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THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

BLACK HILLS GOLD MINING, 1876-1935: TOWARD A TIME-SPACE MODEL

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

DOCTOR OF PHILOSOPHY

BY

JULIUS ATTILA KOVATS

Norman, Oklahoma

1978

BLACK HILLS GOLD MINING, 1876-1935: TOWARD A TIME-SPACE MODEL

APPROVED BY

Richard L. Nostrand

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DISSERTATION COMMITTEE

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ABSTRACT OF THE DISSERTATION

BLACK HILLS GOLD MINING, 1876-1935: TOWARD A TIME-SPACE MODEL

by
Julius Attila Kovats

Doctor of Philosophy in Geography
University of Oklahoma, Norman, Oklahoma
1978

Professor Richard L. Nostrand, Chairman

The discovery of gold in the Black Hills in 1874 precipitated one of the significant mining "rushes" in the American West. The mining activity that soon developed underwent many of the same transitions and vicissitudes--in demographic composition, settlement morphology, political organization, levels of technology, and economic prosperity--that seemingly characterized other mining areas in the American West. This study seeks to analyze demographic, social, political and economic patterns as they evolved in the Black Hills between 1876-1935, and it attempts to interpret this and other similar mining regions through a mining model generated from the Black Hills experience.

The model conceptualizes the mining of discontinuous, precious metals in time and space. Mining is seen as progressing through four, step-wise competitive stages: individual vs. individual, individual vs. company, company vs. company, and one-company domination; it is also seen as developing within high, intermediate, and weak zones of concentration which constitute macromining space. The model is applied with reasonable confidence to Colorado's mining regions, and it would seem to explain the evolution of mining in those small and medium-sized areas having "classical" frontier conditions.

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CHAPTER I

INTRODUCTION

The Study

During the mid-1960s I worked as an exploration geologist for the Homestake Gold Mining Company in the Black Hills of South Dakota. My search for ore deposits in the vicinity of Lead, South Dakota, required that I become knowledgeable about historical materials concerning past mining activities. The study of that literature on the origin and evolution of Black Hills gold mining companies eventually materialized into the present dissertation.

This dissertation treats the origin and development of the Black Hills gold mining industry from 1876 to 1935. It focuses on the spatial organization of pioneer settlements, land use, and economic structure. It generalizes about the Black Hills gold mining example through the formulation of an evolutionary mining model. My main objective is to formulate and test a time-space mining model. To this end I present a general, evolutionary mining model that illustrates successions in mining from frontier to modern conditions. The model is descriptive, qualitative, and mainly inductive; it applies only to irregular and discontinuous metallic deposits of relative high value such as gold and silver, and not layered or blanket-type deposits such as coal and bentonite.

The text has been organized into ten chapters with brief summaries at the end of each. I have employed a temporal cross-sectional approach. Certain patterns were reconstructed between 1876 and 1935, and descriptions and explanations as to their origin and development are given. The organizational aspects of the geography of the Black Hills gold mining industry were placed within the spatial-temporal framework.

Field studies were conducted during the summers of 1975 and 1976, when several of the now inactive mines such as Trojan and Bald Mountain were visited. Densities, distributions, and styles of mining operations, as well as settlements and relic features, were observed and recorded. A few Homestake company employees were interviewed about past mining activities, and records and maps were collected whenever possible.

Museums and archives such as the Adams Museum in Deadwocd, South Dakota, were visited, staff members were interviewed, and records and maps were hand-copied or xeroxed. Much information was gathered at the library of the School of Mines in Rapid City, South Dakota, and at the E. Y. Berry Library of Black Hills State College in Spearfish, South Dakota. City and country libraries were also visited in Custer and Spearfish, South Dakota, and in Newcastle and Casper, Wyoming. Perhaps the most useful sources were those in the Homestake Library in Lead, where a large collection of special manuscripts, newspapers, maps, company records, old mining journals, and other rare records were put at my disposal. Important data were also obtained from the Lawrence County Courthouse in Deadwood, where the tax lists of mineral lands proved to be one of my most important sources. Old newspaper articles and editorials in the Black Hills Mining Review, the Pahasapa Quarterly, the Black Hills Engineer, the

Wi-Iyohi, and other journals and magazines contained much relevant information.

Some 350 sources relating to the history, nature, and problems of the mining activities in the Black Hills were read. Books by pioneer writers such as Annie Tallent, Richard B. Hughes, and the Rev. Peter Rosen provided background. The writings of Watson Parker, the foremost authority on Black Hills history, settlements, and ghost towns, provided the foundation for my studies. Also helpful were Bureau of Mines, U. S. Geological Survey, and U. S. Department of Commerce and Immigration. Unfortunately, reliable statistics about mining activities in the early phases of the gold mining industry, especially from 1876 to the 1890s, were lacking, and I often had to rely on my intuition or judgment of historic trends.

The Black Hills in Context

The first gold rush of any magnitude occurred in Georgia in 1828. Although it was a short-lived venture, producing only some $20 million worth of gold, it was the first of the gold mining frontiers, and it marked the beginning of the gold mining tradition. In Georgia techniques for extraction were developed as was a class of prospectors and miners who were unique in lifestyle and mentality.[1]

During the 70 years between the Georgia gold stampede and the Alaskan gold rush of 1898, there were numerous gold rushes in the United States—from the Rockies to the Sierra Nevada-Cascades, and from Montana

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[1]Elma D. R. Spencer, Green Russel and Gold (Austin: University of Texas, Printing Division, 1966), p. 4.

to Arizona. The exact dates and locations of discovery are not known for certain in many instances, for several discoveries sometimes occurred simultaneously at several places in the same region. There was often also a considerable time lag between the discovery, the rush, and settlement. It is also difficult to estimate the total number of people who participated in any particular gold rush. Undoubtedly the largest in terms of number of miners, geographic area, and the amount of gold produced was the California rush.

Approximately 200,000 people participated in the California gold rush between 1848 and 1868. The Alaskan gold rush involved about 60,000 participants between 1898 and 1902. The Black Hills rush drew a maximum of 40,000 people. Whether the Black Hills rush was the last in the contiguous United States is debatable. Other regions such as Tombstone, Arizona, could make a good case for this claim. The Black Hills gold rush was, nevertheless, among the largest gold stampedes west of the Mississippi, and it was a culmination of successive mining frontiers.[2] The gold rushes between 1828 and 1902 in the United States are shown in Tables 1 and 2, and the distribution of gold mining regions in the United States is illustrated in Fig. 1.

Gold mining frontiers were significant for the following reasons: 1) Mining camps were established as "outposts of civilization" at or near the gold discoveries regardless of the climatic or topographic environment. With the exception of California and Utah, mining camps were the first permanent settlements in the western United States to have substantial populations and to draw residents from all walks-of-life.

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[2]Rodman W. Paul, "Mining Frontier of the Far West, 1848-1880," Histories of the American Frontier (New York: Holt, Rinehart and Winston, 1963), p. 176.

GOLD RUSHES IN THE UNITED STATES, 1828–1900

	GOLD DISCOVERY	BOOM IN GOLD MINING	DEPRESSION IN GOLD MINING	POPULATION (STATE)	TERRIT. ORG.	STATE ORG.	Nº OF PEOPLE PARTICIPATING
GEORGIA DAHLONGA, AURORA, BLUERIDGE PROVINCE	1828,1832	1828–1838	1848–		1733	1788	2000–4000?
NEW MEXICO OLD PLACER, ORTIZ, SILVER CITY	1683,1828, 1833	NO REAL BOOM	–	1850 61547 1880 119565	1850	1912	1000–3000
CALIFORNIA COLOMA, NEVADA CITY, PLACERVILLE SACRAMENTO, ETC.	1848–1849	1849–1858	NO REAL DEPRES.	1850 92 597 1860 379 994 1880 864 964	1848 (ANNEXED)	1850	150–200 000
NEVADA COMSTOCK LODE, GRASS VALLEY, VIRGINIA CITY, TONOPAH, GOLDFIELD	1859,1873 1900	1864–1873 1874–1878 1900–1904	1882–1900 (SILVER)	1860 6 857 1880 62 260	1861	1864	35–55 000
IDAHO LEWISTON, PIERCE, FLORENCE, BOISIE, SILVER CITY, ATLANTA	1860,1861 (PLACER) 1862,1864 (LODE)	1864–1890	1892–1899 (LABOR WAR)	1870 14 999 1880 32 610 1890 88 548	1863	1890	15–25 000
OREGON JACKSONVILLE, JOHN DAY, POWDER RIVER, COASTAL OREGON	1851,1861	1851–1860	1880–	1850 13 294 1880 174 768	1848	1859	2000–6000
MONTANA FLINT CREEK, WASHOE, ALDER GULCH, VIRGINIA CITY, LAST CHANCE GULCH, HELENA	1852,1856 1860,1862,1864	1853–1858 (PLACER) 1860–1869 (LODE) 1864–1875 (SILVER)	NO REAL DEPRES.	1870 20 595 1890 142 924	1864	1889	25–35 000
WYOMING SOUTH PASS, CARISSA, SWEETWATER VALLEY	1855, 1865 1867–1868	1867–1873	1873–	1870 9118 1880 20 789 1890 62 553	1868	1890	800–2000
COLORADO DENVER, JULESBURG, GOLDEN, NEVADA CITY CENTRAL CITY, PIKE'S PEAK, ETC.	1858, 1859 1860–1861	1860–1862 (PLACER) 1878–1890 (LODE) 1889–1892 (SILVER)	1893–1894 1896–1897 1902–1904	1860 34 277 1880 194 000 1890 413 249	1861	1876	80–120 000
ARIZONA FOUR CORNER, LOWER GILA-COLORADO RIVER, PRESCOT, TOMBSTONER	1856,1863 1879	1858–1869 (PLACER) 1879–1886 (LODE)	1870s (APACHE WARS)	1870 9658 1880 40 440 1890 88 243	1863	1912	3000–7000
SO DAKOTA BLACK HILLS, CUSTER, DEADWOOD, LEAD	1874,1876	1875–1882	1881–1890 (SILVER)	1870 11 776 1880 98 268	1861	1889	20–35 000
UTAH BINGHAM CANYON, WASATCH RANGE, ETC.	1869,1873	1870–1873 1885 (COPPER)	NO REAL DEPRES.	1850 11 380 1880 143 963	1850	1896	2000–5000
ALASKA JUNEAU, DOUGLAS, DAWSON CITY, KLONDYKE, NOME, FAIRBANKS, ETC.	1876,1880–81 1886,1892 1897–98,1902	1886–1908	" "	1890 32 052 1900 63 592	1884–1912 (DISTRICT)	1959	60–80 000

SOURCE: SEE FOOTNOTES IN THE TEXT

TABLE I

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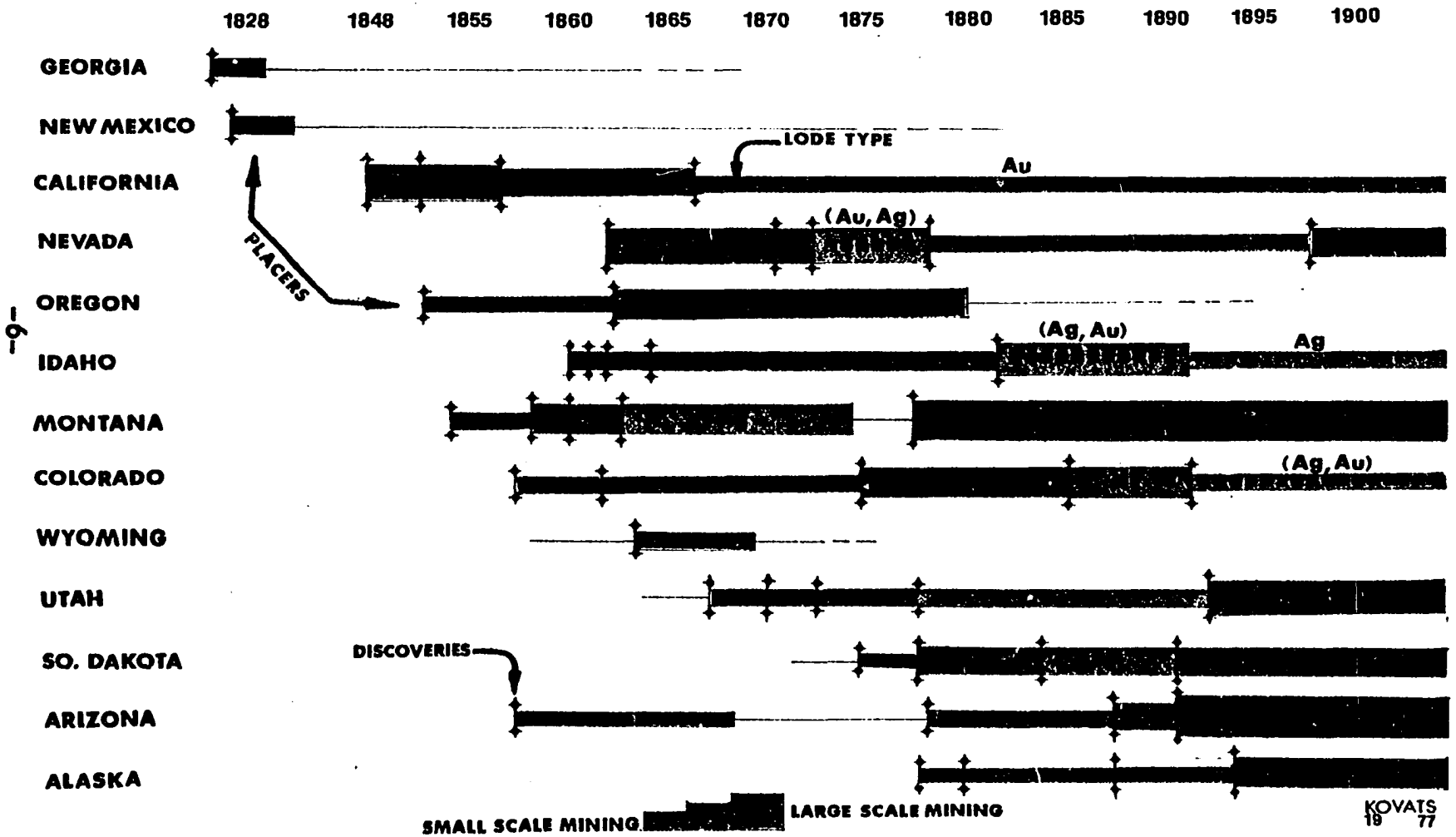
TABLE 2

GOLD RUSHES IN THE UNITED STATES, 1828-1900



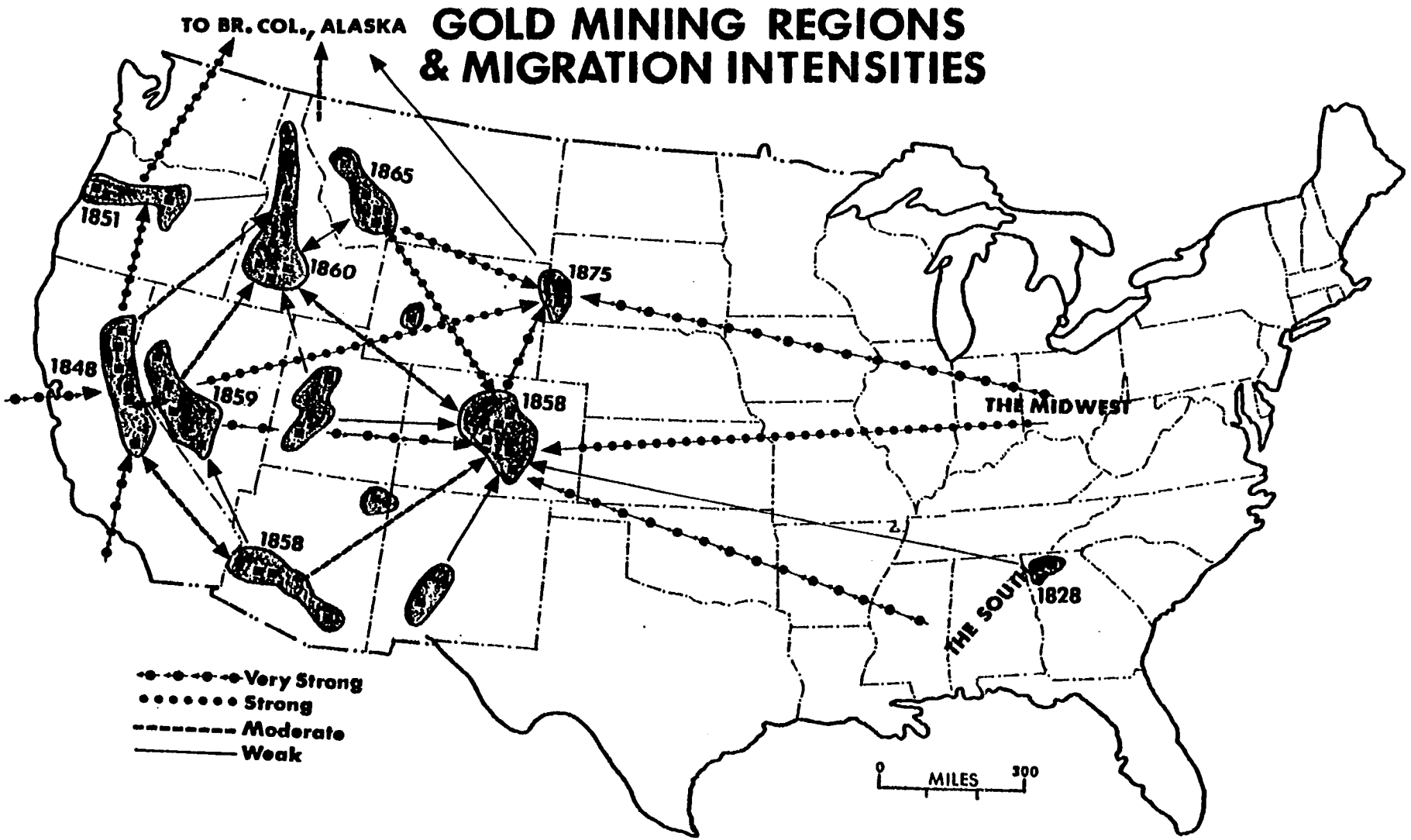


FIGURE 1

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2) Gold mining camps were the vanguards of civilization, the forerunners of American control. They shaped Indian-White relations and they contributed to the eviction of the Indians from their tribal lands or reservations. Thus, the Cherokees were forced from Georgia and the Sioux from the Black Hills. A large percentage of the established western towns had their origins as gold mining camps, and also the majority of historic ghost towns were once flourishing gold camps. 3) Gold mining accelerated territorial or state organization. 4) Gold mining aided the establishment of other industries such as timber exploitation, railroad construction, and manufacturing. Agriculture and stock raising were stimulated in the vicinity of gold mining camps. Metallurgy, engineering, chemistry, and other sciences such as chlorination and cyanidation in the crushing and reduction of gold ores were also stimulated. 5) Gold mining produced close to $6 billion in the United States between 1848 and 1918. It provided jobs in times of agricultural, business, and other depressions, it elevated property values tremendously, it stimulated large investments, it paid higher dividends to stockholders than other industries, and by 1914, it helped make the United States the largest creditor nation in the world. 6) Gold mining invited road and railroad construction, thus facilitating the exploitation of other resources. 7) Gold mining camps, through miners' meetings, created American mining laws. The gold miners were the front-runners in the organization of labor into unions: the eight-hour work day, safety regulations, and workman's compensation, were all demanded and fought for by the gold miners. 8) Gold mining stimulated journalism and the advertising industry. Many of the early banks,schools, and miners' associations

were also directly related to gold mining activities in the western United States. Mining camps also created inflationary trends and contributed to organized crime in the United States. Lawlessness, fraudulent promotional schemes, prostitution, and other social ills were all part of the gold mining frontier.

