mine on Princess Royal Island with some producers in the old Rossland camp. The same mines contributed about 5 per cent of the total output in 1923, and about 9 per cent in the following year.
In 1925, the Consolidated Company blew in a copper furnace to handle the accumulated concentrates and ores from the company's Rossland properties and to treat the concentrates from the Copper Mountain mine, for which the Consolidated had the smelting contract. After 1928, however, when the Granby Company switched its Copper Mountain shipments from Trail to Tacoma, and when the Rossland properties were clearly exhausted, the Trail smelter ceased to accept copper ores.

Silver

Although silver production in British Columbia between 1922 and 1929 decreased in some years, the trend in output was clearly upward. In 1929, some 9,900,000 ounces were produced by the mines of the province, an increase of about 40 per cent over 1922, and of 270 per cent over 1921. The overall rising production of silver was due in large part to the very great increases in the output of base metals, with which silver was associated. Although the price of silver fluctuated considerably in the early 1920's and trended steadily downward in the later years of the decade, such lower prices had only a limited effect on silver production. In British Columbia, approximately 80 per cent of the silver came from mines in which the silver value of the ores was of less importance than other metals such as gold, copper, lead and zinc. Thus, lower silver prices led to decreased revenue for such mines, but they did not generally curtail production, at least while the prices of the co-produced metals
were high. Lower silver prices did, however, adversely affect those mines in which silver values were high. In 1927, for example, the silver output from the Slocan mines was less than half that produced in the previous year, a decline brought about largely by the fall in silver prices during 1927.\textsuperscript{19}

As might be expected given the by-product nature of silver mining, the geographical distribution of silver production during this period was considerably more dispersed than that exhibited by the base metals. The areas of major importance were the north coast (Portland Canal and Nass River Mining Divisions), the Slocan (Slocan and Slocan City Mining Divisions), and the southern part of the East Kootenay (Fort Steele Mining Division). In the early years of the 1920's the Premier mine, a gold-silver producer near Stewart, was the largest individual silver producer in British Columbia, yielding some 3,340,000 ounces annually between 1922 and 1924. This represented about 46 per cent of the total provincial output for the three-year period. Also in the north coastal region, the Hidden Creek mine of the Granby Company, although primarily a copper producer, contributed between three and seven per cent of the provincial silver output in the years between 1922 and 1929.

In the East Kootenay, the Consolidated Mining and Smelting Company's Sullivan mine, which had come to dominate lead and zinc production over the period, had also become the largest silver producer in British Columbia by 1925. In the following year it was the largest silver pro-
ducer in Canada. Between 1922 and 1929, this mine steadily increased its output of silver, and by 1929, it accounted for over 50 per cent of the total provincial output.

The remainder of the silver produced in British Columbia came from a large number of much smaller mines, many of which were located in the Slocan. The Slocan mines produced an average of 11 per cent of the province's silver between 1922 and 1929, although in some years when silver prices were low, their output was substantially reduced. In 1927, for example, they accounted for only 3.8 per cent of the silver output.

Silver was also produced in varying amounts from several other areas, among which the Greenwood, Omenica, and Vancouver Mining Divisions were particularly significant. By 1929, the distribution of silver production in British Columbia was as shown in Table 2

<table>
<thead>
<tr>
<th>Mining Division</th>
<th>Per Cent of B.C. Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fort Steele</td>
<td>51.0</td>
</tr>
<tr>
<td>Portland Canal</td>
<td>24.0</td>
</tr>
<tr>
<td>Slocan</td>
<td>9.7</td>
</tr>
<tr>
<td>Greenwood</td>
<td>4.5</td>
</tr>
<tr>
<td>Nass River</td>
<td>2.9</td>
</tr>
<tr>
<td>Omineca</td>
<td>2.6</td>
</tr>
<tr>
<td>Vancouver</td>
<td>2.0</td>
</tr>
<tr>
<td>Similkameen</td>
<td>1.7</td>
</tr>
<tr>
<td>Ainsworth</td>
<td>0.9</td>
</tr>
<tr>
<td>Nelson</td>
<td>0.2</td>
</tr>
<tr>
<td>All others</td>
<td>0.5</td>
</tr>
</tbody>
</table>
As these figures indicate, much of the production came from only three areas. In two of these three areas, output was largely from a single major mine.

Gold

Lode-gold production in British Columbia, as elsewhere in the world, had been adversely affected in the immediate post-war period by rising costs of production and a standard price for the product. During the 1920's, the price of fine gold remained fixed at $20.67 an ounce, and while production costs declined for mining in British Columbia in general, relatively high costs were still frequently cited as a major handicap to the expansion of gold production.

Between 1922 and 1924, lode-gold production rose to reach levels it had consistently maintained from the turn of the century until the First World War. For the remainder of the 1920's, however, output declined steadily. By 1929, it was only 20 per cent above its level at the beginning of the decade. The highly fluctuating and downward trending gold output was the result of three major factors. Firstly, a significant percentage of the gold produced was a by-product from base-metal mines and was, therefore, subject to yearly fluctuations according to the grade of ore treated. Secondly, one of the major lode-gold producing areas of British Columbia, the Rossland gold-copper camp, declined throughout the 1920's and was virtually exhausted by the later
years of the decade. Finally, no new major gold mines came into production between 1922 and 1929, and some of the major mines closed down or reduced their output.

As in the case of silver, the distribution of gold production in British Columbia was more dispersed than that of the base metals. There was, however, one area which contributed the bulk of the province's lode-gold throughout the period. In 1922, the north coastal region, including the mining divisions of Portland Canal, Skeena, and Nass River, accounted for almost 85 per cent of the 197,856 ounces produced, some 62.5 per cent coming from the Portland Canal Division alone. In the remainder of the period, this northern area never produced less than 70 per cent of the total lode-gold output.

The important output of the north coast was due not to a large number of small mines, but to a relatively few major producers. In every year between 1922 and 1929, the Premier gold-silver mine near Stewart was by far the largest single contributor to gold output, both in its own district and in the Province as a whole. On the average for the period, the Premier produced over 60 per cent of British Columbia's lode-gold. Another major gold-silver mine in the north coast was the Belmont-Surf Inlet mine on Princess Royal Island. This mine annually contributed an average of 14 per cent to gold output before it closed in 1926, its ore bodies being exhausted. In addition to these two gold-silver mines,
the Granby Company's Hidden Creek mine yielded a significant amount of by-product gold between 1922 and 1929.

Elsewhere in British Columbia, the major centres of gold production were in the Boundary-Yale districts and on the south coast. In the last-named area the Britannia mine, once it recommenced production in 1923, steadily increased its output of by-product gold. The expansion of gold production in the south coast area over this period was, in fact, almost totally due to the increased output of the Britannia mine. In 1929, the mine yielded almost 10 per cent of British Columbia's lode-gold.

The Boundary-Yale district contributed about 8 per cent of the gold mined in British Columbia in the years between 1922 and 1929. As in the other major producing areas, output was primarily from a few large mines. The Osoyoos Mining Division annually yielded about 15,300 ounces, much of that coming from the Hedley Gold Mining Company's Nickel Plate mine. Declining gold output at the Nickel Plate, especially after 1925, was one of the reasons for the general decline of lode-gold production in British Columbia during that period.

With the re-opening of the Copper Mountain mine in Similkameen in the early 1920's, this division began to add to the gold output of the province. The division accounted for about 2.7 per cent of the provincial gold between 1926 and 1929, with the by-product gold from the
Granby's Copper Mountain being responsible for the majority of the yield. In the Lillooet district, the mines at Cadwallader Creek (i.e. the Bridge River area), on which considerable development work had been done by the mid-1920's, began to contribute to the lode-gold output. Here, too, most of the metal came from one major mine, the Pioneer. In 1929, this mine was responsible for about 3 per cent of the total provincial output of lode-gold.

Table 3 illustrates the relatively wide-spread distribution of gold production which had emerged in British Columbia by 1929.27

TABLE 3
DISTRIBUTION OF GOLD PRODUCTION: 1929

<table>
<thead>
<tr>
<th>Mining Division</th>
<th>Percentage of B.C. Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portland Canal</td>
<td>66.5</td>
</tr>
<tr>
<td>Vancouver</td>
<td>9.8</td>
</tr>
<tr>
<td>Osoyoos</td>
<td>9.8</td>
</tr>
<tr>
<td>Similkameen</td>
<td>4.1</td>
</tr>
<tr>
<td>Lillooet</td>
<td>3.5</td>
</tr>
<tr>
<td>Nass River</td>
<td>3.2</td>
</tr>
<tr>
<td>Nelson</td>
<td>1.7</td>
</tr>
<tr>
<td>Trail Creek (Rossland)</td>
<td>0.1</td>
</tr>
<tr>
<td>All others</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Here, as in the case of silver production, it is clear that a sizeable proportion of the lode-gold produced came from three areas in the province. In each of these, the output was largely from a single major mine. That
the successful gold mines such as the Premier, Pioneer, and the Nickel Plate were located on high-grade ore-bodies relatively close to tide-water or rail connections supports the fact that "only the richer and more conveniently accessible deposits can hope for profitable operations under existing conditions."  

Other Metals

In addition to the major metals discussed above, the lode-mining industry during the 1920's produced a number of other metallic minerals. The extension of smelting facilities at Consolidated Mining and Smelting's Trail smelter, noted earlier, led to the production of small quantities of cadmium and bismuth. Both metals were by-products from the treatment of concentrates from the Sullivan mine. It had been known for some time that the Sullivan ores also contained a small amount of tin. In 1925, the company succeeded in recovering 124 tons of tin concentrates, containing about 13,000 pounds of tin. The material was, however, of no commercial value until methods of reduction were perfected, and it remained stored at the smelter until such treatment was available.

Between 1928 and 1930, some platinum and palladium were also recovered as by-products from refining operations at the Trail plant. The source of these metals is uncertain, but it is presumed to have been copper concentrates from the Copper Mountain mine. Finally, small quantities of iron ore continued to be produced in the 1920's, with small
shipments largely coming from the Good Hope mine on Texada Island, and from the Alta Lake region near Vancouver.

Conclusions: Spatial Changes and the Reasons for Them

By the end of the 1920's, the lode-mining industry of British Columbia was in a particularly healthy state. The production of all the major metals, except gold, was at record or near record levels. The total value of lode-metal output was over $52,000,000, an almost three-fold increase over the value obtained in 1922 (Figure 4). This record production came from 105 shipping mines (Maps 11 and 12), but as noted earlier, only a small number of these mines contributed significantly to the total provincial output.

Both the tonnages shipped and the number of mines indicated in Maps 11 and 12 reveal the tremendous growth of production which took place in the lode-mining industry between 1921 and 1929. Moreover, the pattern of shipping mines clearly shows the limited geographical expansion which accompanied this growth in output. A comparison of the maps for 1921 and 1929 shows that the bulk of the production growth occurred in three major areas—the north and south coast, and the East Kootenay. Furthermore, in each of these areas, the growth was due largely to the expansion of a single major mine and to the initiative of its controlling company.

The reasons for the expansion in output at the two major copper mines—Hidden Creek and Britannia—were an increased demand for copper,
FIGURE 4

COMPOSITION OF LODE-METAL PRODUCTION
BRITISH COLUMBIA 1929

Total Value of Production - $52,144,849.00

Average Prices 1929

<table>
<thead>
<tr>
<th>Metal</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>18.11 cents/pound</td>
</tr>
<tr>
<td>Lead</td>
<td>5.05 cents/pound</td>
</tr>
<tr>
<td>Zinc</td>
<td>5.39 cents/pound</td>
</tr>
<tr>
<td>Silver</td>
<td>52.99 cents/ounce</td>
</tr>
<tr>
<td>Gold</td>
<td>$20.67/ounce</td>
</tr>
</tbody>
</table>

SOUTHEASTERN BRITISH COLUMBIA

For explanation of symbols, see main map legend

New Denver
Beaverdell
Trail
rising prices for the metal, continued development of the ore-bodies, and a high level of mining and treatment efficiency. Higher prices for lead and zinc, and the expansion of treatment facilities at the Trail smelter were the major factors accounting for the sizeable growth of the Sullivan mine.

The impact of the Consolidated Mining and Smelting Company was, however, felt well beyond the company's own large mine at Kimberley. Indeed, the expansion of facilities at Trail and the acceptance of Slocan ores at the Trail plant since 1925 were the major reasons for the growth of mining activity in the Slocan-Ainsworth area. In 1926, the Consolidated Company had erected a concentrator at the old St. Eugene mine near Moyie, and in the later years of the 1920's had recovered and retreated mill tailings from Moyie Lake. In the Nelson area, the major producing mine in 1929, the Hunter V, was a Consolidated operation. Nor were the activities of the company restricted to the Kootenays. In 1929, for example, the company was conducting metallurgical experiments on chromium ores from the Flint mine at Scottie Creek, was pursuing development in copper properties near Port Hardy on Vancouver Island, and was financially involved in development work at the Big Missouri mine in the Portland Canal area. In short, by 1929, the regional impact of the Consolidated Mining and Smelting Company was both widespread and considerable.
A similar influence on the mining industry was generated by the Granby Consolidated Mining, Smelting and Power Company. This company not only operated the only other smelter in the province, but also, at its Anyox complex, operated two copper mines—the Hidden Creek and the Bonanza—as well as two silver-gold mines—the Golskeish and the Granby Point. The company also operated the increasingly important Copper Mountain mine south of Princeton.

A comparison of the maps for 1921 and 1929 also indicates that, in the latter year, there were still very few producing mines that were not located within a few miles of railway lines already operating in 1921 or within a few miles of tidewater. The availability of such transport in the established areas has been noted earlier. Other centres of production in 1929 also conform to the pattern. For example, the small mines south of Hazelton were on the Canadian National Railway mainline; the Bridge River mines west of Lillooet were close to the Pacific Great Eastern Railway; and the Copper Mountain mine and its mill at Allenby were both connected by the Kettle Valley line which ran from Midway in the Boundary district to Hope at the head of the Lower Fraser Valley. Moreover, virtually none of the known metalliferous deposits located in interior areas not served by rails were brought to the shipping stage during this period. It would appear, therefore, that the role of accessibility, and particularly the availability of low-cost rail or water
transport, remained a major factor in the location of shipping mines. However, while this and several other economic, physical, and technological conditions combined to determine the feasibility of mining any particular mineral deposit in the province, it is also clear that the activities of the major mining corporations—Consolidated, Granby, and Britannia—greatly influenced the spatial pattern of producing mines in British Columbia at this time.
FOOTNOTES


2. The Britannia mill was destroyed by fire in late 1920. Construction of a new mill was underway in 1922 and was completed early in 1923. The mine produced nothing in 1922, See Annual Report of the Minister of Mines, 1922, p. N23.


11. The 1929 output of the 101,483,857 pounds was, in fact, not exceeded until 1962 when 108,979,144 pounds were produced.


25. Although the Premier was first known as a high-grade silver mine, the value of gold production from the mine exceeded that of silver in every year after 1922. See J.D. Galloway, "Lode-gold Mining in British Columbia," British Columbia Miner, Vol. 4, No. 12 (December, 1931), p. 21.


32. The company also used the new mill to treat a considerable tonnage of oxidized dump-ore from the Sullivan mine. See Annual Report of the Minister of Mines, 1929, p. C259.
CHAPTER VII

THE DEPRESSION AND THE GOLD MINING BOOM

The performance of the lode-mining industry in the years between 1929 and 1939 was very much affected by world economic conditions. The stock market crash in late 1929 brought about a considerable drop in the price levels for many metals. By 1931, several major base-metal mines had curtailed their output and many small, marginal operations had ceased production. In one sector of the industry, however, that of gold mining, a sizeable expansion took place during the 1930's as a result of upward changes in the price of gold.

The Immediate Effects of the Depression

The 1929 production levels indicated in the previous chapter would suggest that the stock market crash late in the year had little immediate effect on the overall production of the lode-mining industry of British Columbia. Furthermore, during 1930, when prices for silver, copper, lead and zinc declined, in the aggregate, more than they had in any previous year in history,\(^1\) the production of lead, zinc and silver again rose to record volume levels. Copper output alone registered a slight decline in 1930.

The high output levels of lead, zinc and silver throughout 1929 and the increases in the production of these metals in 1930 was largely
a result of the continued expansion of the Consolidated Mining and Smelting Company's metallurgical plants at Trail and of increased efficiency in treating the ores from the company's Sullivan mine.2 This highly integrated company controlled the mining, milling, smelting, refining and marketing of the ores from the Sullivan. It was, therefore, able to retain almost all the profits from the Sullivan ores and, consequently, to withstand the impact of declining prices far better than many other producers.3 Indeed, throughout the 1930's, the Consolidated was able to maintain reasonably full employment and production.4

The higher zinc production in 1930 was largely the result of the new slag-fuming plant put into operation that year at Trail. The plant recovered zinc formerly lost in the slag from the lead furnaces, and, by late 1930, it was turning out zinc oxide equivalent to 50 tons of metallic zinc a day.5 A sizeable contribution to the 1930 zinc output was also made by the Base Metals Mining Company's Monarch mine near Field. The Monarch was unable, however, to withstand the low and declining prices for lead and zinc and was forced to suspend operations in November, 1930.

Silver production in 1930 rose by almost 14 per cent over its previous record level set in 1929. Some of the increase came from the Sullivan mine, which in 1930 accounted for 46 per cent of total silver output in British Columbia. The increase was, however, due mainly to the output of about 1,500,000 ounces from the Premier Gold Mining Company's Prosperity mine near Stewart.6 In addition, this company's main
mine, the Premier, made a larger production as well.

The record production of lead, zinc and silver in 1930 was, then, largely the result of increased production from major, large-scale mines. The production of these three metals would have been even higher had not the rapid fall in metals prices brought about the closure of many small mines in the province. The first mines to feel the effect of the depressed prices were the small silver-lead-zinc producers in the Slocan and Ainsworth areas. In 1930, a heavy decline in silver, lead, and zinc output was registered in the Slocan district where several former shippers were inactive on account of low metal prices.

Unlike the output of other major metals, copper production declined in 1930 to a level over 10 per cent lower than that of the previous year. Although the Britannia mine made a record output in 1930, this increase was more than offset by declines from the other two major copper mines in the province. In 1930, the Granby Consolidated Mining, Smelting and Power Company curtailed the output of its Hidden Creek mine. In November of the same year, it was forced to close down its Copper Mountain operation, a mine which had accounted for some 22 per cent of provincial copper production in 1929.

The combination of mine closures and the general curtailment programme practised by most metal producers led to a considerable decline in the rate of metal production in the later months of 1930. In the following year, metal prices continued to decline, more mines
closed, and tonnage dropped 18 per cent below the 1930 level. In 1931, only 44 mines were able to ship ores and concentrates. (See Maps 13 and 14).

A comparison of the pattern of shipping mines for 1931 (See Maps 13 and 14) with that for two years earlier (See Maps 11 and 12, Chapter VI) indicates the immediate effects of the depression. Although the largest mines in the province did curtail output, they were still able to produce over 1,000,000 tons of ore in 1931. Smaller mines were more seriously affected. In the Slocan-Ainsworth district, only eight mines shipped in 1931; all the mines along the Bulkley Valley south of Hazelton and those in the northern part of the Kootenays had closed down. Significantly, many of the gold mines in the province, particularly those on the north coast at Stewart, in the Bridge River area west of Lillooet, and in the Sheep Creek region south of Nelson, were able to continue or expand production. The reasons for this apparently anomalous situation will become clear later.

Mine output was not the only aspect of the industry that had declined. During the boom years of the late 1920's, much mill construction had taken place in British Columbia. After 1929, there was far less. Furthermore, during 1930 and 1931 many of the existing plants were idle, including not only those which had been prematurely erected as an adjunct to misguided stock promotions, but also others whose construction had been justified in the late 1920's.
SOUTHEASTERN BRITISH COLUMBIA

For explanation of symbols, see main map legend

MAP 14
In the early years of the depression, the rate of development, especially on properties carrying values in silver, lead and zinc, decreased considerably. This was particularly true in the case of those properties financed by public subscription to small local stock companies. The larger companies, on the other hand, were able to carry out development work much as normal.

By 1931, therefore, base metal and silver mining in British Columbia were clearly in a depressed state. In his summary of the lode mining industry in 1930, the Provincial Mineralogist noted that:

It is evident...that until there is a radical change in the present condition of the metal markets of the world, with less excess stocks and improved prices, no expansion in base-metal mining in British Columbia can be expected. Similarly, a decided improvement in the price of silver will be necessary to stimulate the mining of that metal. 9

During the 1930's, however, there was no "radical change" in base-metal markets. Prices for lead, zinc, and copper declined again in 1932 and along with silver prices, remained at low levels for the remainder of the decade.

Having briefly examined the immediate effects of the depression on the lode mining industry, it is necessary now to look at the performance of the industry during the remainder of the 1930's and to detail the changes that took place in the production of the major metals.
The Gold Mining Industry in the Depression

The depression, which curtailed activity in the base metals industry, actually stimulated the search for gold and, during the otherwise depressed years of the 1930's a considerable amount of gold mining took place. Between 1931 and 1939, the level of gold production in British Columbia rose over 300 per cent. In 1939 some 587,000 ounces of the metal were produced, the highest volume yet, and ever, produced in the province.

The reasons for this rapid rise in gold output which, after 1931, saw new records set in every succeeding year, were two-fold. In the first place, one inherent characteristic of gold mining was that it was a "flourishing and expanding industry in times of general depression." With the standard price and unlimited market that existed for gold at the beginning of the 1930's, production of the metal was stimulated by the decline in production costs, particularly in supplies and wages. Secondly, in the depression, a series of world monetary changes brought about increases in the price of gold. These increases have been pointed out by several authors as the major factors behind the expansion of gold mining in British Columbia. The reduction in production costs relative to the fixed price of gold was, however, as James indicates, also a definite stimulus to gold mining in the province early in the 1930's.

In 1930, lode-gold production rose by almost 11 per cent over the output for the preceding year. Much of this increase came from the
expanding Pioneer mine in the Bridge River area, from the Reno mine at Sheep Creek and from the Union mine in the Grand Forks area. Both of the latter mines had tuned up their mills in late 1929 but were virtually new producers in 1930. The Premier mine at Stewart, the largest gold mine in British Columbia, accounted for 54 per cent of the total output in 1930, although it did produce less gold than in the previous year. The remainder of the gold came from the Nickel Plate at Hedley, a few small gold producers, and as a by-product from copper mining. The last-named source, however, accounted for only 15 per cent of the gold produced in the year. As important as the increase in production, moreover, was the fact that an active interest in gold properties had developed. In some areas, such as the region south of Nelson, a number of small properties were being developed and many old properties were being examined.