Terminology: The Black Hills Example

In the study that follows, several new spatial terms are used that are given the following operational definitions:

Mining region is defined as a large area where concentrated, scattered, or intermittent exploration and mining of unspecified surface and/or subsurface ores has occurred. Its boundaries are subject to change as a result of new discoveries and depletion. In this study the mining region is the largest mapable unit.

A mining region which contains several types of ore deposits can be subdivided into ore-specific subregions. The Black Hills mining region, with its gold, bentonite, uranium, coal, and pegmatite subregions, is an example.

Given the nature of ore-forming processes and subsequent changes in ore concentration and distribution, the ore-specific subregions may have intricate and overlapping boundaries. In the case of the Black

Hills, mining region boundaries are almost coincidental with land forms. Climatic and vegetation boundaries are likewise in close proximity. Since the physiographic, geologic, and other surface expressions of the Black Hills are approximately coincidental with that of the mining region, the Black Hills is an ideal area for developing and applying the concept.

Mining space is defined in a physical and legal sense as an actual or potential ore area of varying size in both the vertical and horizontal scales which has been surveyed and legally claimed but is not yet organized for present or future mining purposes. While in this study "mining region" is used as a general term and refers to unspecified ore deposits (ore-general), the term "mining space" refers to ore-specific areas or subregions within the mining region.

In the case of a single-ore, the mining region may coincide with the mining space. However, many of the metallic ore deposits contain several types of mineral deposits which are spatially separated from one another within the boundaries of a mining region. If these deposits are legally claimed for mining purposes, the mining region can be broken down into respective mining spaces.

The horizontal and surface spatial dimensions of mining space vary. Mining space can be mapped, however, and according to the size and the nature of ownership patterns, it can be subdivided into "macro-mining space" and "micro-mining space."

Macro-mining space is defined as that part of the mining space which is claimed, organized, and worked by more than one individual in partnership, or as a company. It may be the size of a mining district. Defined this way, macro-mining space is the aggregate of the

ore-specific micro-mining spaces. Macro-mining space is the "arena" in which competition for the resources is particularly keen in order to capture, organize, and ultimately dominate the larger space.

The steps in the process of elimination through competition, which ultimately lead to the domination of the entire macro-mining space, are revealed in changing ownership patterns. Partially organized macro-mining space eventually becomes fully integrated.

Micro-mining space is defined as fractions of that macro-mining space that are claimed by an individual or by several individuals. This is the smallest mapable unit and is the building block of the macro-mining space. Micro-mining spaces are called "claims," "lots," or "stakes." The smallest recognized spatial unit is a claim of 600 x 1,500 feet. The micro-mining space is generally composed of more than one single claim, and is normally a group or set of claims under individual ownership. Micro-mining spaces were the first units to come into being.

It is hypothesized that, because of the competitive elimination of individuals, changes in micro-mining space ownership patterns will unleash an evolutionary process which leads ultimately to the organization and domination of the macro-mining space.

CHAPTER II

GEOLOGY AND PHYSICAL GEOGRAPHY

Location and Area

The name "Black Hills" is derived from Paha Sapa, or "Hills that are Black" in Dakota Sioux dialect. In the early nineteenth century this term referred to the hills and mountains that stretched from the North Platte River to the Yellowstone River, and from the South Dakota Badlands to the Big Horn Mountains of Wyoming. Not until the gold rush of 1874-1875 was the name confined to the hilly terrain between 43° and 45° north latitude and 103°and 104° west longitude (Figs. 2 and 3).

The Black Hills proper is located between the Belle Fourche River and the southern forks of the Cheyenne River. The South Dakota-Wyoming state line divides this hilly county into two unequal parts—approximately 70 percent is located in southwestern South Dakota and 30 percent in northeastern Wyoming. This oval-shaped area contains 20,600 square miles of which 12,700 are in South Dakota and 7,900 are in Wyoming; like an iceberg, however, the geological subsurface of the Black Hills is extensive.

The major hills are aligned northwest-southeast and extend for 125 miles; the hills are about 60 miles across. For convenience and

BLACK HILLS AND THE UNITED STATES

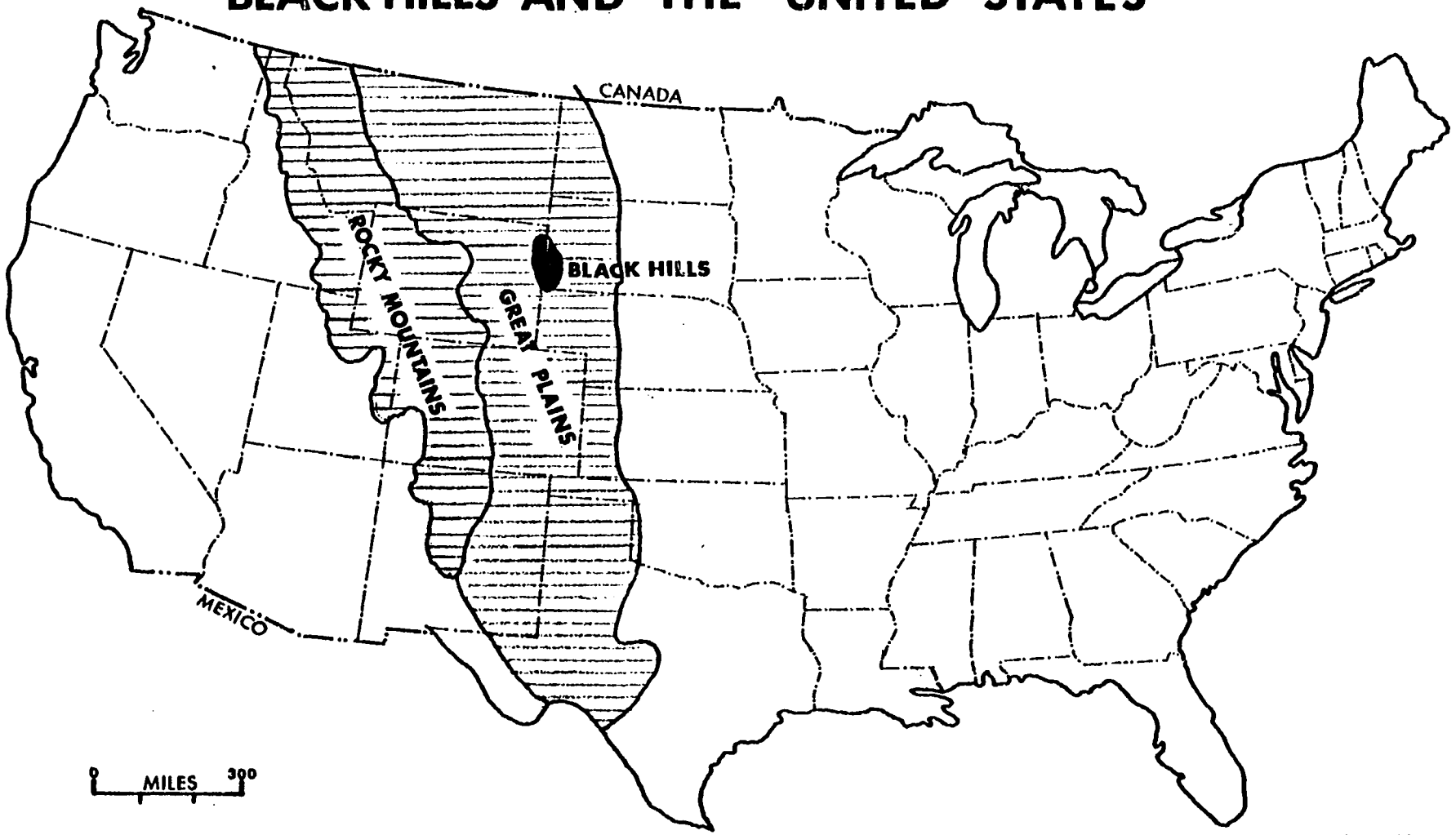

FIGURE 2

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DISTANCES AND THE BLACK HILLS

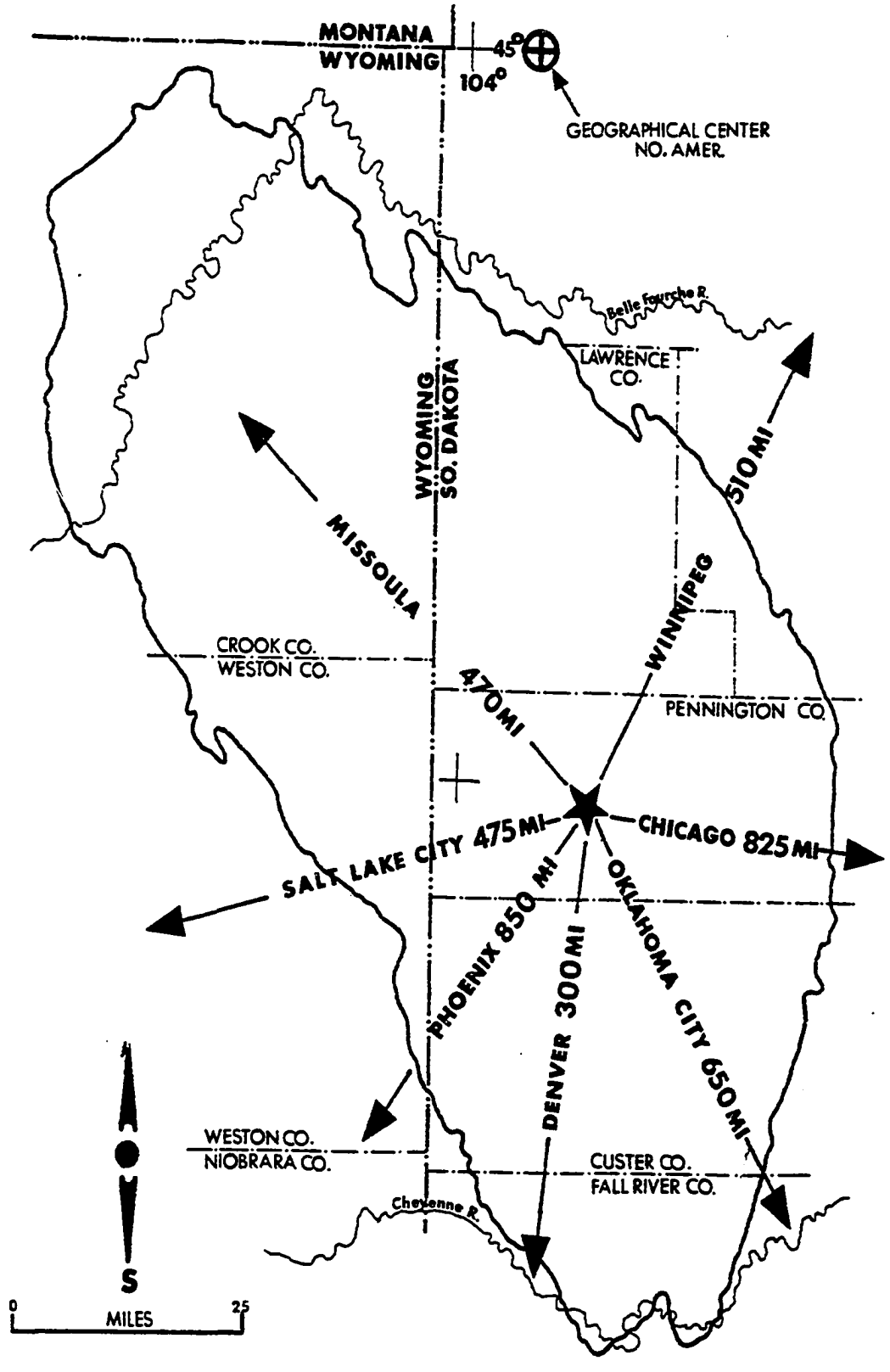

FIGURE 3

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orientation, the Black Hills may be subdivided into five parts: the Western Hills, a broad, rolling upland plateau of high elevation; the Eastern Hills, a narrow, hilly or mountainous country with alternating cliff-forming ridges and deep valleys, canyons, and volcanic peaks of high elevation; the Southern Hills, an undulating and subdued plateau of relatively low relief with wide canyons and mesa-like remnant hills; and the Central Hills and Northern Hills, rugged, high granitic and metamorphic uplands with knobby hills, crested summits, and steep canyons.

Geology, Structure, and Stratigraphy

The Black Hills, like the Rocky Mountains, came into being as the result of the Laramide orogeny. These hills are an outlier of the Rocky Mountains and were uplifted between Late Cretaceous and Early Tertiary periods some 65 million years ago. They are situated on a geotectonic unit called the Wyoming foreland, which since at least the beginning of the Mesozoic era, has bordered the Rocky Mountains geosyncline on the east.[1]

During the Laramide orogeny, the geosynclinal sediments were folded into the Rocky Mountains and were accompanied by large-scale faulting, magma intrusions, metamorphism, and volcanism. The foreland region also experienced deformation in the form of faulting projecting

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[1] A foreland, or platform, refers to the interior (landward), more stable part of the continent, but is adjacent to the orogenic belt. The foreland has an intermediate position between the stable shield and the unstable (or active) geosyncline. A geosyncline refers to a sinking surface of elongated shape having a trough-like character in which thick layers of sediments, up to 40,000 feet or more, are accumulating. This type of geosyncline is positioned oceanward. Allen J. Eardly, Structural Geology of North America (New York: Harper and Brothers, 1951), p. 273.

deep into the basement.[2] The most plausible explanation for the origin of the Rocky Mountain system and the Black Hills is found in the recently postulated Theory of Plate Tectonics. According to this theory, the American continental plate "collided" with the Pacific oceanic plate while these two lithospheric units were moving in opposing dirctions. The American plate was drifting westward and the Pacific plate spread eastward by an accretionary process caused by successive lava extrusion along the fracture zone of the mid-Atlantic oceanic ridge. At the zone of collision, the thick, geogynclinal sediments, being lighter in density and mainly of "granitic composition," were folded and uplifted into linear mountains, while the oceanic plate, which was composed of heavier "basaltic rocks," buckled under; however, the stress of deformation was transmitted to the foreland sediments and produced deep-seated thrust faults along which magma intrusions occurred in the form of batholiths.[3]

The foreland was fragmented into basin blocks and mountain blocks--the former were subsided and the latter were frequently elevated by the intruding magma underneath. The structural relief between the basins and adjacent uplifts was as much as 40,000 feet.[4] One of the batholithic intrusions and uplifted mountain blocks formed the Black Hills.

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[2]Basement is a non-committal term referring to the igneous and metamorphic rocks of Precambrian age which forms the base upon which younger, marine sediments were deposited.

[3]Batholith is a large body of intrusive rock, mostly of granitic composition. The size is at least several hundred square miles. In a three-dimensional view, the shape of a batholith is irregular and its depth is unknown.

[4]John K. Sales, "Regional Tectonic Setting and Mechanics of the Origin of the Black Hills Uplift," Wyoming Geological Association Guidebook, Twentieth Annual Field Conference (Laramie, Wyoming: 1968), p. 10.

The Black Hills uplift is an irregular, dome-shaped anticline, and is classified as a tectonic dome-mountain in which the rocks are arched over a broad radius and the sediments dip away in every direction.[5] Regional tectonic setting suggests that the uplift is an asymmetrical feature and is double-domed with a saddle in between. The granite in the "southern dome" reaches the surface, while in the "northern dome" the underlying granite is covered by an undetermined thickness of metamorphic rocks. The asymmetrical nature of the elliptical dome is further pronounced by the bent axial trend of rocks and structures. In the Southern Hills, the axis is short, about 40 miles long, trending in a north-south direction; in the Northern Hills, the axis is long, approximately 80 miles long, and trends in a northwest-southeast direction. Also, the eastern side of the Black Hills was tilted considerably to the northeast during the Pliocene or Pleistocene.