In 1931, lode-gold output declined slightly. The decline was due mainly to the closure of the Nickel Plate, a formerly large producer; to the lower output from the Premier, where gold reserves were declining and lower-grade ore was being mined; and to the closure of Granby's Copper Mountain, a sizeable contributor to by-product gold output.

The lower gold output in the province in 1931 did not, however, reflect the general condition of the gold-mining industry. In the Bridge River area, the Pioneer mine made a much larger output and was able, through continued development work, to prove up additional reserves.
of good-grade gold ore. The success at the Pioneer attracted attention to the Lillooet Mining Division, and many prospects in the area were optioned. A major development was the takeover of the Lorne mine by the Bralorne Syndicate. At this property, steady development was carried out and the construction of a 100-ton mill commenced. Elsewhere in British Columbia, the Union and Reno mines increased their gold output and many small gold properties were explored.

In 1932, lode-gold output increased by almost 24 per cent over the level of the previous year. Much of the increase came from the mines in the Bridge River area where the Bralorne brought its 100-ton mill into operation. The Premier mine, still the leading gold producer in the province, produced at nearly the same rate as in 1931, and many small gold producers contributed to the total production. The increased output of lode-gold during the year was, moreover, only a slight indication of the activity which took place in searching for and developing gold properties. Throughout the province, in old and new camps, prospectors and scouting engineers were "energetically seeking for gold properties." Of the thirty-three mining companies incorporated to work lode-deposits in 1932, twenty-seven were formed to operate lode-gold properties. Customs-ore receipts at the Trail smelter in 1932 were nearly three times as large as in 1931, due largely to the efforts of leasers, small syndicates and small companies turning their attention to formerly dormant gold properties.
The construction of ore-treatment facilities paralleled the activity in prospecting and production. In 1932, the capacity of the Pioneer mill was increased from 100 to 300 tons a day. Reno Gold Mines, after acquiring the old Motherlode property, built a tramway and hydroelectric plant, rebuilt the mill and began operation. In the central interior of the province, the Cariboo Gold Quartz interests erected a 60 ton a day cyanide plant at their mine near Barkerville. In the Nelson and Osoyoos areas, some small mills on gold properties were reconditioned during the year.23

The major stimulus to this activity in the early years of the depression was, as noted earlier, a widened gap between costs and prices in gold mining. In 1932 this gap was widened even further, due not to further decreases in production costs, but to higher gold prices for British Columbia producers. The bulk of the gold produced in British Columbia during 1932 was sold on the basis of payment in American funds, which at that time were at a premium with respect to the Canadian dollar. The advantage to producers in selling gold on the basis of American funds averaged, in 1932, approximately 13.6 per cent. In other words, the gold mines in the province were able to sell their output at an average of $23.47 an ounce, a premium of $2.80 an ounce over the world price of gold.24
In 1933, this so-called premium was increased even further when, in March of the year, the United States broke the dollar's link with gold. In the autumn, President Roosevelt began to raise the price of gold slightly in an attempt to pull the United States out of the depression. The higher world gold price brought about by the devaluation of the United States dollar meant that in 1933 the Canadian gold producers received an average price of $28.60 an ounce for their gold in terms of Canadian funds.

The impact of this substantially higher price for gold was strongly felt in British Columbia. As the Provincial Mineralogist reported in 1933:

The increase in the world price of gold...with only a comparatively small increase, if any, in the production costs of the metal, enormously increased the profit chances in this form of mining, with the result that many prospects, properties, and mines have been reopened, and the established producers have been enabled to materially expand their operations by including in their ore reserves much tonnage which formerly could not be profitably mined and milled. Added to this established and expanding mining activity there has been extreme activity in searching for and acquiring gold properties in all parts of the Province by representatives of capital, new companies, and small development syndicates.

In 1933, lode-gold production set another record at 223,529 ounces, an increase of 23 per cent over the preceding year. The major mines, such as Bralorne and Pioneer, increased their output, carried out considerable development work, and proceeded with further mill expansion. New mills were built at various smaller mines; old mills were rebuilt
and increased in capacity. In the old Rossland camp, the Consolidated Mining and Smelting Company reopened a number of its mines to leasers who, over the year, produced over 7000 ounces of gold from unworked stopes and shaft pillars in the old Le Roi, Centre Star, Josie, War Eagle, and other mines.  

The price of gold continued to rise early in 1934. By the end of the year, however, President Roosevelt recognized that his policy of upward gold price adjustment had failed to alleviate the depression in the United States, and he fixed the price of the metal at $35.00 an ounce. This new price was almost $15.00 higher than the formerly fixed price of $20.67, and was about $7.00 higher than the price Canadian producers had received in 1933. This significantly higher price of gold, together with the fact that there was no sign to indicate that it would be reduced in the near future, stimulated even more gold mining activity in British Columbia. Several of the established mines again increased their milling capacity, twelve new mills commenced production, and a number of old and new properties were brought to the production stage.

Throughout the remainder of the 1930's, with the price of gold fixed at $35.00 an ounce, gold output continued the rise that had begun early in the decade. This increase came not only from the larger mines of the province such as the Pioneer, Bralorne, and Silbak Premier, but also from a considerable number of intermediate and smaller size mines.
Moreover, another trend established in the early 1930's, that of a geographical spread of gold mining into both new and old areas, continued throughout the decade. In 1934, rich gold-quartz veins were found at Zeballos on Vancouver Island, and in the next few years the Zeballos camp became an important producer. In the spring of 1935, full operations were resumed at the Nickel Plate near Hedley, an important gold producer that had been closed since 1931. In the northwest part of the province, development work was undertaken at the Big Missouri mine, a mine operated by Buena Vista Mining Company but financially controlled by the Consolidated Mining and Smelting Company. In 1938, a 750 ton a day underground mill was completed at the Big Missouri and production from the property began. In the Cariboo, the area where the earliest major attempts to develop lode-deposits had occurred (See Chapter III), there was much lode-gold activity by the later 1930's. As Fraser notes, modern machinery and improved metallurgical methods helped to bring about the transition from placer to lode-mining in the Cariboo district, "but the determining factor was the re-valuation of gold." By 1939, the production of lode-gold had risen to 587,180 ounces. It was indeed ironic that throughout the harsh years of the 1930's, the gold mining industry boomed as never before, urged on by the higher price of gold. Geographically, the industry was considerably more widespread than it had been a decade earlier as Table 4 indicates.
### TABLE 4

**DISTRIBUTION OF LODE-GOLD PRODUCTION: 1939**

<table>
<thead>
<tr>
<th>Mining Division</th>
<th>% of B.C. Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lillooet</td>
<td>25.3</td>
</tr>
<tr>
<td>Nelson</td>
<td>18.3</td>
</tr>
<tr>
<td>Cariboo</td>
<td>12.0</td>
</tr>
<tr>
<td>Portland Canal</td>
<td>9.6</td>
</tr>
<tr>
<td>Osoyoos</td>
<td>9.5</td>
</tr>
<tr>
<td>Clayoquot</td>
<td>9.3</td>
</tr>
<tr>
<td>Vancouver</td>
<td>3.9</td>
</tr>
<tr>
<td>Skeena</td>
<td>3.1</td>
</tr>
<tr>
<td>Atlin</td>
<td>2.9</td>
</tr>
<tr>
<td>Similkameen</td>
<td>2.1</td>
</tr>
<tr>
<td>Trail Creek</td>
<td>1.5</td>
</tr>
<tr>
<td>Greenwood</td>
<td>0.8</td>
</tr>
<tr>
<td>Clinton</td>
<td>0.6</td>
</tr>
<tr>
<td>All Others</td>
<td>1.1</td>
</tr>
</tbody>
</table>

---

The Recovery of the Base Metal Industry

As the foregoing discussion has suggested, the decade of the 1930's in British Columbia clearly belonged to the gold mining segment of the mining industry. The base metal industry, on the other hand, did not remain for the entire decade at the depressed levels of output established in the early 1930's. Average yearly prices for lead, zinc, and copper remained, on the whole, below those of the immediate pre-depression years. Yet by 1939 the outputs of lead and zinc had recovered to levels slightly above those set in 1930. Copper production in 1939 (73,254,679 pounds) was still 28 per cent below its record output of 1929. Nevertheless, considering that copper output in 1936 (21,671,711 pounds) was the lowest in the province since 1900, it is clear that this...
segment of the base metal industry had made a considerable recovery during the late years of the 1930's.

With regard to lead and zinc, the slow recovery to pre-depression output levels made between 1933 and 1939 was almost solely due to the activity of the Consolidated Mining and Smelting Company. The Consolidated Company was able to maintain almost normal production and later to increase the output of lead and zinc in the face of low metal prices for both metals largely because of concerted and successful efforts in reducing production costs, particularly the treatment costs of the Sullivan ores. In some years, lower treatment costs were achieved at the expense of lower recovery rates, but by the middle 1930's, the recovery of metals from the Sullivan ores was virtually back to pre-depression levels.

During the depths of the depression in 1931 and 1932 when many of the other producers of lead and zinc were forced to curtail or suspend their production, the Sullivan mine at Kimberley accounted for 99 per cent of the provincial output of lead, and over 99 per cent of the zinc. Although a number of lead-zinc producers were able to reopen or increase their output after 1932, the Sullivan mine, between 1933 and 1939 still produced about 96 per cent of the lead and 88 per cent of the zinc output in British Columbia.

While the Sullivan mine virtually monopolized the production of lead, and clearly dominated the production of zinc, a number of other
mines did contribute, in some years at least, to the Provincial output of these metals. In 1933, lead and zinc prices for British Columbia producers increased slightly over their low levels of 1932, due largely to the favourable money market of Canada with respect to Great Britain, the country to which much of the lead and zinc was sold. Although lead-zinc-silver producers in the Slocan and the northern areas of the province remained, on the whole, inactive, the higher prices allowed the Base Metals Mining Corporation to reopen their Monarch mine at Field in August, 1933. This mine produced for only slightly over two years, but during this time it contributed about 3.5 per cent of British Columbia's lead and 5.8 per cent of the zinc. The rise in lead and zinc production between 1933 and 1934 was almost totally the result of greater output at the Monarch and at the Sullivan. Throughout the remainder of the 1930's, the Sullivan was the only lead-zinc producer of any significance. The lead and zinc not produced by the Sullivan came largely from the north coast, Boundary, and Nelson-Slocan areas where a considerable number of small mines, the development of which could be undertaken cheaply or which had been carried out prior to the depression, were able to come back into production.

Elsewhere in the base metals sector of the mining industry, copper production exhibited a rapid and substantial decline between 1930 and 1936. The copper industry in British Columbia was dominated, by the
late 1920's, by three major mines. As noted earlier, one of these mines, the Hidden Creek, had curtailed its output in 1930. Another major mine, Copper Mountain, had closed in November of that year. In 1931, it was clear that copper was in the worst position of all metals, with large stocks of refined copper on hand and consumption of the metal much below normal. Over the next two years, Granby's Hidden Creek mine had increased its output slightly, but this company's Copper Mountain operation remained closed. Furthermore, by 1933 the Britannia mine was operating at about 20 per cent of its normal capacity. Although the copper industry had by this time developed extremely low costs and remarkably efficient mining and metallurgical practice and was, consequently, in a good position to take advantage of even a slight increase in the market price for copper, copper prices remained at below 8 cents a pound from 1932 to 1935. In 1934, copper production had dropped to 49,651,733 pounds, a total some 53,000,000 pounds below its record output of 1929. Then, in August 1935, the copper industry of British Columbia received a serious setback when the Granby Consolidated Mining, Smelting and Power Company closed its mine and smelter at Anyox. Production in that year declined to 20,806,672 pounds, the lowest output of the industry since the post-World War I period. The closure of the Anyox complex was also significant because all copper produced in the province would thereafter be exported in concentrate form for smelting
While the copper industry in British Columbia was in a period of production decline, the beginning of 1936 found the world copper industry in a better condition than at the beginning of the four previous years. Late in 1935, the world's copper stocks were reported as only slightly in excess of normal requirements. Moreover, a steady growth in the demand for copper, due to increased consumption in Great Britain, Germany and Japan, made the outlook for 1936 "the brightest for the copper industry since the depression." During the year, average copper prices were almost 9.5 cents a pound, a 22 per cent rise over prices in 1935. Production in British Columbia in 1936 dropped to its lowest level since 1900, due almost entirely to the loss of the Anyox mines. The Britannia mine, on the other hand, returned to capacity production and increased its output over 1935 by 38 per cent. This mine was, in fact, the only major copper mine which operated for the entire year and it accounted for 94 per cent of the province's total copper output.

The higher average copper prices which obtained in 1936 (13.078 cents a pound), together with the availability of Japanese markets, the construction of a steam-electric power plant, and the opening of a company coal mine near Princeton, allowed the Granby's Copper Mountain mine to reopen in mid-1936. By late summer, 1937, the Copper Mountain
mine attained full production, and with the Britannia mine in a similar state, copper production in British Columbia more than tripled between 1936 and 1939. Total copper production in 1939 had not returned to the pre-depression levels, but, excepting the record output set in the later 1920's, it was the highest production in the history of the industry. Of the 93,254,679 pounds of copper produced in British Columbia in 1939, the Britannia mine contributed almost 51 per cent, and the Copper Mountain mine about 46 per cent. The remainder came from small producers in various areas of the province, and from the smelting operations at Trail.

The Production of Other Metals in the Depression

Of the other lode-metals produced in British Columbia during the 1930's, only silver was of any significance. Small amounts of bog iron, mercury and tungsten concentrates were shipped at different times, but no large developments occurred. The Trail complex produced bismuth and cadmium, and antimony in some years.

Silver production during the 1930's followed a pattern almost identical to that of lead and zinc, reflecting the largely by-product nature of silver with respect to the other two metals. After reaching a record output in 1930, silver production declined in 1931 under the impact of low prices for lead, zinc, and silver. Most of the smaller
silver-lead-zinc mines of the province remained closed, the Prosperity mine closed early in 1931, and the Sullivan and Premier were forced to curtail their output to some extent. Between 1932 and 1935, the price of silver more than doubled. In silver camps, such as that of the Slocan, where mining activity responded to rises in the price of silver, production of the metal increased over this period. Although silver prices declined by 30 per cent in 1936, the higher prices of the mid-1930's had stimulated a renewed interest in the Beaverdell camp north of Greenwood. By 1939, the small but high-grade silver mines of this area were producing about 9 per cent of the total silver output of the province. In most years the silver mines of the north coast made sizeable outputs of silver, as did the smaller mines in the Slocan after about 1935.

The Spatial Pattern of Production: 1939

The pattern of shipping mines on Maps 15 and 16 reveals the considerable geographic expansion that accompanied the boom in gold-mining between 1931 and 1939. On the south coast, there was a considerable increase in activity, notably at the Zeballos camp on the west coast of Vancouver Island. On the north coast, the Surf-Inlet mine on Princess Royal Island reopened and expanded its output. Near Stewart, the Big Missouri's tonnage was ten times greater than in 1931. Moreover, gold mining had expanded even further north along the coast to Tulsequah
MAP 15

BRITISH COLUMBIA
Mines Shipping 1939
(Thousands of tons)

For area in inset see Map 16.

SOUTHEASTERN BRITISH COLUMBIA

For explanation of symbols, see main map legend
where the Polaris-Taku mine produced a considerable quantity of the metal.

The impact of relatively stable production costs and rises in the price of gold brought about a considerable expansion of output in the Bridge River area, where the Pioneer mine increased its output over the 1931 level and the Bralorne had commenced production. The high gold price was also largely responsible for the successful establishment of several mines in the central interior of British Columbia, particularly at Wells, in the heart of the Cariboo gold country. Here, mines such as Cariboo Gold Quartz, Cariboo Hudson, and Island Mountain, all equipped with cyanide treatment facilities, made sizeable outputs in the late 1930's. In 1939, these three mines produced 70,418 ounces of gold, about 12 per cent of total provincial output.

Elsewhere in the province, the gold mining boom had intensified activity in several areas. The most notable region was the Sheep Creek area south of Nelson where mines such as Kootenay Belle, the Reno, and the Queen, all equipped with concentrating mills, were producing considerable quantities of gold. Throughout the general area south of Nelson, in the old Rossland and Boundary camps, and in the area south of Penticton, the new gold prices allowed a considerable number of small mines to ship ore. In most cases, it was the value of the gold produced that justified their operation.
The pattern of mines on Maps 15 and 16 also shows a number of the changes that had occurred in the base metal segment of the industry between 1931 and 1939. The most notable shifts had been the virtual disappearance of copper mining in the Anyox area, and the revival of copper mining at Copper Mountain near Princeton. In 1931 the Britannia mine and the Hidden Creek mine had together produced about 95 per cent of British Columbia's copper, and in 1939 the Britannia and the Copper Mountain produced about the same percentage.

In lead and zinc production, the Sullivan mine continued the domination it had established in the early 1920's. In 1939, the mine produced about 98 per cent of the province's lead and about 82 per cent of the zinc. About 75 per cent of British Columbia's silver also came from this mine, with most of the remainder coming from the gold mining operations around Stewart and from the extremely high-grade ores of the Highland Bell mine at Beaverdell.

Conclusions

The tremendous expansion of gold mining in British Columbia throughout the 1930's and the gradual recovery of base-metal and silver mining in the latter half of the decade, led the lode-mining industry to a near-record value output in 1939. By value of production, lode-gold had become the most important metal in the province, due both to a higher
output and to a higher unit price. (Figure 5). The expansion of gold mining and the recovery of other metal mining was, moreover, paralleled by an increase in the number of mines. In 1939, some 222 mines shipped ores or concentrates from numerous areas in British Columbia. This was the largest number of mines that had ever shipped in one year.52

In general, then, the decade of the 1930's in British Columbia belonged to the gold mining segment of the mining industry. Much of the productive and geographic expansion which had occurred was the direct result of the 75 per cent increase in the price of gold that had occurred over the period. In the mining of base metals, much less expansion had taken place. The production of copper, lead, and zinc was dominated by major mines as it had been in 1931, and over the decade no new large base metal mines came into operation. As Lay noted with respect to the northeastern part of the province, corporate efforts did not find much encouragement under the existing conditions of the base metal markets.53 It was a comment that could be generally applied to all of British Columbia during the 1930's.
FIGURE 5

COMPOSITION OF LODE-METAL PRODUCTION

BRITISH COLUMBIA 1939

Total Value of Production - $54,710,584.00

Average Prices 1939

<table>
<thead>
<tr>
<th>Metal</th>
<th>Price</th>
<th>Per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>10.09 cents</td>
<td>per pound</td>
</tr>
<tr>
<td>Lead</td>
<td>3.17 cents</td>
<td>per pound</td>
</tr>
<tr>
<td>Zinc</td>
<td>3.07 cents</td>
<td>per pound</td>
</tr>
<tr>
<td>Cadmium</td>
<td>70.47 cents</td>
<td>per pound</td>
</tr>
<tr>
<td>Silver</td>
<td>40.49 cents</td>
<td>per ounce</td>
</tr>
<tr>
<td>Gold</td>
<td>$36.14</td>
<td>per ounce</td>
</tr>
</tbody>
</table>

FOOTNOTES

1. Decreases in average prices between 1929 and 1930 for the major metals were: Lead 22.3%; zinc 33.2%; copper 28.3%; and silver 28%. Annual Report of the Minister of Mines, 1930, p. A9. See also Footnote 7.


5. Annual Report of the Minister of Mines, 1930, p. A28. In addition to the current slag production, there was a large quantity of slag from former operations stored at the Trail plant awaiting retreatment.

6. The Prosperity mine, however, could not survive the low silver prices that obtained in 1931 and was closed, along with the company's Porter-Idaho mine, in April, 1931.

7. The decline is shown in the following table (silver prices in cents per ounce, other metals in cents per pound).

<table>
<thead>
<tr>
<th>Year</th>
<th>Lead</th>
<th>Zinc</th>
<th>Copper</th>
<th>Silver</th>
</tr>
</thead>
<tbody>
<tr>
<td>1929</td>
<td>5.05</td>
<td>5.39</td>
<td>18.11</td>
<td>52.99</td>
</tr>
<tr>
<td>1930</td>
<td>3.93</td>
<td>3.60</td>
<td>12.98</td>
<td>38.15</td>
</tr>
<tr>
<td>1931</td>
<td>2.71</td>
<td>2.55</td>
<td>8.12</td>
<td>28.70</td>
</tr>
</tbody>
</table>


14. H.T. James, op. cit., p. 188.


19. The extensive revival in gold mining was not limited to lode-mining. Placer gold activity was equally affected. "Placer prospecting was stimulated by the issuance by the Department of Mines of provisional free miners' certificates free of charge, which enabled the holders thereof to locate and record placer claims without cost. By the end of 1932 about 10,000 of these certificates were issued..." Annual Report of the Minister of Mines, 1932, p. A7.


21. Ibid.


25. The price increases were arrived at by Roosevelt and two advisors who, evidently, began fixing the price of gold each morning over breakfast. See Timothy Green, The World of Gold, New York, Simon and Schuster, 1968, p. 48.

27. Ibid.


29. Ibid.

30. This mine represented a consolidation of the famous Premier mine at Stewart with two other properties in the northwest coast area—the B.C. Silver and the Sebakwe—through the incorporation of Silbak-Premier Mines Limited. Annual Report of the Minister of Mines, 1936, p. B3.


35. Timothy Green, op. cit., p. 49.

36. Calculated from Table IXa, Annual Report of the Minister of Mines, 1939, p. A18. The boundaries of several mining divisions changed between 1929 and 1939. Portland Canal (1939) included Portland Canal (1929) and Nass River (1929); the Vancouver Mining Division in 1939 was considerably larger than in 1929, having incorporated the mainland section of the 1929 Nanaimo Mining Division. The figures given for 1929 and 1939 are, however, essentially comparable. See British Columbia Department of Mines, Mining Division Maps, 1929 and 1939, Map Section, Provincial Archives, Victoria.


39. The increase in lead production in 1934 over 1933 was 75,760,896 pounds, of which the Sullivan produced 61,630,516 pounds, and the Monarch 11,789,400 pounds. For zinc, the increase was 51,963,093 pounds, the Sullivan contributing 31,833,361 pounds, and the Monarch, 19,546,504 pounds.


43. The closure of the Anyox complex was forecast as early as 1932 (Annual Report of the Minister of Mines, 1933, p. 11) when, under existing conditions and at the usual rate of extraction, the Hidden Creek mine was assessed as containing about two years of ore reserves. The Granby Company went into voluntary liquidation. The mine and smelter were purchased by the Consolidated Mining and Smelting Company who dismantled the operation to use the machinery at other properties. See Canada, Department of Mines, The Canadian Mineral Industry in 1935, Ottawa, King's Printer, 1936, p. 9.

44. H. Sargent, "Mining," Transactions of the Second Resources Conference, Victoria, Department of Lands and Forests, 1949, pp. 158-190. The only exception was the copper-bearing dross from the Trail lead plant. It too, however, was exported to Tacoma.