Subsurface structures, such as the northeast-southwest trending Hartville Arch, connect the Black Hills to the Laramie Range of Wyoming, and the Miles Arch, in turn, links the Black Hills with the Montana Rocky Mountains. The Black Hills dome is also connected with the Sioux uplift, a structural high in the eastern part of South Dakota.

Folding of the Precambrian metamorphic rocks, and faulting of the Paleozoic and Mesozoic sedimentary rocks, were the major forms of rock deformation in the Black Hills. The intruding batholithic magma formed a large and an irregular conical wedge underneath the Black Hills

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[5] Rhodes W. Fairbridge, ed., "Dome Mountain," The Encyclopedia of Geomorphology, Encyclopedia of Earth Science Series, Vol. 3 (New York: Reinhold Book Corp., 1968), p. 282.

and came to rest under several thousand feet of already metamorphosed rocks, such as phyllites, slates, schists, quartzites, and marbles. In the Northern Hills there were five mapable stratigraphic units defined by Homestake geologists identified with a composite thickness of 5,000 feet;[6] in the Southern Hills the total sequence is about 14,000 feet thick.[7]

These Precambrian rocks were re-metamorphosed, contorted, crowded aside, and some parts were assimilated by the molten magma. Great variations in thickness and in different grades of metamorphism between the Northern Hills and Southern Hills make the stratigraphic correlation difficult. The Precambrian sediments and metasediments are estimated by the Homestake Mining Company geologists as 2.0 billion years old, making these rocks among the oldest in North America.

The intruding and slow-cooling magma, through the process of crystallization, gave rise to a number of segregated magmas of different compositions which were injected close-by at various times in the forms of laccolithic intrusions, dikes, sills, pegmatites, and veins.[8] The

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[6]The five units include the Poorman Formation, the thickest and oldest member which is composed mainly of phyllites and slates; the Homestake Formation, a thin, carbonate-rich sequence of cummingtonite and other schists; the Ellison Formation, a thin sequence mainly of quartzite; and the Northwestern and Flagrock Formations, a thick assemblage of primarily phyllites, slates, and micaceous schists.

[7]John P. Gries, "Mineral Resources of the Black Hills Area, South Dakota and Wyoming," Information Circular 8660, Bureau of Mines, United States Department of the Interior (Washington, D. C., 1874), p. 5.

[8]Laccolith is a lense-shaped body of concordant igneous intrusion, generally as a satellite to the batholith; dike is a tabular, intrusive body with discordant relationship to the host rocks; sill is a tabular, intrusive rock with concordant relationship to the host rocks; pegmatite is pipe-like body with coarse crystals mostly of granitic composition and is emplaced around the periphery of a batholith or laccolith; vein is a small concordant or discordant intrusion either metallic or non-metallic, but invariably of quartzitic composition.

final product of crystallization was the Harney Peak Granite.[9] The successive magmas of the Black Hills batholith were rich in a number of base metals, precious metals, rare metals, and non-metallic elements which have been segregated through the processes of differentiation into a large variety of rock types from ultrabasic to acidic composition.[10]

The Black Hills batholith was emplaced in Late Precambrian; the basic (or mafic) rocks are about 1.8 billion years old, and the acidic (or silicic) rocks such as the Mount Rushmore Granite are approximately 1.6 billion years old.[11] The last generation of intrusives is probably of Paleocene or Eocene age.[12]

The remobilization of the magma during Late Cretaceous to Early Tertiary periods produced an abundance of swarm dikes and other intrusive,

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[9]The Harney Peak Granite was a volatile-rich (H_2O, Cl, F, Li, etc.) magma which crystallized to a coarse, biotite-muscovite granite. The coarseness of minerals, the unusual concentration of accessory minerals and the superabundance of some of the rare minerals, such as lithium minerals, beryl, and tantalite-columbite, etc., gave a pegmatitic character to the granite.

[10]Petrogenesis involved amphibolite, hornblendite, pyroxenite, and lamprophyres of ultrabasic and basic composition, as the first-generation of intrusives. The second-generation of igneous rocks were composed of intermediate and acidic intrusives, such as diorite, andesite, quartz-diorite and granite pegmatic. The first and second-generation of intrusives are of Precambrian age. The latest group of intrusives is of Tertiary age, showing a wide range of composition from quartz-rich basaltic, calc-alkalic, and acidic compositions, such as syenitic lamprophyres, trachyte porphyry, nepheline, dacite and rhyolite. These rocks have mainly porphyritic textures.

[11]Joseph P. Connolly, "The Geology of Mount Rushmore and Vicinity," The Black Hills Engineer, Vol. 18 (November, 1930), p. 364.

[12]The Paleocene-Eocene epochs involved the time-interval from 65 to 38 million years ago. Most of the laccoliths, sills, and dikes in the Hills were intruded during this time period.

igneous bodies. The presence of practically every variety of rock composition in a radius of 60 miles created not only a rare, geological curiosity, but also produced an unusual concentration of rare elements and mineral deposits in a relatively small area. The forcibly injected concordant and discordant igneous structures served not only as sources of minerals, or provided channels for the mineralizing solutions, but they also promoted the upward displacement of the Precambrian and Paleozoic rocks—that is, they contributed to the doming of the Northern Hills.[13] For example, in Bear Lodge Mountain, Wyoming, the force of the intrusives of Eocene age dragged the Precambrian granites and metamorphics upward more than 4,000 feet.[14]

The granite and metamorphic rocks constitute the core of the Black Hills. They are exposed in the central part in a 25 (east-west) by 60 (north-south) mile long area of approximately 1,500 square miles.[15]

The granite uplift also punctured a wide area of almost horizontal beds of Cambrian to Cretaceous sequence of sedimentary rocks which all dip away as monoclines from the central core of nucleus. The sedimentary layers are steeply inclined, occasionally overturned in the eastern part, and are gently dipping on the west side of the uplift. Facing the

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[13]There are about 30 dome-shaped, laccolithic intrusives in the Black Hills, many of which expose the igneous rocks. Better known domes include: Crow Peak, Sundance Mountain, Crook Mountain, Mineral Hill, Inyan Kara Mountain, Terry Peak, and Nigger Hill. Igneous rocks are not exposed in Elkhorn Peak, Strawberry Hill, or Bald Mountain.

[14]James A. Noble, "Evaluation of Criteria for the Forcible Intrusions of Magma," The Journal of Geology, Vol. 60 (January, 1952), p. 48.

[15]Neal M. Denson, "Mineral and Water Resources of South Dakota, Section I., Report of the United States Geological Survey, 88th Congress Second Session, (1904), p. 18.

crystalline core, the Early Paleozoic beds form an erosional escarpment, and each higher bed passes beneath a younger one in a regular succession outward toward the periphery of the dome. The core of the dome is composed of a light-colored granite, and this is encircled by metamorphic rocks of darker colors which are in turn surrounded by concentric outcrops of successively younger sedimentary rock of variable colorations. The structure and the colors make the Black Hills easily discernable and one of the most typical domical mountains in North America (Fig. 4).

During and following the uplifts, erosion removed approximately 6,000 feet of originally flat-lying sediments and an undetermined thickness of metamorphic and granite rocks from the central part of the dome. The Paleozoic sedimentary rocks of the Black Hills are much thinner than are their western counterparts, but because of their completeness they are a good representation of the sequence. The Mesozoic section is much thicker than is the Paleozoic sequence; their combined thickness is about 6,000 feet.[16] There are 23 separate, sedimentary formations identified in the Paleozoic and Mesozoic sequence, many of which are mineralized and have economic significance.

From the Cambrian to the Upper Cretaceous, there were nine major sea transgressions with marine sedimentation, four periods of terrestrial depositions, and five periods of erosion in the Black Hills.[17] Approximately 80 percent of the Paleozoic section is composed of calcareous rocks,

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[16]Edward L. Tullis, "The Geology of the Black Hills," The Black Hills Engineer, Vol. 25 (April, 1939), p. 34.

[17]Sea transgressions occurred in the Late Cambrian, Middle Ordovician, Late Ordovician, Late Devonian, Pennsylvanian, Triassic, and Late Cretaceous.

GEOLOGIC MAP OF THE BLACK HILLS
(GENERALIZED)

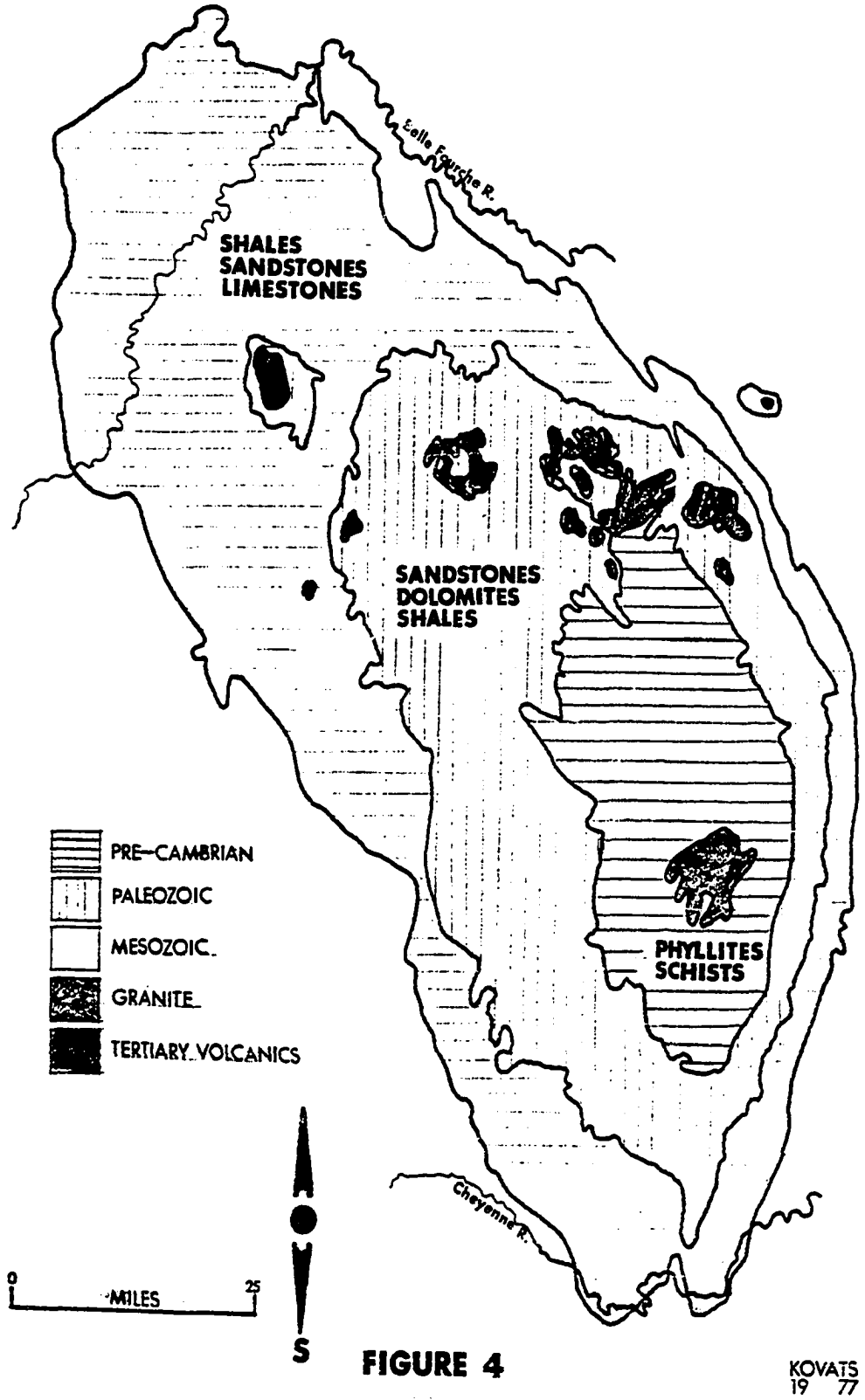

FIGURE 4

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such as dolomites and limestones, while the Mesozoic sequence contains up to 85 percent clastics, such as sandstone and shales (Fig. 5).

During the Cenozoic, the Black Hills had a complex geologic history with many events which are poorly understood today. Several periods of warping, folding, and uplifting began during the Late Cretaceous-Early Paleocene times, with several phases of intense, igneous activities followed by a long period of erosion in the Eocene and Early Oligocene. Large-scale removal of Paleozoic and Mesozoic rocks occurred during these few million years.

The Middle Oligocene was one of the most intense periods of volcanism during the Tertiary. Volcanic ash and tuffaceous materials were emitted and carried by prevailing westerly winds from the Yellowstone-Absaroka center and buried the Black Hills with a blanket of volcanic sand and dust as deep as 800 feet. By Late Oligocene and Early Miocene, renewed uplifts and climatic changes started a long-lasting erosion cycle which eventually stripped off the thick, volcanic, pyroclastic sediments from most of the Black Hills.[18]

The first half of the Cenozoic Era (about 30 million years) was the time of prolonged erosion, sedimentation, and igneous activities; the second half was that of renewed uplift, which continued intermittently

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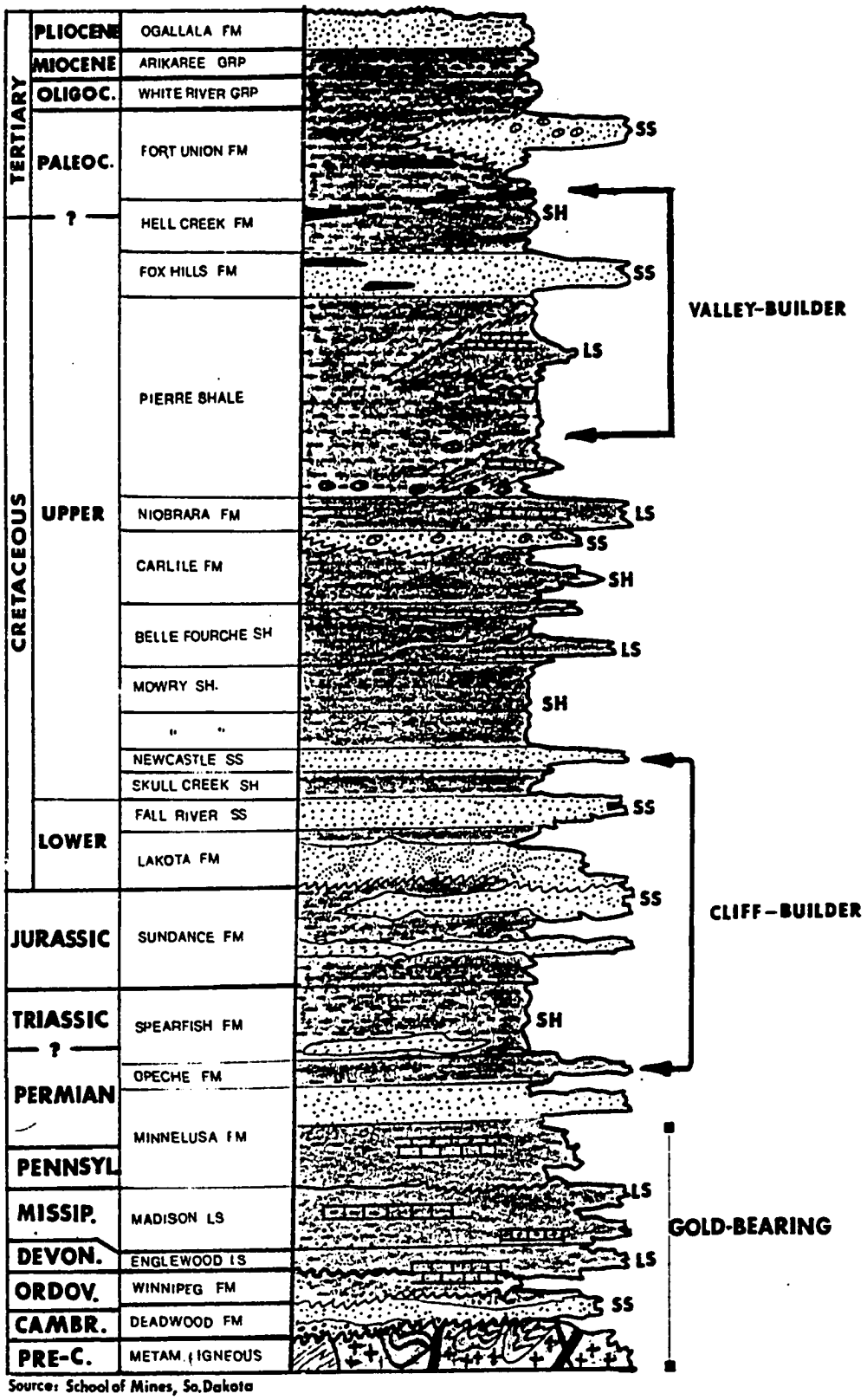
[18]The Oligocene sediments, called the White River Group, contain the Chadron and Brule Formations. The sediments or multicolored (variegated) and were deposited in lake, swamp, valley channel, and flood plain environments. Much of the sediments are bentonitic clays and fine sands derived from pyroclastic materials of andesitic composition. Probably most of the uranium deposits of the "sandstone type" around the Hills were leached out from the volcanic sediments and deposited by groundwater. The White River Group is considered as the most fossiliferous Tertiary unit in North America containing a large variety of mammalian fossils, such as primitive horse, camel, deer, small dog, pig, sabertooth cat, etc.

OUTCROP SECTION OF THE BLACK HILLS
(GENERALIZED)



Source: School of Mines, So. Dakota

FIGURE 5

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until Pleistocene. The accompanying erosion carved the present relief of the Black Hills and the Bad Lands of South Dakota.

There is no evidence that Pleistocene glaciers or ice caps ever reached the Black Hills. A dry periglacial or tundra-type climate probably existed during the ice maxima, and a humid, rainy one may have existed during the interglacial periods. Periods of glaciation were characterized by valley fill or aggradation by stream gravel and sand and by some wind-blown (dune) deposition. The deglaciation periods were characterized by valley cut and downward erosion which produced river terraces along the major rivers such as the Cheyenne. Many of the river terraces contained placer gold deposits and were thus important mining sites during the early gold rushes.[19]

Mineralization

Many of the Black Hills rock formations dating from Late Precambrian to Late Cretaceous are mineralized to various degrees and at various levels. Except for gold, however, only a few mineral deposits have commercial significance. By 1915, practically all gold and other mineral deposits had been discovered, although not all had been exploited. Most of the discoveries came through the search for gold.

Around 1914, 186 minerals had been identified in the Black Hills.[20] The list increased to well over 200 after World War II. About 75 percent

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[19] A remarkably clear discussion of Black Hills geology, stratigraphy, and erosional history is found in the work of N. H. Darton of the United States Geological Survey and C. C. O'Harra and other scholars of the South Dakota School of Mines in Rapid City.

[20] Victor Ziegler, "The Minerals of the Black Hills," South Dakota School of Mines Bulletin, Vol. 10, (1914), p. 250.

of the minerals are mineralogical curiosities, most of which occur in pegmatites; about 70 or so minerals are common and easy to find, and less than 10 minerals have economic importance. Gold, of course, outranks all others by three to one in value.

Based on general characteristics, modes of origin, and ages of the ore deposits, there were two primary (Precambrian and Tertiary) mineralizations, and two secondary (Cambrian and Pleistocene placers) ore emplacements in the Black Hills. Most significant are the so-called replacement deposits in the Precambrian metamorphics and in the Cambrian Deadwood Formation and Pahasapa Limestone of Mississippian age.[21] The replacement deposits are also called Lode deposits and were formed during Precambrian and Tertiary magmatic activities. The relationships between these two periods of mineralization are not yet clear because of frequent superimposition or overlap. It seems that the Precambrian gold ores are relatively coarse and more concentrated and thus can be recovered economically by amalgamation. The gold-silver ratio is more than 1:1. Tertiary magmatic activities produced relatively fine-grained and more disseminated gold ores which can be recovered by cyanidation. The gold-silver ratio is less than 1:1.[22]

The bulk of the gold which was mined came from the Precambrian Homestake Formation.[23] The average content of gold is less than one ounce

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[21]Replacement deposits refer to the substitution of host-rock materials by solution and deposition, derived from an outside source.

[22]Richard V. Hunkins, "The Black Hills—A Storehouse of Mineral Treasure," The Black Hills, by R. Peattie, ed., (New York: The Vanguard Press, Inc., 1952), p. 266.

[23]Homestake Formation is a thin, up to 80 feet thick originally, carbon-rich, shallow, marine sediment, which metamorphosed to a siderophlesite and cummingtonite schist.

per ton. Only large volume production, abundant reserves, and advanced metallurgy, have made exploiting such a low-grade ore economically profitable. The Tertiary gold ores occur either as small veinlets or fissure fillings in the intrusives (such as monzonite) or as "trapped ore" mostly in sulphides (such as galena and pyrite).

The placer deposits were the first to be discovered and exploited in the Black Hills.[24] Based on the mode of origin and age, the placer deposits are of several types in the Black Hills. There are so-called "fossil placers" at the base of the Upper Cambrian Deadwood Formation. These deposits are highly indurated and of small extent and occur in the conglomerate and coarse sandstone at or near the erosional Precambrian and Cambrian unconformity. Most important were the "recent placers" (Pleistocene) which often were referred to as streambed and bench or terrace deposits. The streambed type was stratigraphically the lowest and the youngest--often called "wet placer." The bench placers were located from 10 to 300 feet high along the sides of the valley as terrace remnants from the Pleistocene. The bench type were called "dry placer" because water had to be brought in to extract the gold.

Physical Geography

The Black Hills rise abruptly from the plains to about 4,000 feet. Their salient features are their encircling hogback ridges, which

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[24] Placers are deposits of secondary origin which are derived from the weathering of the exposed primary or lode deposits. Being "imperishable" and heavy minerals, they were trapped in depressions or around some barriers in the streambed during transportation. In addition to gold "dust and nuggets," other placer minerals in the Black Hills include cassiterite, columbite, zircon, monazite, scheelite, and wolframite.

constitute the outer rim of the Hills.[25] Rivers originate at or close to the center of the Hills and radiate away in all direction. This pattern enhanced the early exploration and invasion of the Hills and greatly influenced the general road network (Fig. 6).

The present outlines of the Hills resulted from differential uplift, erosion, and the resistance of the concentrically exposed rock formations. The relatively steep angles of the outer hogbacks suggest that the uplift forces were comparable to those of the Big Horn Mountains in Wyoming. Had erosion not accompanied the uplifts, the Black Hills would now be more than 12,000 feet high.

The Black Hills region is large enough to be classified as a separate section of the Great Plains physiographic province.[26] The physiographic subdivisions of this province were presented for the first time by N. H. Darton of the United States Geological Survey.[27] Based on the compcsition of the exposed rocks, the geological age, and nature of erosion, five physiographic parts were identified (Fig. 7).

The Central (Core) Area is an elevated plateau composed of granitic and metamorphic rocks rising about 4,000 feet, on the average,

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[25] Hogback ridges were formed by differential erosion of steeply tilted, sedimentary layers by the arching of igneous (or salt) domes. The resistant beds in the flanking layers are eroded into narrow ridges in such a manner that the dip slope and escarpment slope are of similar steepness. The dip slope is typically more than 30^{o}-35^{o}.

[26] Nevin M. Fenneman, Physiography of Western United States (New York: McGraw-Hill Book Co., Ltd., 1931), p. 70.

[27] Nelson H. Darton, "Geology and Water Resources of the Northern Portion of the Black Hills and Adjoining Regions in South Dakota and Wyoming," United States Geological Survey, Professional Paper 65 (Washington, D. C., 1909), pp. 498-501.

DRAINAGE PATTERN OF THE BLACK HILLS

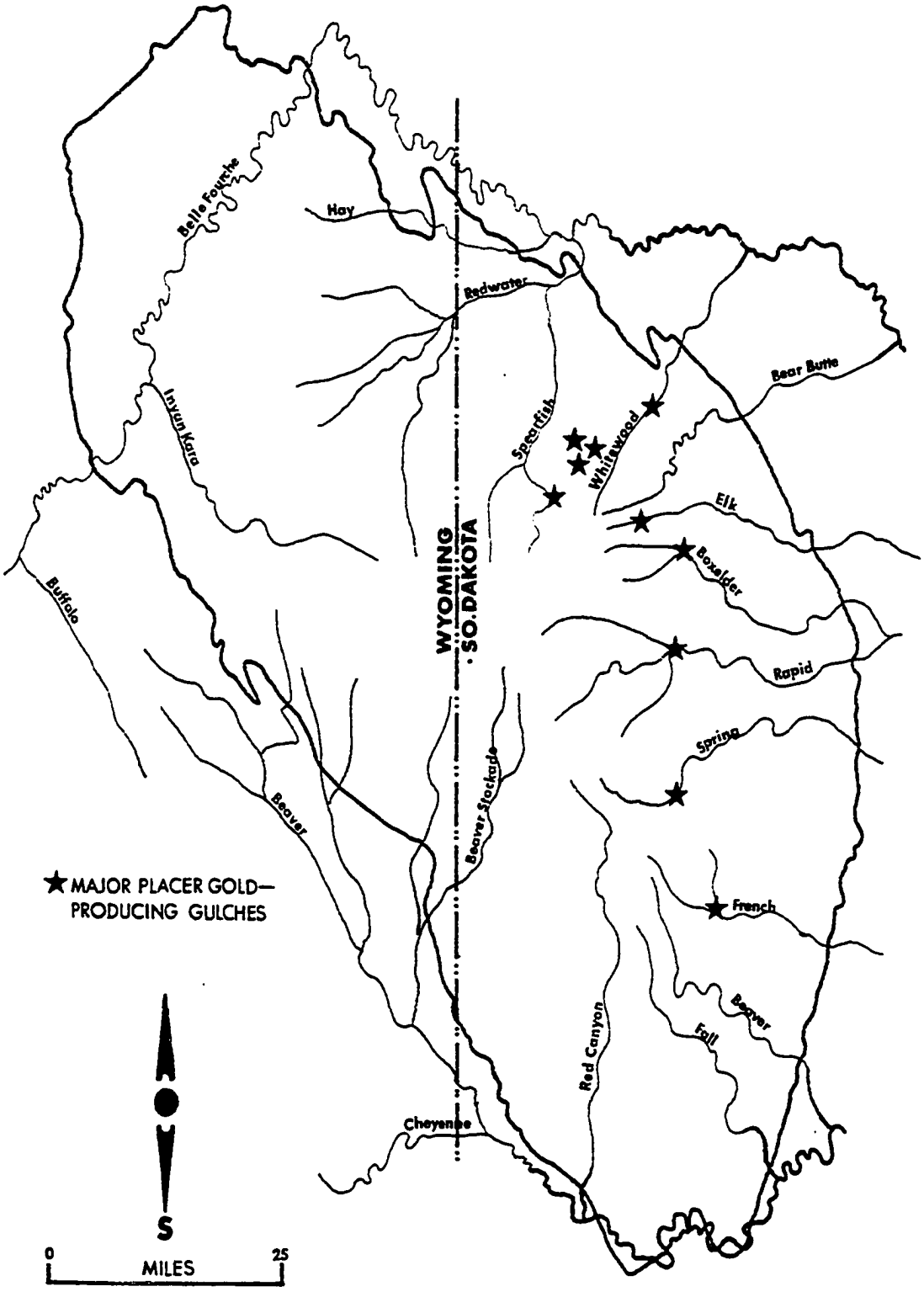

FIGURE 6

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PHYSIOGRAPHY OF THE BLACK HILLS
(GENERALIZED)

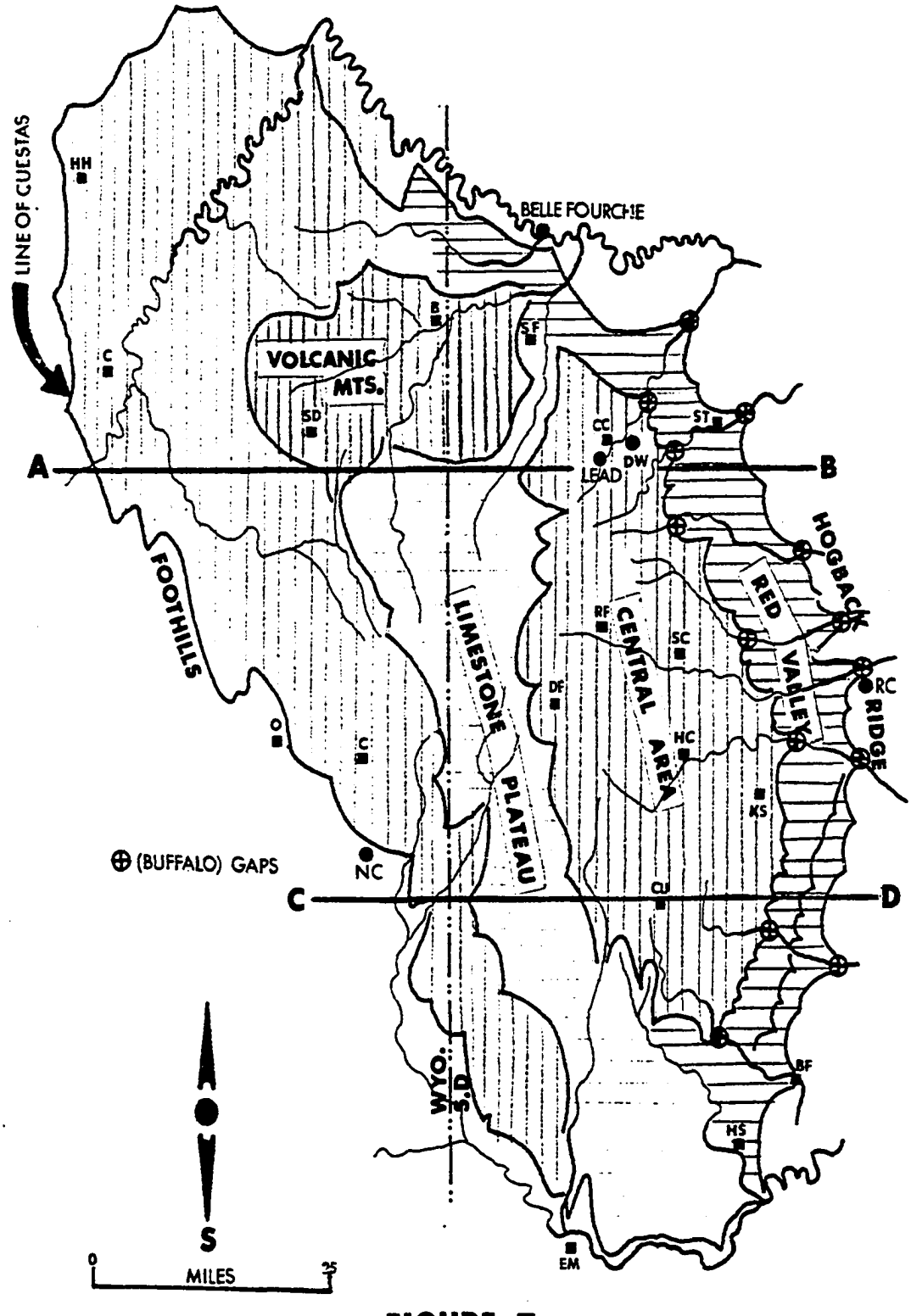

FIGURE 7

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above the norther Great Plains. The topography is rugged; rocky ridges alternate with park-like basins and valleys. A few outstanding summits, such as Harney Peak, rise more than 6,000 feet in altitude.[28] This core area, known also as the Central Basin, contains many steep, knobby, granitic hills referred to as "needles."[29] This part of the Hills was least accessible, but because of its mineral wealth (mainly gold and pegmatites), the earliest mining camps and squatter settlements were established there. The Core Area produced most of the mineral wealth by value of the Black Hills. In the east, the narrow, stream-cut, entrenched valleys widen toward the center above the heads of the canyons. Relatively broad uplands and subdued relief characterize the eastern Central Area.

The Limestone Plateau forms an interior highland rim around the Central Core and has an elevation of 5,000 feet. It is a broad upland, a gently westward-sloping surface composed of nearly flat Paleozoic, carbonaceous rocks of limestone and dolomite. The inner edge presents an abrupt line of cliffs, many miles in length in numerous places, near the center.[30] The eastern part of the Limestone Plateau is only approximately three miles wide, but likewise slopes abruptly toward the Central Area. In places, this inner line of precipitous hogbacks made of erosion-resistant limestone rise 800 feet or more above the valleys. Some crests

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[28]Harney Peak, at 6,242 feet, is the highest point on the Great Plains east of the Rockys.

[29]The exposed granite surface is about 300 square miles, and the metamorphics, about 1,200 square miles.

[30]This ridge is made of gray, laminated bed, called Minnekhata Limestone of Permian age. Below this limestone unit, the thick Minnelusa and Pahasapa formations of carboniferous age are situated. They make up most of the Limestone Plateau.

or summits of this rolling upland almost equal Harney Peak in height and form the main watershed of the Black Hills.

At the base of the outward-sloping Limestone Plateau, an erosion-resistant ridge gives rise to several waterfalls 40 to 50 feet in height. Both the escarpment and the slopes are notched by canyons and form characteristic narrows, called "gates." In the north, the tributaries of Belle Fourche River, such as Spearfish Creek, cut 600 to 800 feet in limestone, as seen in spectacular Spearfish Canyon.

The Red Valley is an erosional valley carved from soft, red shales and sandstone of Triassic age, and is, on the average, two miles wide.[31] Known also as the "Race Track," this valley extends almost continuously around the Hills and is one of the most conspicuous features of the Black Hills. The valley floor is approximately 3,000 feet above the Great Plains and is dissected by several transverse rivers without deflection. The valley is well-developed in the east, north, and south. The inner side of the valley is bounded by the dip slope of the dissected hogback of the Limestone Plateau; the outer side is rimmed by a steep-sided scarp of sandstone hogbacks.

Because the Red Valley is devoid of forest cover, it is easily accessible from most directions. Highways I-90 and U. S. 40 run through the valley. This red-colored valley is the best agricultural and grazing country in the Black Hills. In the north and northeast, the gypsum-capped Look Out Mountain and Red Butte are scenic points of the Red Valley.

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[31]The Spearfish Formation consists of "red beds" interbedded with layers of lenses of gypsum. The formation is about 300 feet in the Southern Hills and up to 700 feet in the Northern Hills.

The Hogback Ridge forms the outer concentric rim and constitutes the conventional topographic boundary of the Black Hills. It is composed of cliff-forming sandstone of the Upper Cretaceous Dakota Formation, and in the east it towers from 300 to 600 feet above the Red Valley. The average elevation of the ridge is about 5,000 feet. For the most part, it is a single-crested ridge of hard sandstone varying in prominence and steepness of slope. This crested ridge, however, is the dominant topographic feature of the Black Hills and is particularly well developed in the east. In the north and south, the ridge spreads out into a sloping plateau and is up to 10 miles wide; elsewhere, it is one to three miles wide and is cut by deep canyons and "gaps" such as Buffalo Gap in the east. Since the Great Plains are a little over 3,000 feet above sea level east of the Hills, and over 4,000 feet above sea level west of the Hills, the Hogback Ridge stands out conspicuously by rising abruptly from 1,000 to 2,000 feet above the surrounding plains.