46. Ibid.


48. Small amounts of bismuth and cadmium appeared in the production records for several years of the 1930's. The antimony produced at Trail was a by-product of silver refining at the smelter, and was allowed to accumulate at the plant. Canada, Department of Mines, The Canadian Mineral Industry of 1934, Ottawa, King's Printer, 1935, p. 3.


51. Most of the remainder of the zinc came from slag at the Trail smelter which cannot be credited to individual mines. Annual Report of the Minister of Mines, 1939, Footnote to Table IXb.

52. Annual Report of the Minister of Mines, 1934, p. A8. The total is compiled from the Annual Report of the Minister of Mines, 1939, and from the unpublished production records in the Department of Mines and Petroleum Resources, Victoria. The total does not include a number of very small operations who shipped test or trial lots to the Government Sampling Plant at Prince Rupert.

CHAPTER VIII

THE SECOND WORLD WAR: 1940-1945

The outbreak of war in late 1939 brought about a substantial rise in the demand for several metals. The lode-mining industry responded to these new demands by increasing production of the major metals and by initiating production of several "strategic" metals. This chapter deals with the performance of the industry in the years of the Second World War and attempts to show why, after a period of strong demand and relatively stable prices, the production of most metals and the number of producing mines were considerably lower in 1945 than they had been in 1939.

Production During the War: An Overview

British Columbia during the years of the Second World War was, argues Ormsby, a very different place from the British Columbia of the depression period.¹ "For the province as a whole, the War ushered in an era of prosperity, marked by a great increase in population."² Moreover, she continues, in every part of the province, the War stimulated production. In the mining industry

the Trail plant manufactured [daily] 200 tons of ammonia and other chemicals for war supplies, and by 1942 the smelter was turning out every day 700 tons of refined lead and 470 tons of refined zinc
for war purposes. Prospectors searched the hills for bismuth, cadmium, mercury and other rare and precious metals....

The implication that the mining industry as a whole prospered during World War II is by no means substantiated by the actual performance of the lode-mining industry in this period. After exhibiting a 10 per cent increase in tonnage output between 1939 and 1940, and maintaining that level in 1941, the tonnage of the industry declined steadily between 1941 and 1945 from 7,938,803 to 4,377,722 tons. Lode-gold production declined from a record high output of 587,180 ounces in 1939 to 175,373 ounces in 1945. The output of silver, from a record high of 12,327,944 ounces in 1940, dropped to 6,157,307 ounces in 1945, the second lowest output of this metal since 1921.

In the base metals sector of the industry, copper output declined steadily between 1940 and 1945, reaching in the latter year its second lowest output since the early years of the twentieth century. Lead and zinc production did rise substantially in the early years of the war and set record volumes in 1942. During the remainder of the war, however, lead and zinc output fell quickly to levels characteristic of the mid-1930's.

The general decline in production for the major metals during the war was, moreover, paralleled by a decline in the number of shipping mines. The record high of 222 such mines in 1939 had, by 1945, dropped
to a twentieth century record low of 36. In addition, employment in the lode-mining industry, despite the influx of working-men to the Pacific Coast which began in 1941, declined from 6027 in 1940 to 3683 in 1945. This drop in employment was, as will be indicated later, a major reason for the general decline in output which characterized the lode-mining industry during the Second World War.

Despite the general decline in production of the major metals there was a substantial, though generally short-lived, increase in the output of a number of "strategic" metals which had not been produced in any quantity, if at all, in the province before. Indeed, in many parts of the world, the demands of war and the interruption of peace-time sources of supply stimulated a greatly increased production of such metals as mercury, cadmium, bismuth, tungsten and tin. In terms of these metals, British Columbia's contribution to the war effort was considerable and was due, in large part, to the efforts of the Consolidated Mining and Smelting Company of Canada.

World War II: The Major Metals

As noted earlier, the production of lead and zinc increased substantially in the early years of the war, both metals reaching new record volume outputs. Much of the increase came from the Sullivan mine which, together with the concentrator at Chapman Camp, was operated at an unprecedented scale. Most of the company's production of lead and zinc
was under contract to the British Government, while the balance was practically all required, directly or indirectly, for war purposes. The combined output of lead and zinc from this mine increased by over 35 per cent between 1939 and 1942; the rate of increase being greater than that for the province as a whole. In 1942, the Sullivan mine was producing over 97 per cent of British Columbia's lead and over 91 per cent of the zinc. Much of the remainder came from the Monarch mine at Field which had re-opened early in 1940 with contracts in the United States, and from a number of mines in the Slocan-Nelson area. Output could have been even greater in 1942 had not a shortage of labour prevented production from a number of idle properties.

In March, 1943, the tonnage from the Sullivan mine was at a record high of 243,631 tons, but it fell steadily until October, when only 170,282 tons of ore were produced. The decline in production, due mainly to a shortage of labour, caused a substantial decline in the output of refined lead and zinc from the Trail smelter. Moreover, the shortage of labour not only retarded the rate of ore extraction at the mine, but also caused development work to lag behind production. For the first time in several years, development work at the Sullivan was insufficient to maintain ore reserves, with 1,600,000 more tons being mined than were actually developed during the year.
The drop in production at the Sullivan accounted for most of the decline in lead and zinc output for the province in 1943. (Lead dropped 12.5% and zinc 15.5% over 1942 levels). The Base Metal Mining Corporation's operations at Field also showed a decline in the year and a number of small mines and leasing operations stopped shipments. The decline was only partly offset by a few mines which came into production with war contracts, such as the Kootenay Florence mine at Ainsworth which was taken over in 1943 by the Canadian Wartime Metals Corporation.¹³

During 1944 the decline of lead and zinc production in British Columbia continued. During the year, only fifteen silver-lead-zinc mines made shipments to smelters, several of these mines operating under contracts to the Metals Reserve Corporation of Washington, D.C. Some of these operations, however, such as the Highland Bell near Ainsworth, operated at a reduced scale due to the difficulty in obtaining satisfactory labour.¹⁴ The Kootenay Florence mine ceased operating entirely in May, 1944, when the contract for sales of lead and zinc concentrates to the United States Metals Reserve Corporation was cancelled. At the Sullivan mine, which still produced 97 per cent of the province's lead and 88 per cent of the zinc, output declined again. A shortage of labour was partly responsible, but the decline at the mine was largely due to the amount of preparation needed to work lower levels and to the curtailment of production necessitated by a back-filling programme.¹⁵
In 1945, lead and zinc production in British Columbia improved slightly over 1944, with the Sullivan mine accounting for almost all the increase. The Base Metal Mining's Monarch and Kicking Horse mines near Field also increased their outputs in 1945 with labour conditions slightly improved by the end of the year. Lead and zinc production in the Nelson-Slocan-Ainsworth area declined considerably in 1945, due to further mine closures or reduced output brought on by the continued labour shortages, the scarcity of mechanical equipment, and the termination of war-time contracts.

Copper production in British Columbia during the Second World War declined steadily and quickly, the output falling from 78,000,000 pounds in 1940 to 26,000,000 in 1945. The major reason for the decline was the often acute labour shortages that forced curtailment at the two major copper mines, the Britannia at Britannia Beach and the Copper Mountain south of Princeton.

Although the Britannia and Copper Mountain operations were able to maintain production levels in the first year of the war, the loss of labour due to enlistments and to the availability of more remunerative employment in other war industries, was felt in 1941. Employment at the Britannia over 1941 declined from 1200 to 870, and at the Copper Mountain, from 643 to 400. Moreover, at the Copper Mountain mine, over
half the underground crew of 300 men were reportedly inexperienced in mining. In 1942, facing further labour shortages which had reduced production capacity and markedly curtailed development work, both the Britannia and Copper Mountain operations sought aid from the Canadian Government in order to increase their production. Both companies arranged contracts with the Wartime Metals Corporation which, in part, guaranteed production costs and allowed a small profit. Yet, in spite of this aid and the attempt by the Federal Government to shift employment from the "non-essential" gold mines into the base metal mines, labour shortages continued in the copper mines and production decreased further. In 1943, the Britannia reported no improvement in the acute labour shortage, and production, though continuous, was at 50 per cent of normal. The Granby operation also continued to suffer from the lack of mine workers and resorted to using women on surface work.

These conditions continued throughout 1944 and much of 1945. Moreover, the contracts with the Wartime Metals Corporation were cancelled late in 1944 as an Allied victory in Europe became more certain. For the remainder of the war, labour remained in short supply, development and exploratory work were markedly curtailed, and production continued to decline. Although both the Britannia and Copper Mountain operations
maintained their dominance of the copper industry in British Columbia, their combined output in 1945 was substantially less than each mine had itself produced in 1940. In the rest of the province, copper mining was at a virtual standstill. Some 137,000 pounds were produced by the Nickel Plate and Hedley Mascot gold-mines in the Osoyoos Mining Division, and about 94,000 pounds by the Silbak Premier in the Portland Canal.23

The decline in production which characterized the base metal industry in British Columbia during the war was even more pronounced in the lode-gold mining industry. From the record high outputs of the late 1930's, gold production declined by 70 per cent during the war. The 175,373 ounces produced in 1945 represented the lowest output of lode-gold since the early years of the 1930's, when average prices for the metal were 46 per cent below those which obtained in 1945.24

If the labour shortages which characterized the mining industry in British Columbia during the war were felt strongly by many of the base metal producers, they were even more severely felt by the gold mines, especially after 1941. In the first two years of the war, production of gold declined slightly, but activity in the gold mines was normal, many mines remained in operation, and mill capacity was increased at others.25 By 1942, however, the demand for labour in other types of mining and in war-oriented secondary industry had seriously affected the gold mines. Moreover, in June 1942, the Canadian Metals Controller issued an order which restricted the production, development, and new installations in
non-essential mines in order to conserve labour and materials which were urgently required for more essential purposes. This order which, in effect, restricted the employment of underground men in operating and new gold properties, together with the more attractive benefits available to mine workers to be found in other war industries, was felt in the gold mines throughout British Columbia in 1942. On the north coast, operations at the Silbak Premier were handicapped by the shortage of labour, and the Big Missouri mine was shut down. In the Cariboo, operations at the Cariboo Gold and Island Mountain mines were severely curtailed due to the loss of labour. In the Bridge River area, the shortage of men reduced the Pioneer's output to one-third of capacity. In the Zeballos camp on Vancouver Island, the shortage of men and materials forced five of the seven mines in operation to close during the year. Throughout the province, many gold mines experienced a considerable drop in the size of their labour force.

In 1943, more gold mines were forced to curtail their output and more mines closed. By the end of the year, only eight gold mines remained in operation and, as the Provincial Minerologist reported, even those were having a difficult time to keep operating. Gold production for 1943 had declined to 224,403 ounces, the lowest output for a decade.

Throughout 1944 conditions remained poor and the output from almost every mining division declined or, as in the case at Zeballos,
virtually stopped. Furthermore, for the greater part of 1945, the man-
power shortage, especially in underground workers, was still critical. 
In 1945, the total lode-gold output from the province was only 175,373 
ounces, a figure substantially less than that produced by the Premier, 
Pioneer and Bralorne mines alone in 1939. 30

As the above discussion illustrates, the lode-mining industry 
during the war experienced a period of decline, at least as far as the 
major metals were concerned. Yet at the same time, the output of a 
number of so-called miscellaneous metals was greatly stimulated by the 
demands of war.