The Foot Hills form a series of gently rolling, discontinuous, low hills and broad, terraced, river valleys beyond the Hogback Ridge. These smooth rolling hills are made mostly of soft shales of Upper Cretaceous Pierre Formation in the east. To the west they are carved from indurated sandstone of Fox Hills Formation with somewhat more rugged, erosional features. On all sides these hills fade imperceptibly into the Great Plains topography. This grass-covered undulating country is from 60 to 150 feet high and constitutes the transition zone between the Black Hills and the Great Plains proper. A generalized topographic cross-section of the Northern and Southern hills is presented in Figure 8 .

TOPOGRAPHIC CROSS-SECTION

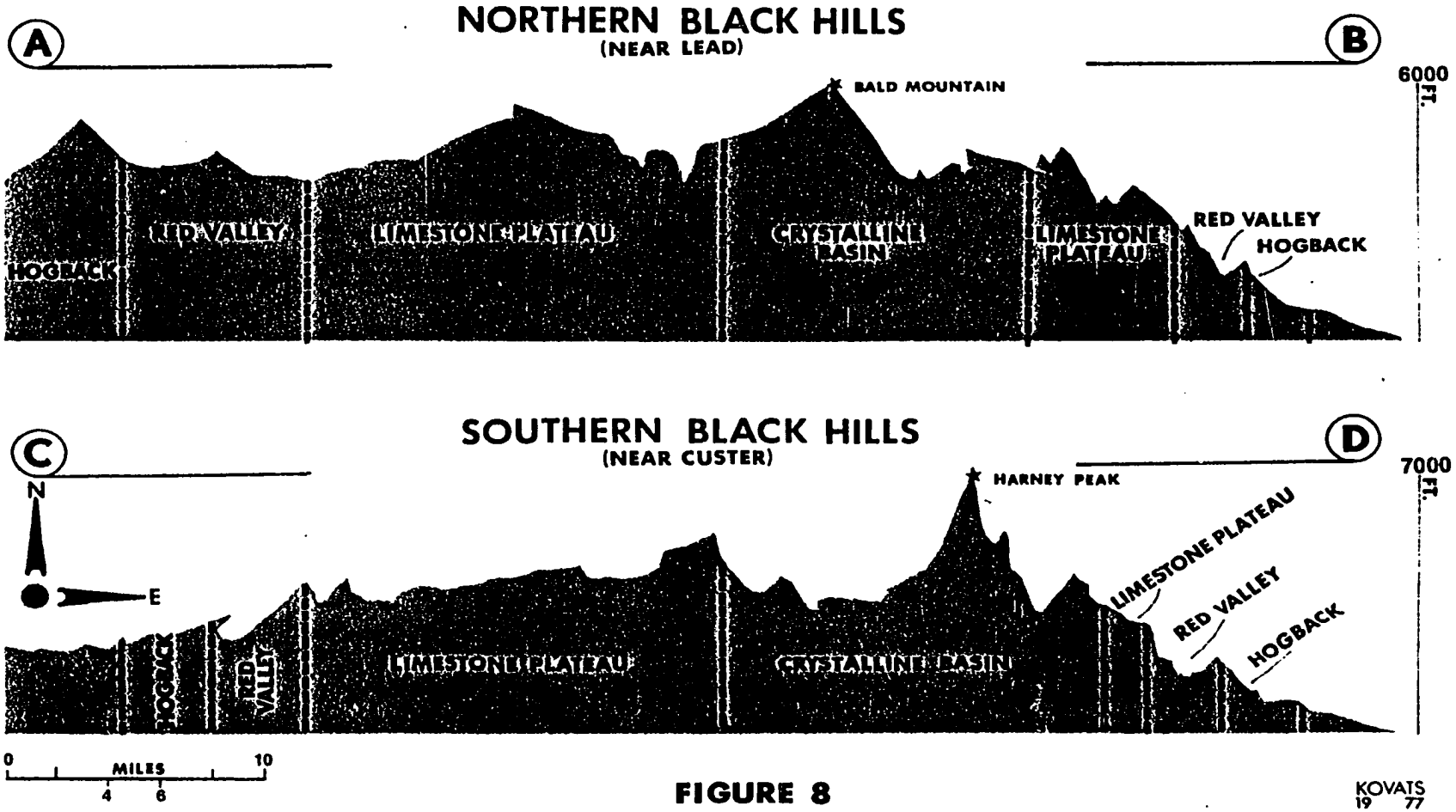

FIGURE 8

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Even though the Volcanic Mountains of the Black Hills do not constitute a discrete subdivision, their unique features, economic importance, and scenic beauty warrant a separate treatment. These "mountains" are an isolated group of small laccolithic hills, peaks, and volcanic "plugs" found mostly in the Northern Hills. These volcanic features are composed of erosion-resistant rocks such as basalt, rhyolite, andesite, and phonolite. No conclusive proof as to their exact origin and age has yet been presented. Many of them appear to be remnants of once-larger, igneous bodies, volcanic necks, sills, or other tabular bodies intruded into the sedimentary sequence and subsequently "exhumed" by erosion. Others are parts of extinct volcanoes, eroded lava flows of the Pleistocene, or early epochs of the Tertiary. These volcanic features are exemplified by Devil's Tower, the Missouri Buttes, Bear Butte, Inyan Kara Mountains, and many others.

Summary

In summary, the Black Hills are located between the Belle Fourche River and the southern fork of the Cheyenne River. The oval-shaped area includes some 60,200 square miles unequally divided by the South Dakota-Wyoming state line. The regional tectonic setting suggests that the Black Hills uplift is an irregular, dome-shaped anticline in which rocks are arched over a broad radius and the sediments dip away in every direction. In the central part exposed granite is surrounded by metamorphic rocks. The rocks become younger in age towards the periphery.

There were two primary (lode ore) and two secondary (placer ore) ore emplacements in the Black Hills. Rich deposits occur when the Precambrian mineralization has been supplemented by Tertiary magmatic activities. The bulk of the gold production was and is still being mined from

the Precambrian Homestake Formation. Both the Precambrian and Paleozoic rocks are mineralized; however, the mineralizing solution occasionally reached also the Cretaceous rocks.

The Black Hills can be subdivided into five physiographic sections. The present topography is the result mainly of Pleistocene and Recent erosion and deposition. Radial drainage patterns enhanced the exploration and invasion of the Black Hills.

CHAPTER III

THE BLACK HILLS BEFORE 1876

In prehistoric times, the Black Hills was a refuge from periodic droughts for bands of nomadic hunters. Pictographs in Craven Canyon in the Southern Hills, occasional teepee rings, lost or discarded flint points, and scattered archeological sites between Hot Springs and Bear Butte testify to the temporary presence of the aborigines.

In historic times, Indians continued to visit the Hills to acquire lodgepoles, beaver pelts, small game, buffalo, and probably to experience religious "vision quests." But, according to Indian legend and folklore, permanent habitation in the Hills was "bad medicine." Shared by several Northern Plains Indians including the Cheyenne, Crow, and Dakota-Sioux, the region was venerated, forbidden, and sacred ground. Tangled thickets, narrow passages, and rough terrain made travel by foot and horse difficult. Stormy weather, frequent floods, snow, hail, and lightening also seem to have precluded permanent habitation. Thunder and the noises of howling and possibly whirling winds in the numerous caves may have frightened early visitors in the Hills, evoking fears and superstitions.

It is not known whether Spaniards reached the Black Hills. No written documentation of such visits has been discovered. Cecil Harris,

a Keystone, South Dakota, geologist told me that in about 1940 a Spanish sword was found stuck into a crevice near Harney Peak, but this may be only an unfounded rumor or hoax. Even if such a sword were found, it could have been left there by fleeing Pueblo Indians during the reconquest of New Mexico rather than during Spanish exploration.

Expeditions

The earliest, somewhat inaccurate accounts of the Black Hills came from travelers such as Jonathan Carver (1766-1768), and fur trappers such as the La Verendrye Group (1742-1743) who were seeking the shortest route from the interior of the continent to the Pacific coast. More important was the government-sponsored Lewis and Clark Expedition (1804) which assessed the resources of the northern parts of the newly-purchased Louisiana Territory. From this expedition a fairly accurate description and a map of the Black Hills region was made.

Between 1804 and the gold rush of 1874-1875, there were no less than 30 expeditions to various parts of the Black Hills. These expeditions differed in nature, composition, and purpose. Many of them were military-strategic in purpose and were directly or indirectly related to rumors of gold. A significant percentage of them were thwarted by the United States Army or were deterred by hostile Indians, and only a few resulted in detailed and accurate descriptions of the Black Hills.

Most of the Black Hills expeditions, whether actually executed or only attempted, were financed and organized from surrounding towns such as Bismark, North Dakota; Sidney, Nebraska; Sioux City, and Yankton, South Dakota; and Cheyenne, Wyoming. They also came from neighboring forts such as Fort Laramie and Fort Randall. Military posts played an important

role in the invasion and control of the Black Hills (Fig. 9). About 56 percent of the expeditions were initiated from eastern South Dakota, 24 percent from Wyoming and Nebraska, and 20 percent from towns and forts along the middle course of the Missouri River (Fig.10).

The majority of expeditions were multi-purpose and, therefore, some of the categories overlap. The principal motive for exploration between 1804 and the 1850s was fur, while gold and military-strategic considerations became the prime motives between the 1850s and the 1870s. Approximately 19 percent of the explorations into the Black Hills were motivated by the fur trade, 31 percent by military goals, and 50 percent by rumors of gold.[1] It is interesting to note that group initiatives were responsible for about 40 percent of the explorations; private or individual enterprises about 38 percent; and government-sponsored expeditions about 25 percent. The list of actual and attempted expeditions is by no means exhaustive; the important ones and the best documented explorations into the Black Hills are included in Table 3.

The approximate entry points and routes through the Black Hills were reconstructed from travel descriptions for La Verendrye' Group, Jedediah Smith, Lt. Governor Kemble Warren, Capt. Raynolds, the Powder

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[1]Based on the writing of Watson Parker on the Black Hills gold rush, I have identified the purpose of the Black Hills explorations as follows: 1) search for a Pacific route; 2) scientific explorations with military escort; 3) military and strategic considerations; 4) business venture with or without military escort; 5) individual enterprise; and 6) missionary activities: Watson Parker, "The Exploration of the Dakota Black Hills," (unpublished M. A. thesis, University of Oklahoma, 1962); "The Black Hills Gold Rush, 1874-1879," (unpublished Ph.D. dissertation, University of Oklahoma, 1965); Gold in the Black Hills, (Norman, Oklahoma: University of Oklahoma Press, 1967).

FORTS AROUND THE BLACK HILLS (1870s)

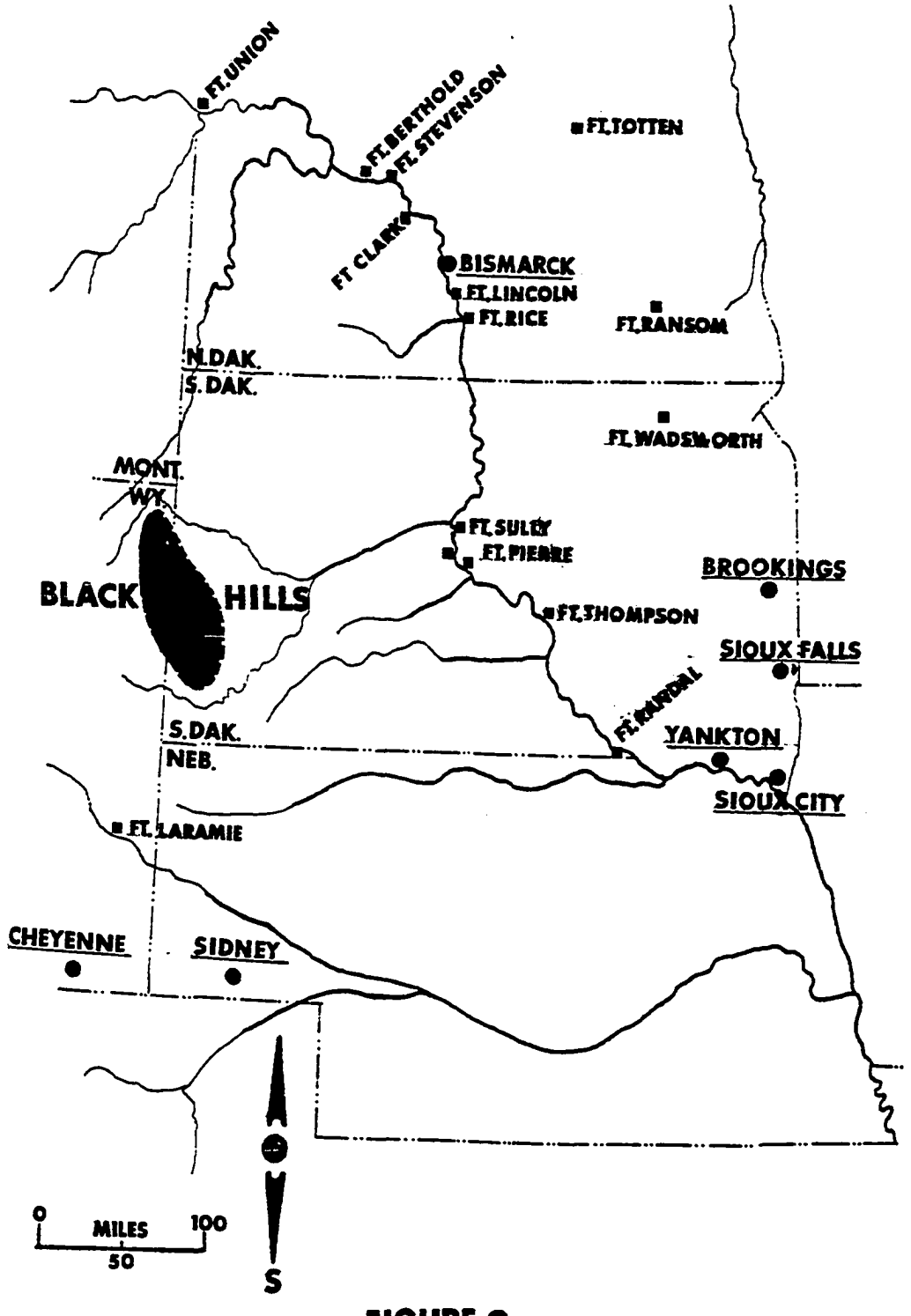

FIGURE 9

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DIRECTION & NUMBER OF BLACK HILLS INVASIONS, 1804-1875
(EXPRESSED IN PERCENTAGE)

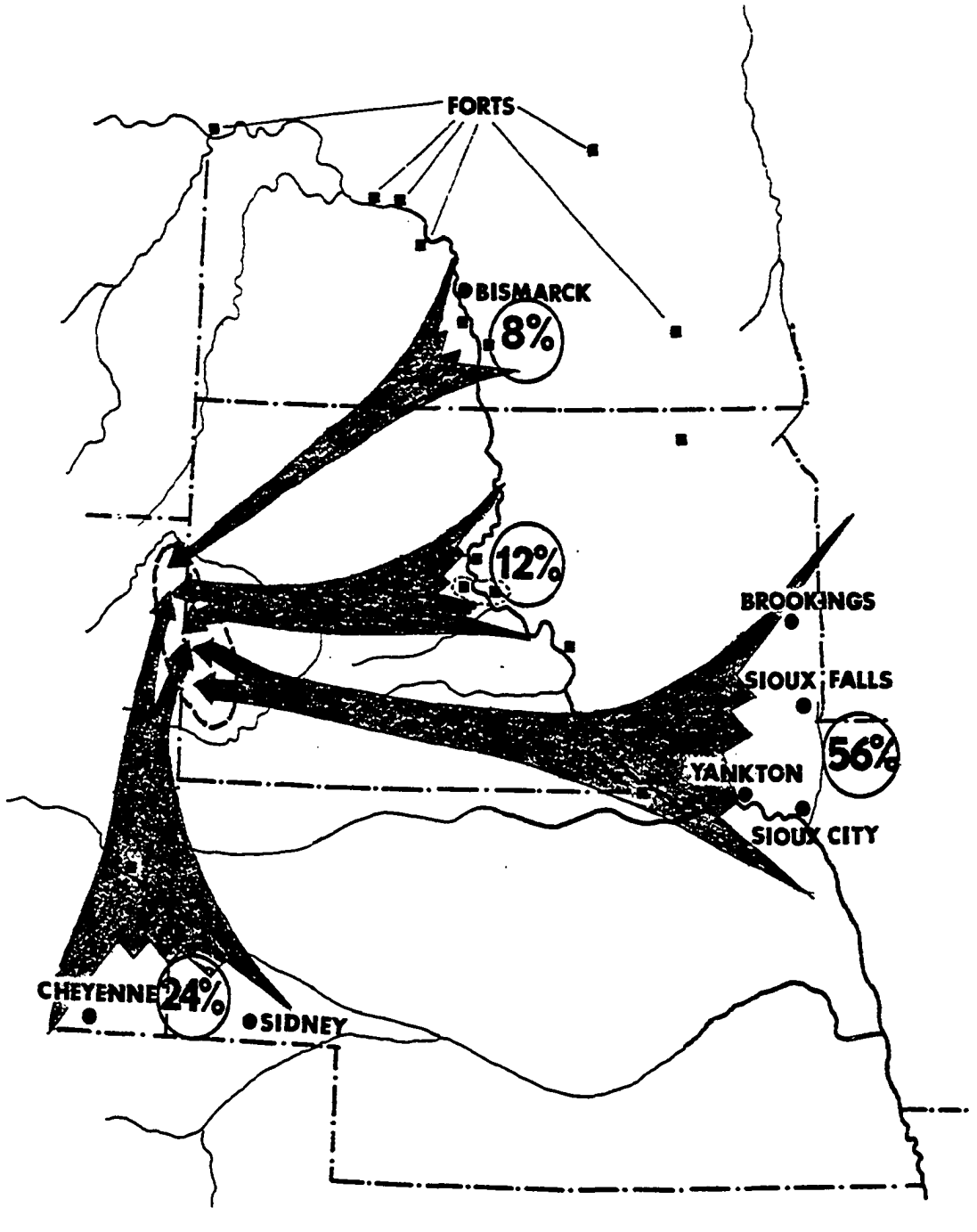

FIGURE 10

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TABLE 3
BLACK HILLS EXPEDITIONS, 1804-1875

EXPLORATION	DATE	ENTERPRISE	PLACE OF ORIGIN	PURPOSE	ENTRY	RESULT
LA VERENDRYE GROUP	1742	FUR COMPANY	THREE RIVERS, CANADA	FUR TRADE	NO. HILLS	VAGUE DESCRIPTION
JONATHAN CARVER	1767	"	?	FUR TRAPPING	E. HILLS	REFERENCE TO "SHINING MTS."
LEWIS & CLARK	1803	U.S. GOV.	ST. LOUIS	RESOURCE ASSES. MILITARY	NO. HILLS	REPORTS, NO REFERENCE TO GOLD
OVERLAND ASTORIANS	1811	FUR	ST LOUIS	PACIFIC ROUTE, FUR	NE. HILLS	TRAVEL DESCRIPTION
JEDEDIAH SMITH	1823	FUR COMPANY	ST LOUIS ?	FUR TRADE	SO. HILLS	REPORT, NO GOLD REP.
THOMAS L. SARPY	1830's	" "	ST LOUIS	FUR	E. HILLS	TRAVEL NOTES NO REFERENCE TO GOLD
AMERICAN FUR CO.	1835	"	"	FUR TRADE	NO. HILLS	NOTES
FATHER DE SMET	1860's	CATHOL. CHURCH	?	MISSIONARY	?	GOLD MENTIONED
DOUGLAS PARTY	1852	PRIVATE	FT. LARAMI	GOLD	NO. HILLS	GOLD "IN PAYING QUANTITY" REPORTED
SAINT GEORGE GORE	1855	"	ENGLAND	SPORT HUNTING	E. HILLS	DIARY, GOLD IMPLIED
WARREN EXPEDITION	1857	U S. GOV.	SIOUX CITY	SCIENTIFIC, MILITARY	W. HILLS	REPORT ON GOLD
W.F. RAYNOLDS	1859	"	FT. PIERRE	" "	NO. HILLS	GOLD MENTIONED
B.H. EXPLORING ASSOC.	1861	GROUP	YANKTON	GOLD	-	-
G.T. LEE	1863	PRIVATE	ST. LOUIS ?	GOLD	SO. HILLS	REF. TO GOLD
POWDER RIVER CAMPAIGN	1865	U.S. GOV.	FT. LARAMI	MILITARY	NO. SO. HILLS	GOLD REPORTED

TABLE 3
(CONTINUED)

EXPLORATION	DATE	ENTERPRISE	PLACE OF ORIGIN	PURPOSE	ENTRY	RESULT
"SURVEY CREW"	1865	GROUP	FT. PIERRE	MILITARY, GOLD	-	
F.V. HAYDEN	1866	PRIVATE	YANKTON	SCIENTIFIC	NO. HILLS	GOLD REPORTED
CAPT. P.B. DAVY	1868	"	"	GOLD	-	-
B.H. & BIGHORN ASSOC.	1869	GROUP	CHEYENNE	"	-	-
FENIAN MOVEMENT	1869	"	SIOUX CITY	"	-	-
B.H. MINING ASSOC.	1872	"	"	"	-	-
CUSTER EXPEDITION	1874	U.S. GOV.	FT. LINCOLN	MILITARY	NO. HILLS	GOLD DISCOVERED
O'NEILLS COLONY	1875	GROUP	SIDNEY	COLONISATION	-	-
"CHARLIE" REYNOLDS	1875	PRIVATE	FT. LARAMIE	GOLD	SO. HILLS	?
JENNEY & NEWTON	1875	U.S. GOV.	NEW YORK	"	"	GOLD REPORTED
GORDON-WITCHER EXP.	1875	PRIVATE	CHICAGO	"	"	GOLD PANNED
REV. S. HINMAN	1875	U.S. GOV.	SPOTTED TAIL	TRANSP.	NO. HILLS	GOLD ?

SOURCE: SEE FOOTNOTES IN TEXT

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River Campaign, and General Custer. Most expeditions after 1874 closely followed Custer's route (Figs. 11, 12, 13, and 14).

Gold

Although the presence of gold in the Black Hills was noted in the early 1850s by Father De Smet and by the Douglas Party, serious explorations for gold did not begin until the mid-1860s. Even though Warren's report confirmed gold "in payable quantities," it was the Custer Expedition that is credited with the first official discovery of gold.[2] Custer dispatched several reports to higher authorities in 1874, but nowhere did he state there was gold in quantity. An excerpt of General Custer's Report to the War Department, taken from Annie D. Tallent's The Black Hills, illustrates the rather vague nature of the report on gold:

> It will be understood that within the limits of the Black Hills we were almost constantly marching, never halting at any one point for a longer time than one day—except one. . . . From this it will be seen that no satisfactory or conslusive examination of the country could be made regarding its mineral deposits; enough, however, was determined to establish the fact that gold is distributed throughout an extensive area within the Black Hills. No discoveries, as far as I am aware, were made of gold deposits in quartz, although there is every reason to believe that a more thorough and extended search would have discovered it. Seeking for gold was not one of the objects of the expedition ; consequently, we were but ill-prepared to institute or successfully prosecute a search for it, even after we became aware of its existence in the country.[3]

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[2]"Gold in South Dakota," Wi-Iyohi, Vol. 21 (March, 1968), p. 4.

[3]Annie D. Tallent, The Black Hills, or the Last Hunting Ground of the Dakotahs (St. Louis, Missouri: Nixon-Jones Printing Co., 1899), p. 11.

EXPLORATION IN THE BLACK HILLS

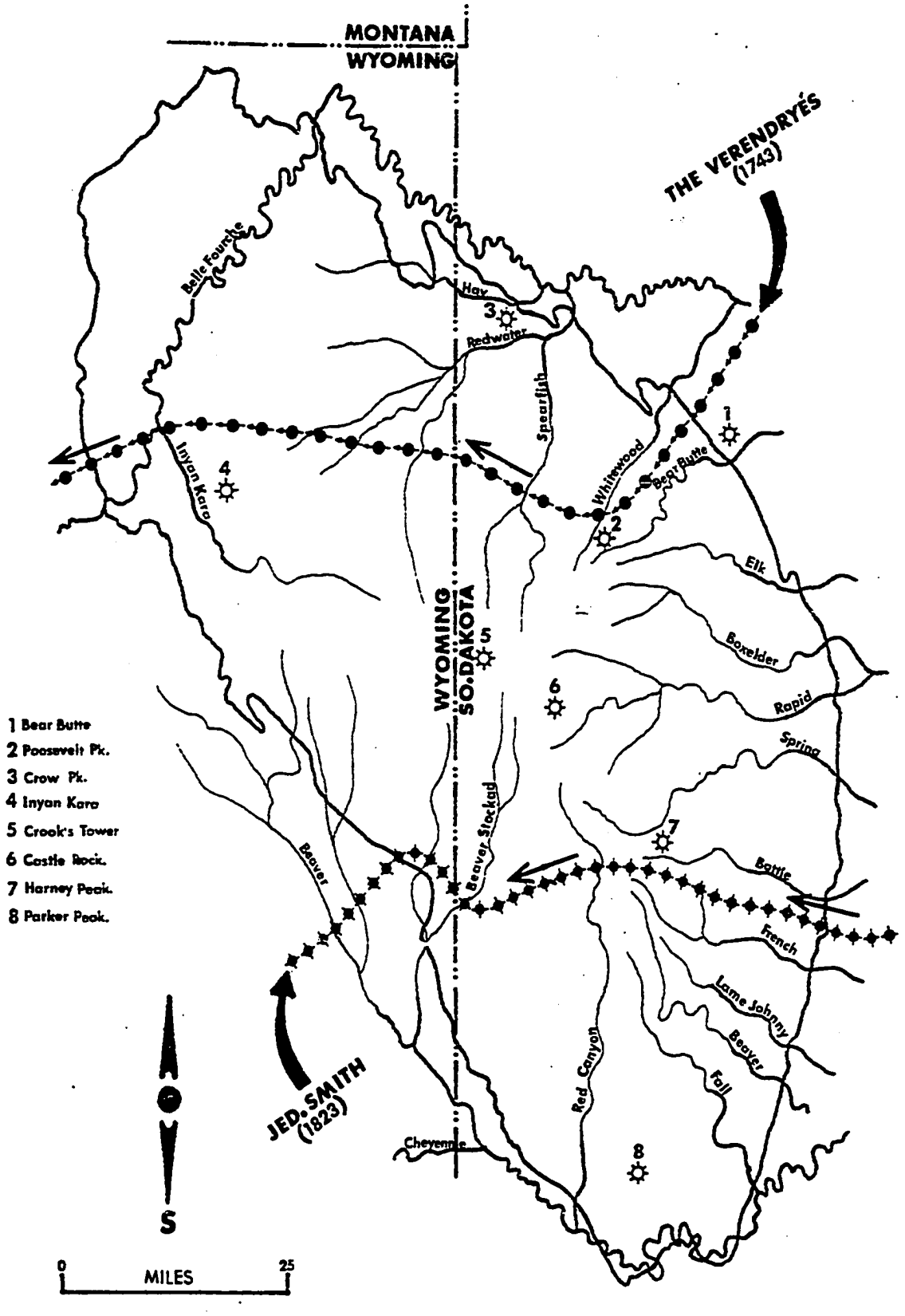

FIGURE 11

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EXPLORATION IN THE BLACK HILLS

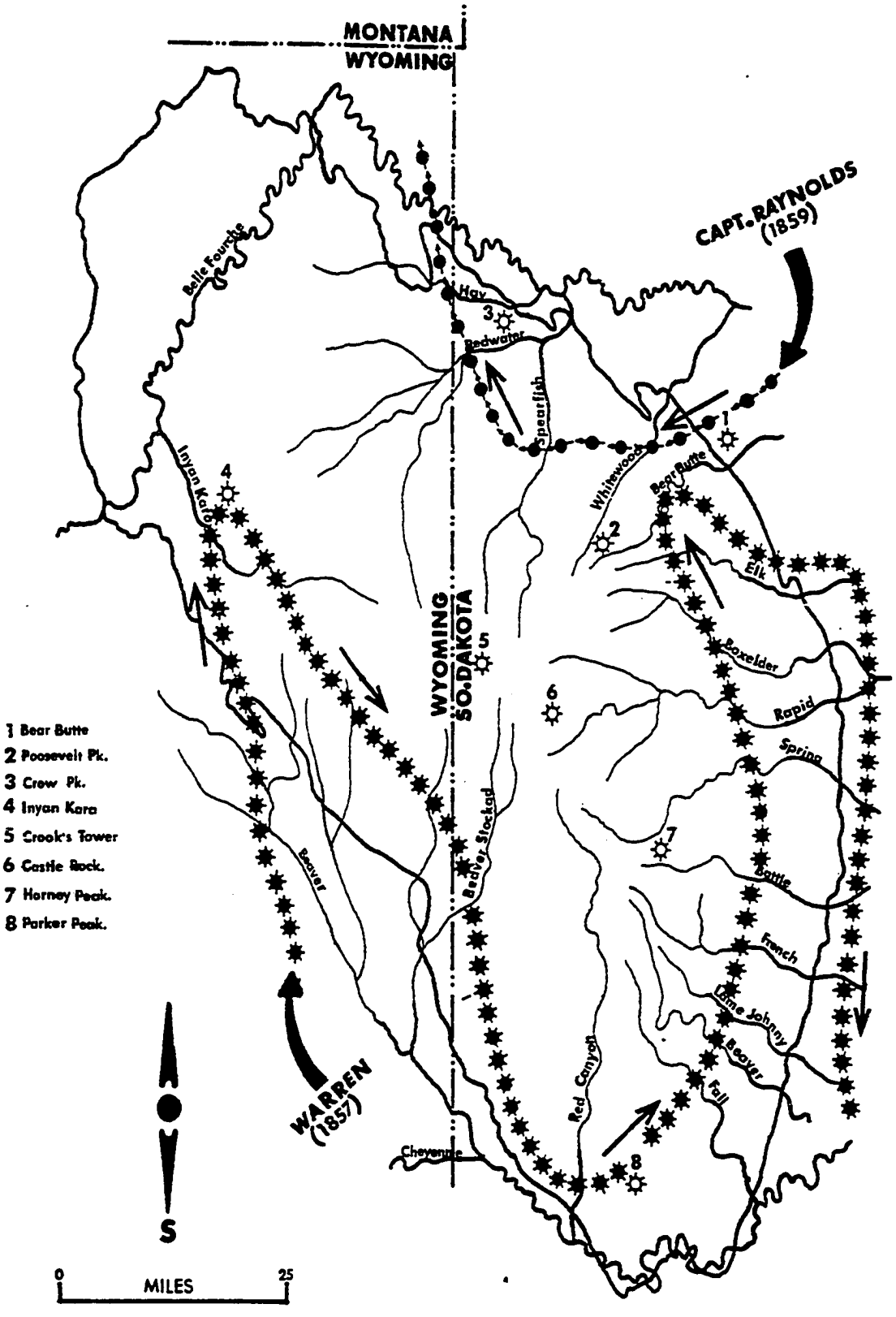

FIGURE 12

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EXPLORATION IN THE BLACK HILLS

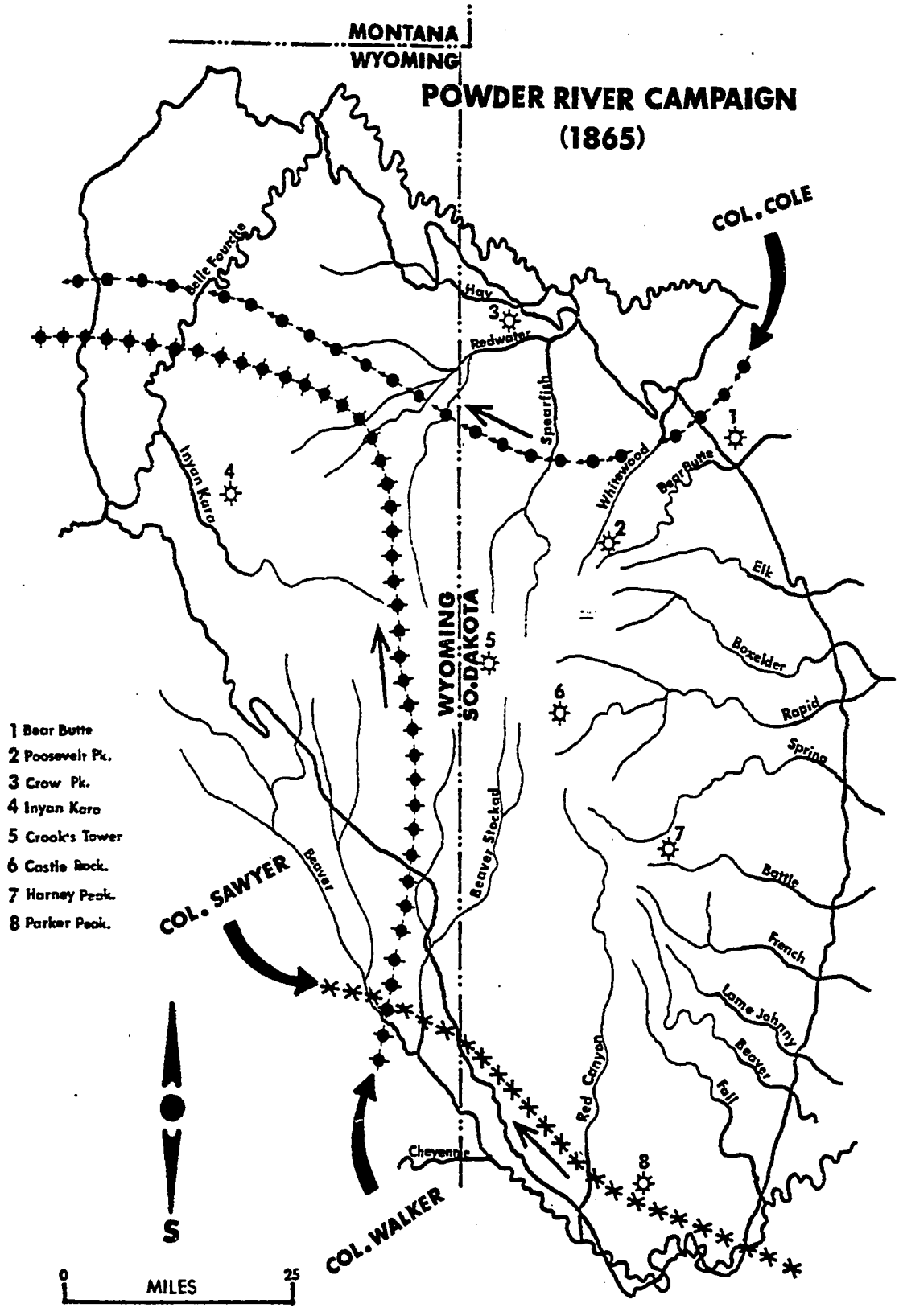

FIGURE 13

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EXPLORATION IN THE BLACK HILLS