World War II: The Strategic Metals

In 1939, the production of antimony, bismuth, cadmium, mercury, 
and tungsten had accounted for slightly more than 2 per cent of the total 
value of lode-metal production in British Columbia. The highly specialized 
and greatly increased demand for the above metals, for both munitions 
and other war supplies, stimulated their production throughout the world. 31 
In the case of mercury and tin, moreover, the Allied countries found 
themselves cut off from the major pre-war sources of supply. 32 These fac-
tors led to the search for commercial deposits in British Columbia and, 
indeed, throughout Canada.

Antimony, cadmium, and bismuth had, for several years, been pro-
duced in small quantities by the plants at the Trail smelter. They were, 
as noted before, produced as by-products from the silver-lead-zinc ores
of the Sullivan mine. During the war, the bulk of British Columbia's production in these three metals continued to come from this source.

Some antimony had been shipped from small operations at Stuart Lake and Bridge River, but their outputs were insignificant. The demand for all three of these metals was strong during the war and, as Table 5 indicates, the Trail plants produced sizeable amounts of the metals.

**TABLE 5**

PRODUCTION OF ANTIMONY, BISMUTH, AND CADMIUM (000's pounds)

<table>
<thead>
<tr>
<th>Year</th>
<th>Antimony</th>
<th>Bismuth</th>
<th>Cadmium</th>
</tr>
</thead>
<tbody>
<tr>
<td>1938</td>
<td>-</td>
<td>-</td>
<td>510</td>
</tr>
<tr>
<td>1939</td>
<td>1,200</td>
<td>409</td>
<td>799</td>
</tr>
<tr>
<td>1940</td>
<td>2,550</td>
<td>45</td>
<td>779</td>
</tr>
<tr>
<td>1941</td>
<td>3,170</td>
<td>-</td>
<td>1,081</td>
</tr>
<tr>
<td>1942</td>
<td>3,041</td>
<td>346</td>
<td>972</td>
</tr>
<tr>
<td>1943</td>
<td>1,114</td>
<td>408</td>
<td>599</td>
</tr>
<tr>
<td>1944</td>
<td>1,938</td>
<td>124</td>
<td>386</td>
</tr>
<tr>
<td>1945</td>
<td>1,668</td>
<td>190</td>
<td>510</td>
</tr>
</tbody>
</table>

New tin production in Canada during the war all came from the Consolidated Mining and Smelting Company's plant near Kimberley. The 64,744 pounds of the metal produced in 1941 was the first commercially produced metallic tin from domestic ores ever produced in Canada. The Consolidated produced considerable quantities of tin, as indicated in Table 6.
TABLE 6

TIN PRODUCTION IN BRITISH COLUMBIA
(000's pounds)

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1941</td>
<td>65</td>
</tr>
<tr>
<td>1942</td>
<td>1,238</td>
</tr>
<tr>
<td>1943</td>
<td>777</td>
</tr>
<tr>
<td>1944</td>
<td>517</td>
</tr>
<tr>
<td>1945</td>
<td>850</td>
</tr>
</tbody>
</table>

British Columbia's contribution to the war effort in antimony, bismuth, cadmium, and tin was supplied, as indicated above, from the operations of the Consolidated Mining and Smelting Company. There were, in addition, a number of other metals produced in the province during the war, mercury and tungsten being particularly important. Again, the Consolidated Mining and Smelting Company was prominent in their production. 37

Mercury production in British Columbia began as early as 1895 when some 138 flasks of the metal were produced from cinnabar occurrences near Kamloops Lake. 38 Significant quantities of mercury were not produced, however, until the Second World War. At that time, the demand for the metal became considerable and the normal peacetime trade in mercury was interrupted. During the war, five mines in British Columbia produced mercury, three of which, the Empire Mercury, the Red Eagle and the Hardie turned out only very small amounts. 39 Some 132,088 pounds of mercury were produced by the Takla Mercury mines in 1943-44, a property near Takla
Lake operated by Bralorne Mines Limited. This production too, however, was overshadowed by the output from the Pinchi Lake mine on Stuart Lake, first discovered in 1937 by a member of the Geological Survey of Canada, and optioned by the Consolidated Mining and Smelting Company the following year. In light of the increased demand for mercury in the early years of the war, the Consolidated Company quickly developed the Pinchi Lake property and erected a treatment plant. In 1940, the mine produced over 150,000 pounds of the metal. Further development and expansion of plant capacity led to a threefold increase in output by 1941, and to a production of over 1,000,000 pounds in the following year.

The considerable production of mercury from the Pinchi Lake operation, together with greatly increased output in the United States and Mexico, quickly alleviated the shortage of the metal which had faced the Allied countries in the early war years. By 1943, Canada was capable of producing at least eight times the amount of mercury required to meet current needs, and surplus stocks were considerable. The United States was also self-sufficient in mercury production by 1943, and, in that year, the United States Metals Reserve Company cancelled all contracts with mercury producers. Canadian producers, i.e. Pinchi Lake and Takla, were then dependent upon domestic sales, orders from the British Government, and upon private sales to United States consumers. The combined demand of these sources was not sufficient to warrant further production
of mercury in British Columbia and, in the summer of 1944, the Pinchi Lake mine ceased production.\(^42\) It was followed in September by Bralorne's Takla mine. Thoughout the remainder of the war, all shipments of mercury were from the Pinchi Lake stockpile.\(^43\)

Of the other metals produced in British Columbia under the stimulus of war demands, tungsten was of some importance. Tungsten, the production of which was small and intermittent prior to 1939, was in great demand through much of the war, and a number of British Columbia mines produced the metal. For the most part, tungsten was produced in the form of scheelite concentrates,\(^44\) but the relatively high price of the metal permitted hand-cobbled ore to be shipped direct.\(^45\)

In 1939, the entire production of tungsten in British Columbia, and in all of Canada, was some 8800 pounds from Columbia Tungsten's Hardscrabble mine near Wells in the Cariboo.\(^46\) In the following year, the Hardscrabble carried out only development work and British Columbia's tungsten output consisted of small intermittent shipments from the Phillips Group in the Bridge River area. During these early years of the war, however, the supply of tungsten in Canada was critically short, and other sources of tungsten in British Columbia were being developed, notably at the Regal Silver property near Revelstoke, in the Atlin area, and at the Red Rose Group near Hazelton. The latter two areas were being
explored by the Consolidated Mining and Smelting Company. In 1941, this company optioned the Phillips group, shipping about 3 tons of high-grade ore to Chapman Camp, and commenced work on the Red Rose property. Elsewhere in the province, the Hardscrabble mine was closed after the failure of diamond-drill testing, and the Regal Silver owners continued their attempt to produce a marketable scheelite concentrate.\textsuperscript{47}

In the following year, much activity on the scheelite occurrences in British Columbia was undertaken. The Consolidated Company was examining or working some seven properties; the Bralorne interests held options on three mines; and eleven other tungsten properties were at various stages of development. Late in the year, the Emerald mine near Salmo was taken over by the Canadian Wartime Metals Corporation to meet threatened shortages of tungsten in Canada and Great Britain.\textsuperscript{48} In 1943, British Columbia produced some 975,000 pounds of tungsten, the bulk coming from the Consolidated's Red Rose mine. The remainder came from the same company's Tungsten Queen at Bridge River, from Bralorne's Tungsten King in the same area, from the Lucky Boy at Trout Lake,\textsuperscript{49} and from the government-operated Emerald mine near Salmo.

By the end of 1943, the supply situation of tungsten in Canada, critically short to that point, had markedly improved. Consumption of tungsten was largely dependent on the production of high speed alloy steels, a production which declined considerably due to the accumulation
of this special steel and to changes in the military requirements. As a result of this, and because there was a large surplus of ferro-tungsten, concentrates, and scrap on hand, the Metals Controller late in 1943 instructed all producers to discontinue their operations and ship whatever material they had on hand. He also gave notice that no new contracts to purchase tungsten would be made. This action terminated the production of tungsten in British Columbia in late 1943, and virtually stopped further development. This condition obtained for the remainder of the war and the tungsten shipped from British Columbia in 1944, as in the rest of Canada, came from stockpiles.

During the war, two other metals were mined in British Columbia, but neither was produced in significant amounts. In 1941, the Consolidated Mining and Smelting Company extracted about 3000 tons of manganese from an outcrop in the Cranbrook area and, in 1943, the same company mined a small quantity of molybdenum from its Molly mine near Salmo.

The Spatial Pattern of Production: 1945

The general labour shortage which characterized the mining industry during the war brought about a reduction in output at many mines in the province and, moreover, forced many mines to close. Both the curtailment of production and the closing of operations are clearly reflected in Maps 17 and 18. Major gold mines, such as the Silbak-Premier at
BRITISH COLUMBIA
MINES SHIPPING 1945
(THOUSANDS OF TONS)

- Less than 10
- Smelter
- Settlement

SOUTHEASTERN BRITISH COLUMBIA

For explanation of symbols, see main map legend

MAP 18
Stewart, the Cariboo Gold Quartz at Wells, and the Pioneer at Bridge River had substantially reduced their output. A number of other gold mines, such as the Privateer at Zeballos, the Surf Inlet on Princess Royal Island, and the Polaris-Taku at Tulsequah had closed. In addition, many of the small gold mines that had operated in 1939 in the southern parts of the province were no longer shipping.

In terms of the base metals, sizeable tonnage reductions were evident at the two major copper mines, the Britannia and the Copper Mountain. In lead and zinc production, the Sullivan continued to dominate the industry, although as noted earlier, production at this mine had fallen off in the later years of the war. Early wartime demands for lead and zinc had allowed the reopening of some older mines in the Slocan area, some of which were producing considerable amounts of these metals in 1945. On the whole, however, the level of mining activity in the Kootenay was substantially lower than it had been in 1939, as the small number of mines shipping from this area would indicate.

Virtually none of the mines in British Columbia that had produced the minor metals such as mercury and tungsten were shipping in 1945. The wartime demand for these metals had been strong, but it was equally short-lived.
Conclusions

With the exception of the minor metals discussed in the preceding paragraphs, the demand for metallic minerals generated by the Second World War was not, on the whole, matched by increases in production and the establishment of new mines. War demands for lead and zinc brought about an increase in the production of these two metals early in the war. Much of this increase came from the Sullivan mine, although a few old properties in the Kootenay region were re-activated. However, the inability of mines to keep development work at a level to maintain this production and the shortage of labour forced the production of lead and zinc to decline during the later years of the war. The wartime demand for these metals and the decline of lode-gold, however, made lead and zinc the most important metals in the industry. (See Figure 6).

At the end of the Second World War, the lode-mining industry was in a particularly difficult position. The total value of production was only $51,539,902, a figure some $3,000,000 below that produced in 1939. Furthermore, while production had generally declined during the war, the emphasis in the industry had been on production. As a result, many mines in the province ended the war facing a considerable rebuilding program. It was this rehabilitation of operations and the development of reserves that would characterize the immediate post-war activity of the British Columbia lode-mining industry.
FIGURE 6

COMPOSITION OF LODE-METAL PRODUCTION

BRITISH COLUMBIA 1945

Total Value of Production - $51,539,902.00

Average Prices 1945

- Copper 12.55 cents/pound
- Lead 5.00 cents/pound
- Zinc 6.44 cents/pound
- Silver 47.00 cents/ounce
- Gold $38.50/ounce

FOOTNOTES


5. *Annual Report of the Minister of Mines and Petroleum Resources, 1970*, Table V. The figures in the 1970 Annual Report for lead and zinc frequently differ from figures given for these metals in earlier Annual Reports. The differences arise because of revisions made to early figures to account for the recovery of lead and zinc from slag at the Trail smelter. For further explanation, see *Annual Report of the Minister of Mines and Petroleum Resources, 1960*, Table VI, Footnote 3.