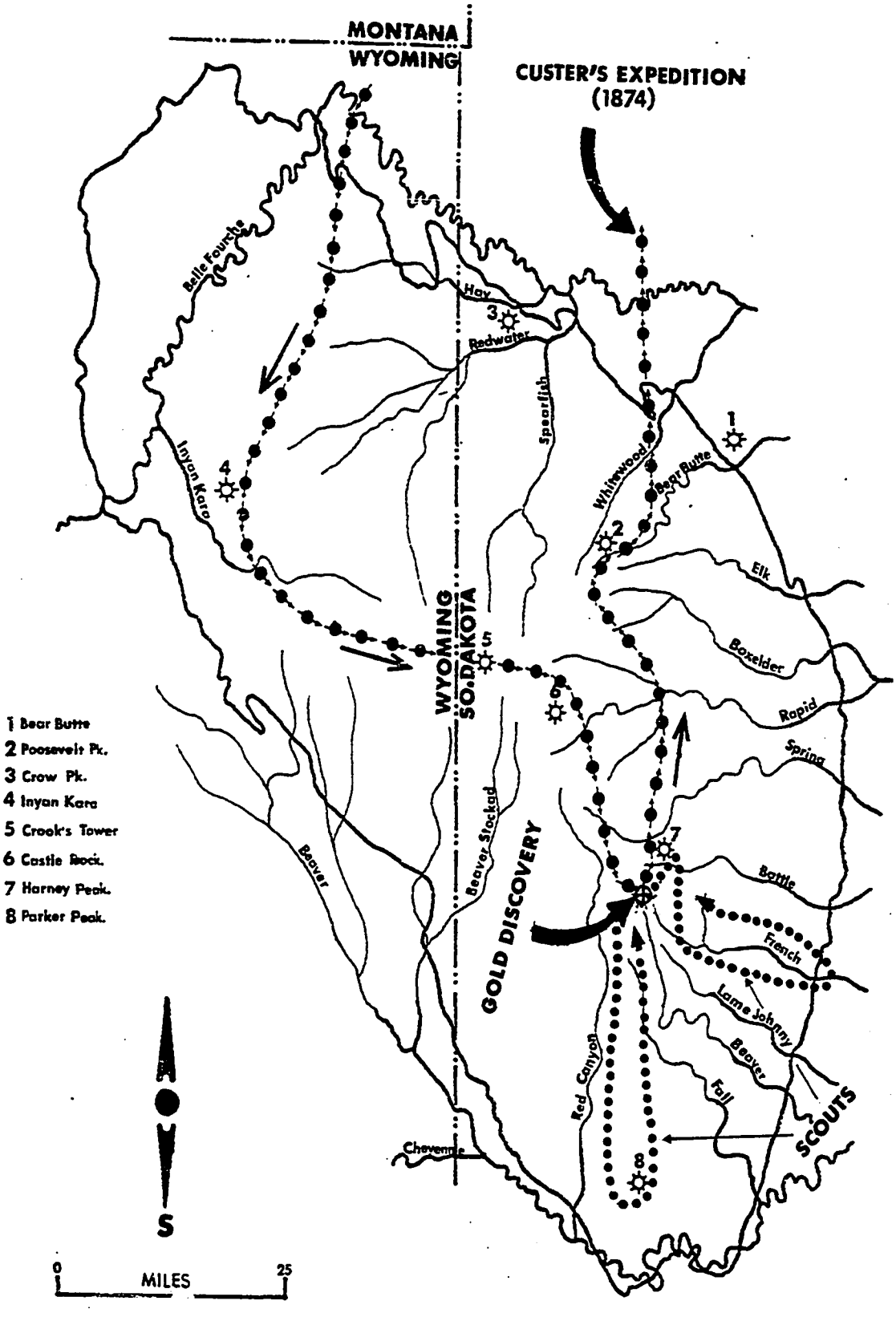

FIGURE 14

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Official records do not even reveal who discovered the gold or where it was first found, although credit is usually given to Horatio Nelson Ross, a miner attached to the expedition, who apparently discovered gold in December 1874 along French Creek near the present city of Custer.[4]

The Black Hills gold rush was among the last gold rushes in North America. The reasons for the relatively late interest in gold in the Black Hills may be summarized as follows: the sparcity of population in adjacent areas and isolation from the main routes of travel to the West such as along the Platte and Missouri rivers; the implacable hostilities and resistance of the Dakota Sioux toward the invaders or settlers; the relatively greater attention paid to other western gold regions--for example, Montana, Colorado, and California; and the bad publicity or unfavorable reports about gold and environmental conditions.

No single reason can wholly explain the exploration undertaken in the Black Hills, and likewise there was no one cause for the gold rush of 1874-1875, but the last half of the nineteenth century did see a number of economic, social, and political problems which may have contributed to the time being right for a rush. Those conditions and events promoting the Black Hills gold rush were as follows: An agricultural depression and associated low crop prices affected the economy of the midwestern states and territories in the 1870s--perhaps mining did not appear as hazardous as farming. The grasshopper plagues between 1873 and 1876 struck the plains and prairie provinces

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[4]Cleophas C. O'Harra, "The Discovery of Gold in the Black Hills," The Black Hills Engineer, Vol. 17, No. 4 (November, 1929), p. 287.

of Kansas, Iowa, Minnesota, and the eastern Dakotas. As a result of these calamities, many homesteads were abandoned for more alluring possibilities, such as gold mining. In the 1870s railroad companies faced serious financial crises and bankruptcies which resulted in extensive labor lay-offs and sales of land. A yellow fever epidemic in the lower Mississippi Valley contributed to the westward movement. And the decline or exhaustion of many western gold fields in Colorado, Montana, and Nevada also forced miners to look for opportunities elsewhere.

Newspapers, such as The Cheyenne Daily Reader and the Sioux City Times featured stories, editorials, and advertisements weighing in favor of the opening of the Hills.[5] The activities of promoters and speculators prepared the way for an invasion, while the failures, hardships in gold mining, and danger from the Indians were played down, and even when published were often ignored by those hungry for gold and adventure. The nostalgic circulation of tall tales and stories about the "good ol' days" in various mining camps inspired former miners, farmers, gamblers, businessmen, and adventure-seekers to dream of lucky strikes, wealth, and fame. Even those old timers who were suffering from hardening of the arteries, cirrhosis of the liver, and tar-clogged lungs were willing to give it one more try.

Editorials, such as one which appeared in the Faribault Republican on March 20, 1875, arroused much excitement, for they openly invited an invasion of the Hills.

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[5] Faribault Republican, March 28, 1975, Transcript of Letters, Notes, and Documents in North Historical Quarterly, Vol. 6 (Bismark, July, 1932), State Historical Society of North Dakota.

> Gold reported and found in quantities as never before seen, from the bedrock, and only 200 miles from the railroad terminus, (Bismark) as reported by Prof. Hayden, Lt. Warren, Captain Raynold, Major Bennet, and Generals Custer and Forsythe at different times, and their reports are now fully confirmed by the return of the Gordon and Witcher with plenty of "dust."

Indians

Gold was not the only Black Hills resource to be promoted. Custer and others wrote of the scenic beauty, timber, and wildlife. Unfortunately, however, the notion that Indians owned the Hills seemed to be ignored or was at best disputed by many politicians and members of the general public who considered the Black Hills to be a valuable natural resource wasted under Indian control. The public tended to blame the federal government for its lack of decisive action and its refusal to open the country to white settlement.

Political decisions concerning Indians seemed only to encourage a new gold rush. After the Civil War, President Grant adopted an Indian policy that advocated kindness and justice for reservation Indians, but threatened military force against those who rejected life on reservations. In 1869, the Board of Indian Commissioners recommended detribalization of the Plains Indians, abolishment of the treaty system, and abandonment of annuities. Such policies, even though they had not been implemented, became a threat to the Indians, and precipitated increased hostilities and raiding on the part of the Dakota Indians. Hostilities invited increased military interventions, to the delight of both settlers and miners.

In 1873, the territorial legislature of Dakota sent two memmorials to Congress which asked for a scientific expedition of the territory as a whole, but particularly the Black Hills and Badlands. Permission to settle the area was requested in order to prevent the use of the Black Hills as a sanctuary by the raiding Sioux. The idea behind such petitions was that once the settlers arrived, the U. S. Army would be obliged to protect them.[6]

The Treaty of Laramie made the Black Hills an inviolable part of the Big Sioux Reservation. The presence of gold, however, prevented any effective implementation of the treaty. Although the U. S. Army repelled many unlawful reservation invasion attempts, pressure by the settlers, miners, and business groups forced drastic changes in government policies, and so the Treaty of Laramie soon became nothing more than a piece of paper.

The miners and settlers respected neither the Indians nor the treaties. Hence, federal policies were undermined and the preventative measures of the Army were ignored or challenged. Ultimately, the conflict of interest between the land-hungry settlers, gold-seeking miners, profiterring corporate business interests on the one hand and the aims of the territorial governments and the Dakota-Sioux on the other hand were resolved by giving into the demands of the whites.

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[6]Watson Parker, "The Exploration of the Dakota Black Hills," p. 44.

Opening the Hills

There were several treaties with the Dakota Indians affecting the Black Hills; particularly, the Treaty of April 29, 1868, at Fort Laramie, which established the great Sioux Reservation, stands out. All lands west of the Missouri River and south of the Cannonball River, thus, including the Black Hills became reservation land. The discovery of gold in 1874, however, challenged the Indian ownership of the Black Hills.

From 1876 on, several agreements and congressional acts were made with the reservation Sioux. Perhaps, one of the most important being the Agreement of 1876. A commission was sent to the Sioux Nation after the Battle of the Little Bighorn to avoid further hostilities through an agreement by which the Sioux relinquished the lands between the forks of the Cheyenne River and west of the 103rd Meridian, which included the Black Hills. This agreement was the result of the expressed United States governmental concern about its inability to stop the tide of gold-inflamed miners into the Black Hills following the discovery of the precious metal by the Custer Expedition.

It is estimated that 11,000 miners and settlers entered the Hills during the winter of 1875-76.[7] At the time of Custer's Last Stand on June 25, 1876, there were 20,000 people in the Hills. This battle, although a victory for the Indians, served to silence the Indian sympathizers and rally public support for removing the Black Hills from Indian hands. After the Agreement of 1876, there were no concerted

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[7] Muriel S. Wolle, The Bonanza Trail: Ghost Towns and Mining Camps of the West, (Bloomington, Indiana: Indiana University Press, 1953), p. 440.

attacks on military posts or settlers. Approximately 70 percent of Black Hills'towns and camps were founded before the legal cession of the Hills.

Before 1870 there was little, if any, organized effort to encourage migration into Dakota Territory. The Black Hills at this time was not only off-limits to white settlement; it was not considered particularly attractive. In 1860, the South Dakota portion of Dakota Territory had an estimated white population of only 3,063, of which 1,774 were foreign-born.[8]

The Homestead Act and the construction of a railroad from the east in the direction of the Black Hills between 1873 and 1885 encouraged immigration, but the discovery of gold gave the largest impetus, especially between 1876 and 1879. Not only the mining industry, but supporting industries such as timber, quarrying, and water works came to exist in this period. Agricultural and grazing industries benefited also from the large influx of mining population. A fair guess would be that from 1874 to 1880, more than 30,000 persons migrated to the Black Hills. Booming conditions generated by the mining industry were manifested elsewhere in South Dakota. Around the mid-1880s about 7,000 newcomers per month arrived, and during the fiscal year of June 1886-June 1887, 20,067,281 acres of public domain were filed on or disposed of under the Homestead Act and Pre-emption Law.[9]

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[8] J. Leonard Jennewein and Jane Boorman, p. 95.

[9] P. F. McClure, Commissioner of Immigration, "Resources of Dakota," The Vacant Public Lands, Territory of Dakota, (Yankton: Department of Immigration and Statistics, 1887), p. 9.

Except for the Alaskan gold rush of 1896-1898, the Black Hills gold discovery was the last gold rush of large magnitude in the United States, and so represents the last gold mining frontier in a classical sense. The personalities and events which were involved in the opening of the Black Hills were to be immortalized by both the professional historian and the composer of popular fiction and folklore. Thus, lawmen, outlaws, gamblers, prostitutes, and prospectors became the heroes, heroines, and villains of pulp fiction writers, and the names of Wild Bill Hickock, Jack McCall, Poker Alice, Calamity Jane, and Potatoe Creek Johnny were immortalized. The Sioux, symbolized by such leaders as Crazy Horse, Red Cloud, and Sitting Bull, were to be romanticized and portrayed as the most war-like of the Plains Indians. The defeat of Custer and his Seventh Calvary had been portaryed, interpreted, and analyzed in more novels, books, articles, and films than perhaps any other Indian-White battle. In short, the opening of the Black Hills contributed many exciting chapters to frontier history.

Summary

In prehistoric and historic times the Black Hills were occupied periodically by Indians. Since the region was heavily forested, was isolated from the main routes of travel, and was guarded by hostile Indians, few whites went there before 1860. As the rumors of gold became widespread, interest in the Black Hills increased. Gold was officially discovered in 1874, and already some 30 expeditions into the Hills had taken place. The economic condition of the nation and the slackening

of the mining industry in the West set the stage for a new gold rush. Business interests, the railroad, and the news media were main agents behind opening the Hills to whites. Federal and territorial governments, after some hesitation, yielded to the pressures and persuaded the Sioux to relinquish title to their Black Hills.

CHAPTER IV

GOLD MINING BEGINNINGS 1876-1890

Between 1876, when the "rush" actually began, and approximately 1890, gold mining in the Black Hills got underway. The period was characterized by the exploitation of gold largely by hand. By 1889, county and state boundaries had been determined, and about 1890 placer mining had run its course and lode mining was well underway.

Population Composition and Employment

The early local, agricultural settlers and placer miners at the time of the initial gold rush were mainly American-born Yankees from New England, or Southerners known as Old American Stock.[1] Anglo-Americans continued to arrive in large numbers to the Dakotas and Black Hills, especially between 1879 and 1886, but then foreign-born in-migration also became increasingly important. In that part of Dakota Territory from which South Dakota was created, however, 72 percent of the population was American-born in 1885.[2]

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[1] J. Leonard Jennewein and Jane Boorman, Dakota Panorama (Aberdeen, South Dakota, 1961), p. 96.

[2] Stephen V. Visher, The Geography of South Dakota, South Dakota Geological Survey Bulletin, No. 8 (Vermillion: 1918), p. 12.

At the time of statehood for the Dakotas in 1889, a drought cycle began in the Northern Plains. It lasted three years and prompted an Anglo exodus. The vacated lands were taken over by foreign-born immigrants, and for about two decades the foreign-born were responsible for the continued increase of the state's population. The arrival of these migrants, who came mostly from northern Europe and eastern Canada changed the composition of the population, and the majority of them stayed on in South Dakota because they lacked familiarity with the rest of the country and the financial means and connections to migrate elsewhere. The economic conditions where they came from were often worse or at best comparable with those in South Dakota, and many of the new immigrants were only laborers or unskilled workers.

The principal countries of birth of the foreign-born in South Dakota from 1890 to 1930 are given in Table 4. Table 5 shows the total population by county in the Black Hills from 1880 to 1935, and Table 6 illustrates the total number of foreigners by county in the Black Hills during the same period.

While most of the unskilled labor in the gold mining industry was drawn from South Dakota, neighboring plains states, or from various European countries, the skilled labor was recruited primarily from other mining states such as Montana, Colorado, California, and Nevada.[3] For example, the Manuel Brothers who discovered the Homestake Mine came from Montana. The exhaustion of placers and mines and the disastrous fire which destroyed Virginia City, Nevada, left a host of miners without

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[3]John Rowe, The Hard-Rock Man: Cornish Immigrants and the North American Mining Frontier (New York: Harper and Row, 1974), p. 251.

COUNTRIES OF BIRTH OF THE FOREIGN-BORN IN SOUTH DAKOTA, (1890-1930)

	1930	1920	1910	1900	1890
NORWAY	13 061	16 813	20 918	19 788	19 275
GERMANY	12 739	15 674	21 544	18 172	18 188
RUSSIA	9 023	11 193	13 189	12 492	12 398
SWEDEN	6 540	8 573	9 998	8 647	7 746
DENMARK	5 298	5 983	6 294	5 038	4 369
NETHERLANDS	3 068	3 216	2 656	1 566	1 428
CANADA	2 922	3 945	5 012	5 906	8 432
CZECHOSLOVAKIA	2 589	2 819	–	–	–
ENGLAND	2 159	2 943	4 024	3 962	5 113
IRISH FREE STATE	862	–	–	–	–
FINLAND	825	1 085	1 381	1 175	–
POLAND	717	792	–	–	–
AUSTRIA	678	1 151	5 372	3 263	3 163
SWITZERLAND	618	761	800	585	571
SCOTLAND	612	832	1 102	1 153	1 579
FRENCH-CANADA	492	508	998	1 138	1 061
IRELAND	–	1 954	2 980	3 298	4 774
NORTHERN IRELAND	351	–	–	–	–
OTHERS	3 507	4 290	4 522	2 425	2 976
TOTAL	66 061	82 534	100 790	88 508	91 055

SOURCE: J.L. JENNEWEIN, "DAKOTA PANORAMA", 1961

TABLE 4

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BLACK HILLS POPULATION BY COUNTIES
(1880–1935)

	1880	1885	1890	1895	1900	1905	1910	1915	1920	1925	1930	1935
LAWRENCE	13 248	10 326	11 673	14 345	17 897	21 060	19 694	17 710	13 029	14 665	13 920	18 979
PENNINGTON	2 244	3 224	6 540	5 163	5 610	6 078	12 453	10 040	12 720	14 624	20 079	21 467
CUSTER	995	1 292	4 891	3 326	2 728	2 699	4 458	3 452	3 907	4 354	5 353	5 268
BUTTE	—	1 081	1 037	1 575	2 907	3 975	4 993	5 894	6 819	6 438	8 589	8 703
MEADE	—	—	4 640	3 553	4 907	5 405	12 640	8 724	9 367	9 486	11 482	10 941
FALL RIVER	—	472	4 478	4 168	3 541	4 222	7 783	6 027	6 985	6 903	8 741	8 120

SOURCE: THIRD & FIFTH CENSUS OF THE STATE OF SOUTH DAKOTA, 1915,1935.