9. The rather complex operating problem presented by the necessary reversal of the relative proportions of lead and zinc mined, which the demands of the national war economy thrust on the management, was solved successfully. In addition, "the handling of the enlarged output was by no means a light task." *Annual Report of the Minister of Mines, 1941*, p. A76.


13. The Wartime Metals Corporation, a wholly owned Crown Company operating under the Department of Munitions and Supply was incorporated without share capital on March 27, 1942. The Corporation was created to assume the responsibility of administering, directing, operating and supervising such mining and metallurgical projects as the Minister of Munitions and Supply found necessary in order to meet serious shortages of certain metals and minerals. See Canada D.B.S., Mineral Production of Canada, 1944, p. 20.


15. Ibid., p. A73.


17. Throughout the war these two mines accounted for approximately 99 per cent of British Columbia's copper. In 1945, they provided all but 232,031 pounds of the total 25,852,366 pounds produced.


21. In June, 1942, the Canadian Metals Controller issued Order M.C. 19 which restricted the production, development, and new installations in non-essential mines. The order, in part, restricted the employment of underground men in the gold mines and in new gold properties, thereby making available more men for essential base metal mine production. See Canada, D.B.S., Mineral Production of Canada, 1944, p. 19.


25. See the "Progress Notes" on gold mines in Annual Report of the Minister of Mines, 1940, pp. A51-A74, and Annual Report of the Minister of Mines, 1941, pp. A53-A72. The British Columbia Department of Mines had attempted to stimulate gold mining through the Gold Mine Leasing Experiment. This project was designed to assist the owners of small idle gold properties, to improve such properties to make them more attractive to capital, and to actually produce gold and so create foreign exchange. Three mines in the Nelson area were selected for the experiment, one of which (Chapleau) was abandoned in 1941 when it was found the ore mined was not covering expenses. The California mine began shipments in 1941, but was closed in 1943. The third mine, the Arlington, was abandoned by the government since it was felt that the mine could not be improved. Interestingly, this mine shipped throughout the war. None of the mines were, however, significant producers. See Annual Report of the Minister of Mines, 1941, p. A45, and Shipping Lists in Annual Report of the Minister of Mines, 1941-1945.


31. W.R. Jones presents a useful summary of the uses of these various metals, with comments on their specific war uses. See W.J. Jones, op. cit.

32. Prior to the war, Italy and Spain produced 70 per cent of the world's mercury. The position of the Allied countries with respect to tin was critical after the Japanese captured the tin smelters in the Straits Settlements and the important tin mines of Malaya. Canada, D.B.S. Mineral Production of Canada, 1942, pp. 193, 198.
33. See "Progress Notes" on antimony deposits in Annual Reports of the Minister of Mines, 1939-1941.

34. Cadmium data from Canada, D.B.S., Mineral Production of Canada, 1945, Table 171, p. 122; Antimony from Ibid., Table 165, p. 118; Bismuth from Ibid., Table 168, p. 120 and Annual Report of the Minister of Mines, 1943, Table XI.

35. Canada, D.B.S., Mineral Production of Canada, 1942, p. 198. The Consolidated Mining and Smelting Company had recovered tin, however, since 1925. See Chapter VI.

36. Table from Canada, D.B.S., Mineral Production of Canada, 1945, p. 141.

37. In addition to the metals produced by the Consolidated Mining and Smelting Company during the war, the company also produced a number of other products, such as fertilizer, chemicals, and heavy water. For an interesting statement on the last-named product, see C.D. Andrews, "Cominco and the Manhattan Project," B.C. Studies, No. 11 (Fall, 1971), pp. 51-62.

38. John S. Stevenson, Mercury Deposits of British Columbia, British Columbia Department of Mines, Bulletin No. 5, Victoria, 1940, p. 37. Mercury is sold in strong wrought-iron flasks which can be handled and shipped without crating. The standard flask contains about 76 lbs. of mercury and is the market unit of quantity.


42. Canada, D.B.S., Mineral Production of Canada, 1945, p. 135. The Pinchi Lake mine at the time of closure was the largest single producer of mercury in the western hemisphere.


48. The Canadian Government corporation continued development and started work with the object of putting the property on a producing basis at the earliest possible date. The mill at the Emerald mine was built by the Consolidated Mining and Smelting Company. Annual Report of the Minister of Mines, 1942, p. A80.

49. The ore from this small mine was hand-cobbled from the dumps and shipped direct to Ottawa. Annual Report of the Minister of Mines, 1943, p. A79.


52. See John S. Stevenson, Molybdenum Deposits of British Columbia, British Columbia Department of Mines, Bulletin No. 9, Victoria, 1940.
Several major changes took place in the British Columbia lode-mining industry over the 60 year period of development between 1887 and 1945. Firstly, there had been a geographical expansion of producing mines beyond the original mining centre in the Kootenays. In general, this expansion had been through the southern interior and along the coast, although a few mines in the central and northern interior of the province were brought into production as well. Secondly, there had been an upward trend in the number of mines annually shipping ores or concentrates. Thirdly, a considerable increase in the average size of mines had occurred. In the early years of the industry, most mines annually shipped under 100 tons of ore, while in 1945, the average shipment was some 122,000 tons. The increases in the number and size of mines led, fourthly, to a greatly increased output for the industry as a whole between 1887 and 1945. In addition, there had been a decline in the number of smelters operating within British Columbia during this period. In 1887-1892 four smelters were built to handle ores from the Kootenays; in 1945, a large lead-zinc plant at Trail was the only smelter in the province. These changes are clearly summarized by a comparison of the spatial patterns existing in 1887-1892 (Maps 5 and 6) and 1945 (Maps 17 and 18).

A number of other changes in the industry not revealed by the maps
also occurred over this period. There had been a considerable increase in the variety of metals produced. Furthermore, the industry had shifted from a dependence on high-grade to a dependence on low-grade deposits. Finally, there had been a substantial increase in the level of corporate involvement in both the mining and smelting phases of the industry.

An examination of the production levels associated with the various periods in this thesis shows that the development curve of output for the industry between 1887 and 1945 was not smooth. Although the industry exhibited an upward trending output over the period, its development was characterized by periods of rapid growth, relative stability, or decline. The overall pattern of growth in production between 1887 and 1945 reflected a rising demand for metals which accompanied the growth of world population and industry. Short term fluctuations in the economic and spatial behaviour of the industry were, on the other hand, reactions to sharp changes in demand and hence price, resulting from wars, depressions, and booms in industrial investment. The adjustments made to these changes were affected by a number of factors which played major roles in the development of the industry; namely, the nature of markets, the level of corporate involvement, the availability of capital, the level of technology, and the availability of local transport facilities.

The first factor influencing the course of lode-mining development was the nature of the markets available to the industry. Lode-mining in British Columbia evolved in a region that was peripheral to major continental centres of population and industry, and in which the level of
local demand was never sufficiently high to warrant extensive development. As a result, the industry was always highly dependent on the availability and strength of external markets, and on the supply of metals to these markets from mining centres elsewhere. The impact of this dependence on external markets was felt throughout the period between 1887 and 1945. Indeed, the commencement of lode-mining in British Columbia was in part a result of increased demand for non-ferrous metals in the United States and a depletion of competing ore deposits nearer to eastern United States markets. The impact of war illustrates the role played by external markets as well. Increases in demand in war industry centres, together with an interruption of peace-time supplies, led to an increased quantity and diversity of production within British Columbia. Finally it should be noted that some metals, such as iron ore, the occurrence of which was known throughout the period, were not produced in significant quantities largely because of the lack of external markets.

The lode-mining industry was also affected by decisions made at the corporate level in the light of existing technological and world demand conditions. Such decisions influenced both the economic development and the spatial patterns of the industry. After the turn of the century, the importance of the large corporation in the mining industry became considerable. Such companies had the ability to search for new mines in various areas of the province without the prospect of immediate return. In most years, the major companies held a large number of mineral claims which were then released, held, or brought to
production depending on current or forecast economic conditions. The large companies had the financial strength to adopt, adapt, or develop new technological advances; to withstand the impact of short-term depressions in world markets; and to respond rapidly to upward shifts in demand for various metals. Moreover, the Consolidated Mining and Smelting Company's smelter at Trail served to increase the functional connections of the industry by providing a local market for many mines whose development might otherwise not have taken place. In short, the large companies greatly furthered the development of lode-mining in British Columbia, and added to the stability of the industry.

The availability of exploration and development capital was another major factor influencing the economic growth of the lode-mining industry. Capital shortages had retarded the emergence of lode-mining in British Columbia, and the first successful mining was made possible, in part, by injections of capital from outside the province. Over time, the capital requirements of the industry as a whole increased. The shift from high-grade to low-grade deposits, the search for and successful establishment of mines in more remote areas of the province, the need to explore without prospect of immediate return, and the adoption or development of technological innovations, all required substantial capital investment. Capital attraction was not, in general, difficult after the richness and extensiveness of mineral resources in the province became known and after large companies such as Granby and Consolidated became involved in the industry.
Technological advances also played a major role in the development of lode-mining in British Columbia. In the early years, a low level of mining and milling technology precluded the mining of many deposits and restricted productive mining largely to high-grade ore bodies whose ores were amenable to direct smelting, to hand sorting prior to shipment, or to treatment in simple and inefficient plants. With improvements in mining, milling, and smelting practice, the most radical of which took place in the first three decades of the twentieth century largely as a result of the innovative ability and financial strength of major companies, both the nature and geography of metal production changed. The introduction of improved grinding and concentrating techniques led to the profitable working of lower grade ores, to higher recovery rates, and to the production of two or more concentrates from a single ore. The adoption of the flotation process alone was responsible for the growth of several major mines and the birth of the zinc industry in British Columbia. The adoption or development of new materials handling techniques made possible the increased scale of operations required at lower grade mines. Metallurgical developments at the Trail smelter led to higher recovery rates and increased the range of metallic minerals which could be profitably mined in the province. In short, advances in lode-mining technology allowed the industry to respond to a level of market demand which greatly exceeded the supply of metals which high-grade mines could produce. Moreover, these advances released the industry from a relatively restricted spatial pattern, and allowed a wider choice of possible locations.
The nature and extent of transportation facilities also had a major influence on the spatial patterns of producing mines illustrated in this thesis. The patterns show that while mines did appear in several areas at certain periods, most significant metal production was derived from mines located within a few miles of tidewater along the coast, or within a narrow area along the southern border of the province. This general pattern was established not by geology but by restrictions in transportation. The availability of high-capacity, low-cost transport, either in the form of railways or marine shipping, was an essential prerequisite to large-scale mining. In general, where such facilities did not exist, mining either did not occur or was restricted to high-grade deposits particularly of the precious metals. In some cases, mining did lead to feeder line construction and to short-haul road building, but, on the whole, mining was not attractive enough to stimulate long-distance, overland transportation in the high construction cost areas of the province. Only in the post-war period, with a greatly increased demand and with an expansion of the road network and improvements in transportation technology, were the geographical margins of mineral production pushed beyond the limits which obtained between 1887 and 1945.

External Markets and a Comparison with Other Resource Industries

Of the major factors which influenced the development of the lode-mining industry, the availability and strength of external markets was most crucial. For this reason, the pattern of growth in lode-mining can
be compared to that of other resource industries whose raw material
supplies exceeded the level of demand generated within British Columbia.
The development of the lode-mining industry, in fact, followed closely
Robinson and Hardwick's descriptive model of regional economic growth
over this period, a model which links the course of resource ex-
ploration in British Columbia to the changing geographical situation
of the province with respect to world centres of population and
commerce. Robinson and Hardwick identify three periods which fall into
the time perspective of this thesis: a period of early European settle-
ment (1846-1886), a period of post-Confederation speculation (1886-1918),
and a period of production expansion (1918-1946).

Between the middle of the nineteenth century and the coming of
the Canadian Pacific Railway in late 1885, the beginning of a resource
economy based on fish, forestry, and mining was established in British
Columbia. Except in the case of placer gold, the exploitation of these
resources came slowly, as local population was small and access to dis-
tant world markets was difficult. Ralston noted, for example, that the
eyearly development of the salmon industry in British Columbia was tied
almost exclusively to the local fresh market, and only with the in-
troduction of the canning process in the late 1860's and the acquisition
of markets in industrial Europe, did substantial growth take place. In
the forest industry, sawmilling began as early as 1857, but the scale
of timber exploitation over the next thirty years was relatively small.
An intervening source of lumber in Puget Sound closer to the market in
California, and more difficult logging conditions in coastal British
Columbia at current levels of technology, were the major impediments to the establishment of a large-scale sawmilling industry in these early years. In the lode-mining industry, even less growth occurred prior to 1886, although several attempts to establish the industry were made in various parts of the province. A low level of technology, distance from and difficulty of access to world markets, and intervening sources of metals closer to these markets were major factors accounting for the virtual lack of development.

Between 1886 and 1918, a span of years which Robinson and Hardwick have called the period of "post-Confederation speculation," considerable growth occurred in the major resource industries of British Columbia. For the most part, this growth was stimulated by an increased access to external markets. The relative location of British Columbia altered considerably with the completion first of the Canadian Pacific and later of the Grand Trunk and Canadian Northern Railways, with the expansion of the American rail network into the Pacific Northwest and southeastern British Columbia, with improvements in shipping technology, and with the opening of the Panama Canal. These improved links with external markets, together with the depletion of forest and mineral resources in the United States and a growing demand for salmon in Great Britain, stimulated further exploitation of these resources in the province and, in turn, encouraged an influx of speculative capital.

The pattern of development of the major resource industries under the new conditions of demand and accessibility exhibited a number of similarities. In each case, growth was highly speculative throughout
most of the period. In the 1890's and the early years of the twentieth century, substantial capital was invested in timber holdings, mineral claims, and salmon canneries. The number of sawmills, mines, smelters, and canneries increased, and activity spread into areas where a favourable combination of resources and transport facilities was available. In the years before the First World War, however, growth in the major industries became less speculative. In the forest industry, speculation in timber holdings declined, and their exploitation increased, spurred on by boom conditions in the Canadian Prairies. In the salmon fishery, an overproduction crisis triggered a noticeable concentration of ownership. Production continued to grow in the pre-war period, but its speculative character gradually declined as the extent of the resource became better known and more efficient canneries were required. Similar developments took place in lode-mining, where the impending decline of major ore-bodies led to a number of business consolidations and where the emphasis shifted from the grass roots exploitation of high-grade ores to the more settled business of mining higher tonnage and lower grade deposits.

By the end of World War I, the economic base of British Columbia was firmly established in the products of the forests, the mines, and the fisheries. The major spatial patterns of resource exploitation were fairly well established, and the resource industries had passed beyond the speculative pioneer stage. Significant forest production was concentrated on the coast with logging having spread northward on Vancouver Island and along the mainland. Fishing activities and canning, from
their original centres at the Fraser and Skeena Rivers, had expanded to include the larger coastal islands. Lode-mining was centred in the Kootenay-Boundary area and on the north and south coast.

In the years between the end of the First and the end of the Second World War the major resource industries of British Columbia experienced considerable growth. The links with external markets were strengthened during this period of "production expansion," and new markets were obtained. In the coastal forest industry, for example, large-scale growth occurred in lumber production with new markets, particularly in the North Atlantic region, made accessible by full commercial use of the Panama Canal after World War I. High growth rates were also characteristic of the production of most metals, although severe fluctuations were experienced as levels of demand changed in the major markets of the United States and Western Europe. The forest industry expanded further up the coast under the stimulus of the new demands, and by World War II most of the coastal forest was being exploited or was being held for future expansion. Forest production had also expanded into the central interior in the inter-war period; the number and size of sawmills steadily increased and exhibited a linear pattern along the Canadian National Railway route to the Prairie market. Some expansion of producing lode mines also occurred, especially during the 1930's when the price of gold rose substantially above pre-depression levels. On the whole, however, relatively little geographic expansion took place in lode-mining during this period of production expansion, as much of the increased demand was met by mines which were in production
by, during, or immediately after World War I. Large-scale operations had come to dominate both forestry and mining by the end of World War II. Many of the coastal logging operations were as large as they had ever been, or ever would be. The size of mines making significant contributions to total production had greatly increased. Moreover, in both industries, considerable corporate integration had occurred. A high degree of such integration had emerged between sawmilling and logging on the coast, as it had between mining and smelting in the southern interior.

Other resource industries in British Columbia also expanded during this interwar period as declining distance-cost links to world markets made feasible a production greater than that which local demand could absorb. Economic growth in the province was rapid and was paced, for the most part, by the development of resource-based industries oriented to world markets.

Suggestions for Further Research

Much research remains to be done on the geographical aspects of lode-mining in British Columbia. Several avenues for further investigation can be suggested, some of which follow lines already well established in economic geography, and one of which has been pursued only recently.

With regard to the locational aspects of producing mines, an application of the limited body of location theory dealing with extractive industries may provide fuller explanations for the location and changes in location of British Columbia's mines. The location of producing units in mining industries has traditionally been considered
the simplest example of the location problem. As McCarty and Lindberg point out:

producers must select from among the known locations of mineral deposits those most suitable for selling their products in existing or anticipated markets. In order to explain how this selection process is carried out, location theorists have relied heavily on the least-cost principle. Each producing mine can be seen as a point at which entrepreneurs have attempted to minimize production and transport costs. Despite the criticism to which the least-cost hypothesis has been subjected, its application to the British Columbia industry may provide insights into the major variables influencing specific mine locations and into the relative weights which those variables may have had at different points in time. Location theory is, moreover, particularly explicit in dealing with transport costs and may be especially useful in explaining the location of mines in British Columbia during a period of time in which transport costs appear to have been of considerable importance.

A quantification of some of the variables which have been suggested, in qualitative terms, as affecting mine location may be helpful in better explaining such locations. An examination of transport costs, for example, both in terms of their variation over time and space, and their relative importance in the cost structure of producing mines, may serve to confirm the impact such costs appeared to have had.

The impact of the large-scale corporation on the development of the lode-mining industry cannot be overemphasized. Because productive lode-mining in British Columbia became increasingly dominated by such
large companies, the most fruitful avenue for further research lies in a more detailed examination of the influences exerted by the major corporations. Research in what may be called a "corporate behavioural approach" to industrial location and development is in its infancy, and has been concerned largely with manufacturing industries. Yet the trend toward the growth of giant corporations so obvious in manufacturing, in equally obvious in the primary industries, and was evident in the British Columbia mining industry as early as the First World War. Increasingly it became the case that the more important location decisions were made not by individuals or small companies operating one or two small mines, but rather by large, integrated, multi-mine corporations. To understand more fully the response of the mining industry to changes in external demand, it is necessary to examine carefully what Steed has called "the complex patterns of corporate decisions and corporate spatial behaviour."

Further research along these and other lines will aid in understanding the development, location, and locational changes of lode-mining activity. The industry in British Columbia has received little attention from geographers, however, and a broad overview of the historical development of the industry, as provided by this thesis, was a necessary first step.
FOOTNOTES


16. See F. E. Ian Hamilton, "Models of Industrial Location," Socio-
Economic Models in Geography, (ed.), R. J. Chorley and Peter Haggett,

17. See, for example, Robert B. McNee, "Towards a More Humanistic
Economic Geography: The Geography of Enterprise," Tijdschrift voor
201-206; and Guy P.F. Steed, "Corporate Enterprise and the Location
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D. UNPUBLISHED MATERIALS


APPENDIX A

GLOSSARY OF TERMS

Arrastra - A circular rock-lined pit in which broken ore is pulverized by stones attached to horizontal poles fastened in a central pillar and dragged around the pit.

Blister Copper - The product of the Bessemer convertor furnace used in copper smelting. It is a crude form of copper, assaying about 99 percent copper, and requiring further refining before being used for industrial purposes.

Bog Iron Ore - A special class of iron ore originating as a precipitate and deposited at the surface of the earth by waters which leach iron from rocks that may be of igneous or sedimentary origin.

Development Work - Work done to open up ore bodies by shaft sinking, tunneling, or drifting.

Fissure - An extensive crack, break, or fracture in rocks.

Flux - A chemical substance used in metallurgy to react with gangue materials to form slags which are liquid at the furnace temperatures concerned, and low enough in density to float on the molten bath of metal or matte. Limestone and silica are examples.

Free-Milling - Ores of gold or silver from which the precious metals can be recovered by concentrating methods without resort to roasting or chemical treatment.

Gangue - The worthless minerals associated with valuable minerals in an ore deposit.

Hand-cobbled Ore - Hand concentration in which lumps of concentrate are detached from waste.

Matte - The product of a smelter, being metal with some contained sulphur. It must be further refined to obtain the pure metal.
Ore-shoot – The portion, or length of the vein, or other ore structure that carries sufficient valuable mineral to be profitable to mine.

Pillar – A block of solid ore or rock left in place for the purpose of supporting the walls or roof in a mine.

Rawhiding – A means of haulage by which ore is slid over the ground on a pallet made of skins, or skins and logs.

Shaft – A vertical or inclined excavation used for the purpose of opening and servicing a mine. It is usually equipped with a hoist at the top which lowers and raises a conveyance for handling men and material.

Spelter – The zinc of commerce, more or less impure, cast from molten metal into slabs or ingots.

Stamp-mill – An apparatus (also the building containing the apparatus) in which rock is crushed by descending pestles (stamps), operated by water power or steam power.

Stibnite – Common antimony ore found with pyrite, galena, and arsenic minerals.

Stope – An excavation in a mine from which ore is being or has been extracted.

Sulphuret ore – In miners' phrase, the undecomposed metallic ores, usually sulphides. Chiefly applied to auriferous pyrites. An old synonym for sulphide.
APPENDIX B

MAPS OF MINING DIVISIONS
## MINING DIVISIONS - 1905

1. Ainsworth  
2. Alberni  
3. Arrow Lake  
4. Ashcroft  
5. Atlin  
6. Bella Coola  
7. Cariboo  
8. Clamoquot  
9. Clinton  
10. Fort Steele  
11. Golden  
12. Grand Forks  
13. Greenwood  
14. Kamloops  
15. Lardeau  
16. Liard  
17. Lillooet  
18. Nanaimo  
19. Nelson  
20. New Westminster  
21. Nicola  
22. Omineca  
23. Osoyoos  
24. Quatsino  
25. Quesnel  
26. Revelstoke  
27. Similkameen  
28. Skeena  
29. Slocan  
30. Slocan City  
31. Stikine  
32. Trail Creek  
33. Trout Lake  
34. Vernon  
35. Victoria  
36. Windemere  
37. Yale
MINING DIVISIONS-1914

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BRITISH COLUMBIA
MINING DIVISIONS
1921

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35. Stikine
36. Trail Creek
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BRITISH COLUMBIA
MINING DIVISIONS
1939

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