TABLE 5

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NUMBER OF FOREIGNERS BY COUNTIES IN THE BLACK HILLS, SO. DAKOTA (1880-1935)

	1880	1885	1890	1895	1900	1905	1910	1915	1920	1925	1930	1935
BUTTE	–	262	273	365	561	674	768	897	939	834	846	810
CUSTER	230	285	836	301	312	313	448	274	333	266	269	189
FALL RIVER	–	50	701	494	485	556	849	690	616	432	531	343
LAWRENCE	3953	3047	4168	4348	4853	5625	4773	4151	2564	2302	1783	1541
MEADE	–	–	1112	603	818	793	1722	1088	964	783	764	584
PENNINGTON	569	574	1183	477	783	921	1638	1213	1136	1078	1208	955
TOTAL	4752	4218	6273	6588	7812	8862	9658	7313	6532	5695	5401	4442

SOURCE: THIRD & FIFTH CENSUS OF THE STATE OF SOUTH DAKOTA, 1915, 1935

TABLE 6

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employment in Nevada. Troubles in the Pennsylvania coal fields also released expert miners to migrate to the Hills.

The professional people, administrators, and financiers or "capitalists" who came to the Hills were mainly from Boston, New York, Denver, and San Francisco. Eventually, more than two-thirds of the mining companies were financed by east coast, west coast, and Midwest capitalists. It was a California capitalist, George Hearst, grandfather of the present newspaper magnate, who bought the Homestake Mine in 1877. Even British money was invested in the Black Hills, especially in tin mining.

The administrative and business end of the Black Hills gold mining was in the hands of native-born Anglo-Americans from urban America, whereas mining and production were performed by expert miners from other western mining towns and by recent immigrants of several nationalities. There seemed to be a strong tendency for most foreign-born peoples to follow occupational lines. Paradoxically, it appears that when the opportunities arose frequent changes from farming to mining or from mining to stock growing occurred. It seems there was a tendency for the foreign-born elements, once uprooted from Europe, to migrate within a region and change occupations frequently, whereas the American-born population was more likely to participate in long-distance migration and to remain within the same occupation. Data from the 1870s and 1880s are insufficient to reach any definite conclusions, and later intermarriages and the consequent amalgamation of ethnic stock precludes any definitive generalizations.

The mining industry attracted practically all nationalities, yet some groups were more representative than others. Between 1876 and 1877, during the placer phase of the industry, the German, Finnish, and Irish

participated in large numbers, whereas with the commencement of lode mining, the Cornish and southern slavs from the Austro-Hungarian Empire also were highly represented. For example, there were 16 Kovachevich families and 14 Koprivica's listed in the city directory of Lead, South Dakota, in 1908; all were miners living almost under one roof.[4]

Sex ratios in the mining camps and towns of the Black Hills were unbalanced. For example, in Lawrence County the ratio of males to females in 1880 was five to one.[5] With the passing of the mining frontier and the maturation of the mining industry, the ratio became more balanced, but even today males invariably outnumber females. These unbalanced sex ratios are related to the opportunistic and often seasonal nature of the gold mining industry in addition to the fact mining had been a male occupation.

In the 1870s and 1880s the Black Hills had a very young population. The median age in 1875 in Deadwood was 30, and 78 percent of the population was between 21 and 40 years of age. Only two percent was over 50.[6]

Comparing the farming and mining population, especially in terms of nationalities, it appears the agricultural communities, both in the Black Hills and the rest of South Dakota, showed not only a higher degree of stability, but also more concentration or segregation into compact, close-knit communities, excluding other nonrelated nationalities in their mining communities. The Scandinavian, German-Russian, Mennonite, and

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[4]Thomas A. MacDougal, Belt Cities Directory, 1908 Vol. 1 (Lead, South Dakota: Golden Belt Directory Co., 1908), p. 39.

[5]Watson Parker, "The Black Hills Gold Rush, 1874-1879," p. 204.

[6]Ibid.

Hutterite agricultural settlements in eastern South Dakota illustrate this point. In the mining communities of the Black Hills the segregation was less pronounced despite the fact that Lead, for example, had Finn, Cornish, and other sections. Also, between 1876 and 1930, a large numerical representation of some nationalities did not always mean a marked concentration. Finns were a good example. They were numerically small but showed a high degree of concentration, whereas the Germans, who constituted a significant portion of the mining population, were not.[7] Numerical strength, with or without a marked concentration, had a large influence upon the social and cultural life of the community, however.

Placer Mining

Placer, or stream bed, mining was the first type used in the Black Hills, and it prevailed prior to 1890. The mining took several forms. These early methods were rather crude, but they did produce an estimated $1 million in gold in 1876 alone.[8]

A large, flat-bottomed pan that was two inches deep and had sides that sloped from a rim 18 inches in diameter to a bottom 15 inches in diameter was used. The bottom of the pan was usually coated with mercury to aid in holding the gold in. A man would scoop mud and gravel from the stream bottom into his pan and would move the pan from side to side until the dirt and gravel were removed, hopefully leaving gold.

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[7] Immigrant Settlement and Social Organization in South Dakota, Department of Rural Sociology, 1937, p. 47.

[8] Joseph H. Cash, "A History of Lead, South Dakota, 1876-1900" (unpublished M. A. thesis, University of South Dakota, Vermillion, South Dakota, 1959), p. 134.

The process was relatively simple, requiring only a pan, a stream, and a lot of patience.

Sluicing soon grew popular in the Black Hills' streams. This process required a long box with cleats (called "riffles") to catch the gold. Gravel was shoveled into the box and water was run through it. These operations required several men, and the boxes often got to be quite large affairs. At first troughs were 12 feet long and fell four inches from end to end. As a given operation grew, a series of troughs would be notched together with riffles in the first box and slats in the rest. Sluicing was generally carried on right in the stream bed, as 2,000 gallons of water were needed to sluice one ton of gravel. About 65 percent of the gold that was placer-mined was extracted by sluicing.[9]

A third method used by early miners required a rocker and very little water. The area around present-day Rockerville was, not surprisingly, most noted for the use of rockers, and was known in rush days as "Captain Jack's Dry Diggin's." A rocker was a shallow, sloping trough about two feet wide and four feet long, open at the lower end where there were riffles and a piece of carpet or sheepskin to catch gold particles. The box was rocked from side to side as gravel and water were added. In this process the water could be caught at the end and run through again and again. The material caught by the riffles was then panned to obtain the gold. In some areas where water was lacking, including Rockerville, flumes were used to bring water in. The Rockerville flume ran 17 miles

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[9]Parker, Gold in the Black Hills, p. 58.

to Spring Creek, and when constructed in 1880, cost $300,000. By 1882 it had helped to extract $500,000 in gold at Rockerville.[10]

Some placer mining methods were more advanced. Among these methods was hydraulic mining which was used on a large scale in California and Colorado. However, this method was used on a limited scale in Rockerville and the surrounding Black Hills' area, and the amount of gold obtained from such mining in the Black Hills was insignificant.

Settlement

A rapid and successful settling of the Black Hills was accomplished within five or six years. Practically all the mining settlements were founded between 1875 and 1880. Approximately two-thirds of the settlements started as placer camps, and the majority were founded before the Indian cession of the Hills. Placer diggings lasted, on the average, one or two seasons. Only a few survived to be permanent settlements. Lode mining, with a few exceptions, had a longer life-span, approximately five years on the average. Subsequent discoveries of silver and tin lengthened considerably the life-span of the mining communities. Few had a continuous boom period.

There were 427 settlement names in the Black Hills by the 1890s.[11] Such a high number of place names is not unusual, even in a relatively

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[10] William S. Greever, The Bonanza West (Norman, Oklahoma: University of Oklahoma Press, 1963), p. 303.

[11] Watson Parker, Black Hills Ghost Towns and Others, an Historical Gazetteer (Norman, Oklahoma: University of Oklahoma, 1964), p. 36.

small mining region such as the Hills. Boom conditions in conjunction with the exhaustion of mineral resources, new discoveries, and place abandonment often created a high density of place names per square mile.

The Indians left no named settlements, so whatever place names exist in Sioux language were given by the miners or settlers during the gold rush days. Such names include Minnelusa in Pennington County, Minnesala in Butte County, Teepee in Custer County, and Tomahawk in Lawrence County. The Sioux had their own descriptive names for many of the white settlements, creeks, peaks, and other topographical features.

My study of the Black Hills settlements reveals 377 actual or traceable place names in the eight counties, of which 118 were linked to mining, 87 to railroad and stagecoach stops, 23 to the timber industry, and 40 to farming or ranching (Table 7). The most short-lived of these were the placer mining communities and stagecoach stops; more stable were the settlements built around lode mining, railroad stops and timber camps, and agricultural communities; post office "towns" and resort towns showed the highest degree of persistence between 1876 and 1930.

Settlement names were derived from varied sources, and most were named by the settlers or miners themselves. Custer, Crook City, and Sturgis were named in honor of military leaders. Numerous names derived from mines or claims as, for example, Belmoral, Mogul, Anchor City, and Sitting Bull. Topographic features frequently served as names for settlements such as Bear Butte and Ragged Top. Nugget City, Golden Gate, Galena, and Hornblende derived from the mineral or rock mined. Politicians, financiers, discoverers, and mining company personnel added names like Pennington, Roubaix, Trojan, Cartersville, and Brownsville. Locational

SETTLEMENTS OF THE BLACK HILLS
(1830-1930)

	LAWRENCE	MEADE	PENNINGTON	CUSTER	BUTTE	FALL RIVER	WESTON	CROOK	TOTAL
PLACER CAMPS	23		12	4					39
LODE MINING CAMPS	29		21	7				3	60
SILVER CAMPS	8								8
TIN, ETC. CAMPS	3		5	1					9
COAL "TOWNS"							2		2
STAGE COACH STOPS	6		1	5		3	2		17
RAILROAD STOPS	26	10	15	7		8	4		70
TIMBER CAMPS	15		6	1				1	23
QUARRIES	2	2	5	2		5	1		17
POST OFFICES	5	1	1	4		1	1	1	14
RESORT TOWNS	5		6	6		2			19
MILITARY POSTS		5		2		2			9
FUR POSTS	1	2	1						4
FARM/RANCH	10	5	10	7	1	3	3	1	40
CATTLE SHIPPING STATIONS		1		3	1	1	2		8
OTHERS	11	2	12	8		3	2		38
TOTAL	144	28	95	57	2	28	17	6	377

SOURCE : W.PARKER, "BLACK HILLS GHOST TOWNS AND OTHERS"; D.KITCHEN, "GHOST TOWNS THAT LOST"; I.H.KLOCK, "YESTERDAY S GOLD CAMPS AND MINES"; ETC

TABLE 7

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names such as Junction City and Central City were also common, and names of famous mining camps in the West, such as Virginia City and Montana City, were also imported.

Approximately 40 percent of the Black Hills settlements had two or more names used simultaneously. One had seven names--Cartersville, Carterville, Elk Creek, Elkhorn City, Montana City, Gregory, and Lincoln. When the railroad connected with the mining camps, the two-word names were changed or shortened to one--Sitting Bull became Mystic. In all, the Black Hills have over 600 place names which represent 34 per square mile.

The majority of settlements are concentrated in the two mineral belts of the Black Hills--one in Lawrence County, outlined in a trapezoid by Whitewood, Tinton, Hanna, and Roubaix, with Lead and Deadwood in the center. The other mineral belt or "mother lode" is in Pennington County and takes the form of a pentagon with Rochford, Oreville, Keystone, Rockerville, and Silver City on each side.

There are 11 categories of settlements based on function. Their distribution in Lawrence, Pennington, and Custer counties are illustrated in Figs. 15, 16, and 17.

The Black Hills mining region presently has 72 genuine ghost towns.[12] Intermittent or semi-ghost towns are likewise numerous. As

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[12]Ghost town is defined in this study as an abandoned settlement which previously performed an important function or functions until such functions were lost and growth ceased because the minerals were mined out, the source rock was not found, the surrounding area was not suitable for farming, other resources were depleted, or the town was isolated by transportation lines.

LEGEND

(FOR FIGURES 15, 16 &17.)

- ● MINING CAMP/TOWN (GOLD,SILVER,TIN, ETC.
- ■ TRANSPORT TOWN (STAGE, RAILROAD)
- ★ TIMBER CAMP
- ◊ QUARRY
- ○ POST OFFICE
- ⊹ RESORT
- ▲ MILITARY POST
- ⁘ FUR POST
- □ FARM/RANCH
- CATTLE SHIPPING
- ☼ OTHER

SOURCE: WATSON PARKER, BLACK HILLS GHOST TOWNS AND OTHERS, 1964
AND "SOME BLACK HILLS GHOST TOWNS AND THEIR ORIGINS," 1972;
WATSON PARKER AND HUGH K. LAMBERT, BLACK HILLS GHOST TOWNS, 1974;
DICK KITCHEN, "GHOST TOWNS THAT LOST," 1967;
IRMA H. KLOCK YESTERDAYS GOLD CAMPS AND MINES, 1975

SETTLEMENT TYPES, LAWRENCE CO., S.D.

(1930s)

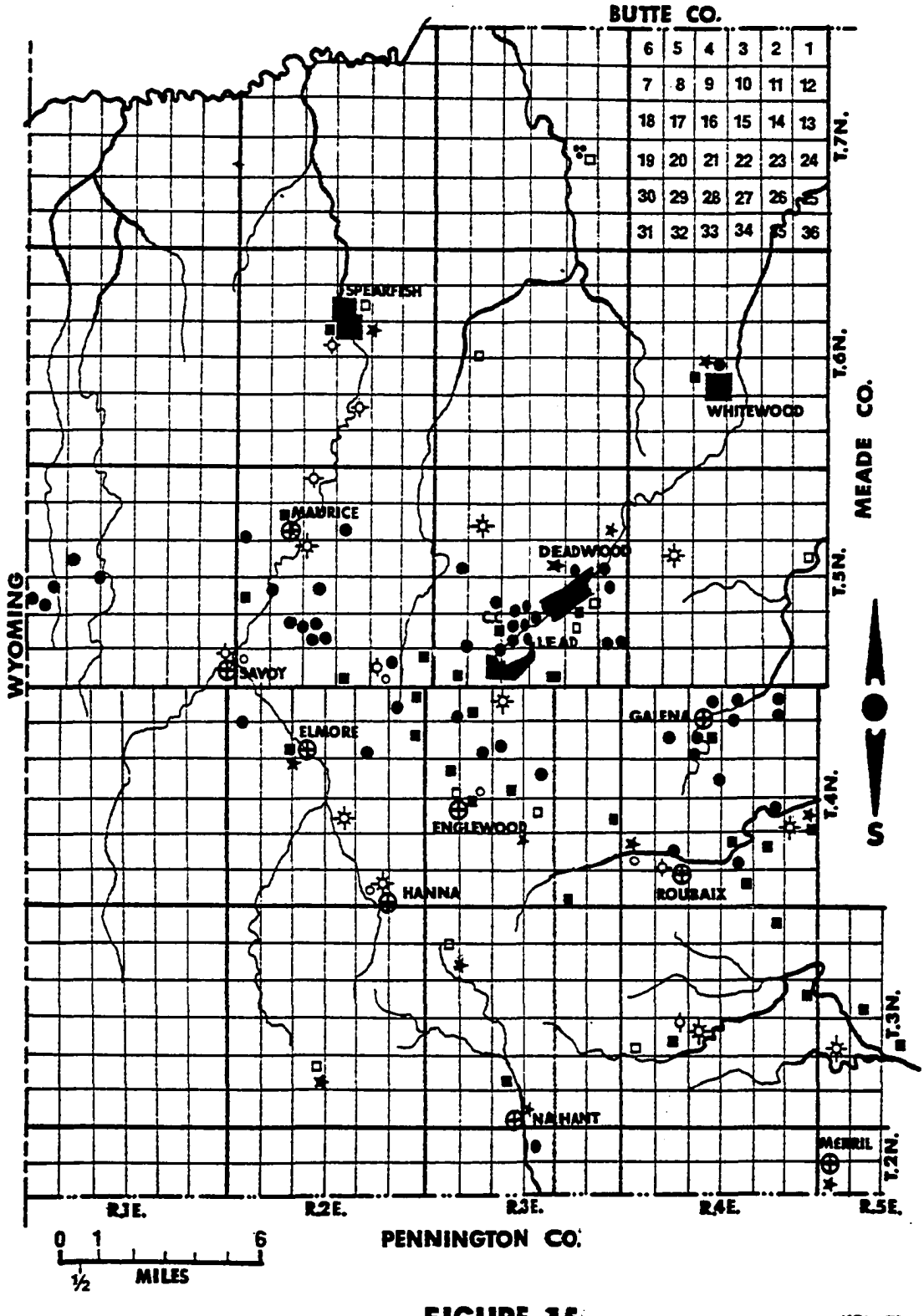

FIGURE 15

KOVATS
19 77

SETTLEMENT TYPES, PENNINGTON COUNTY, S.D.
(1930s)

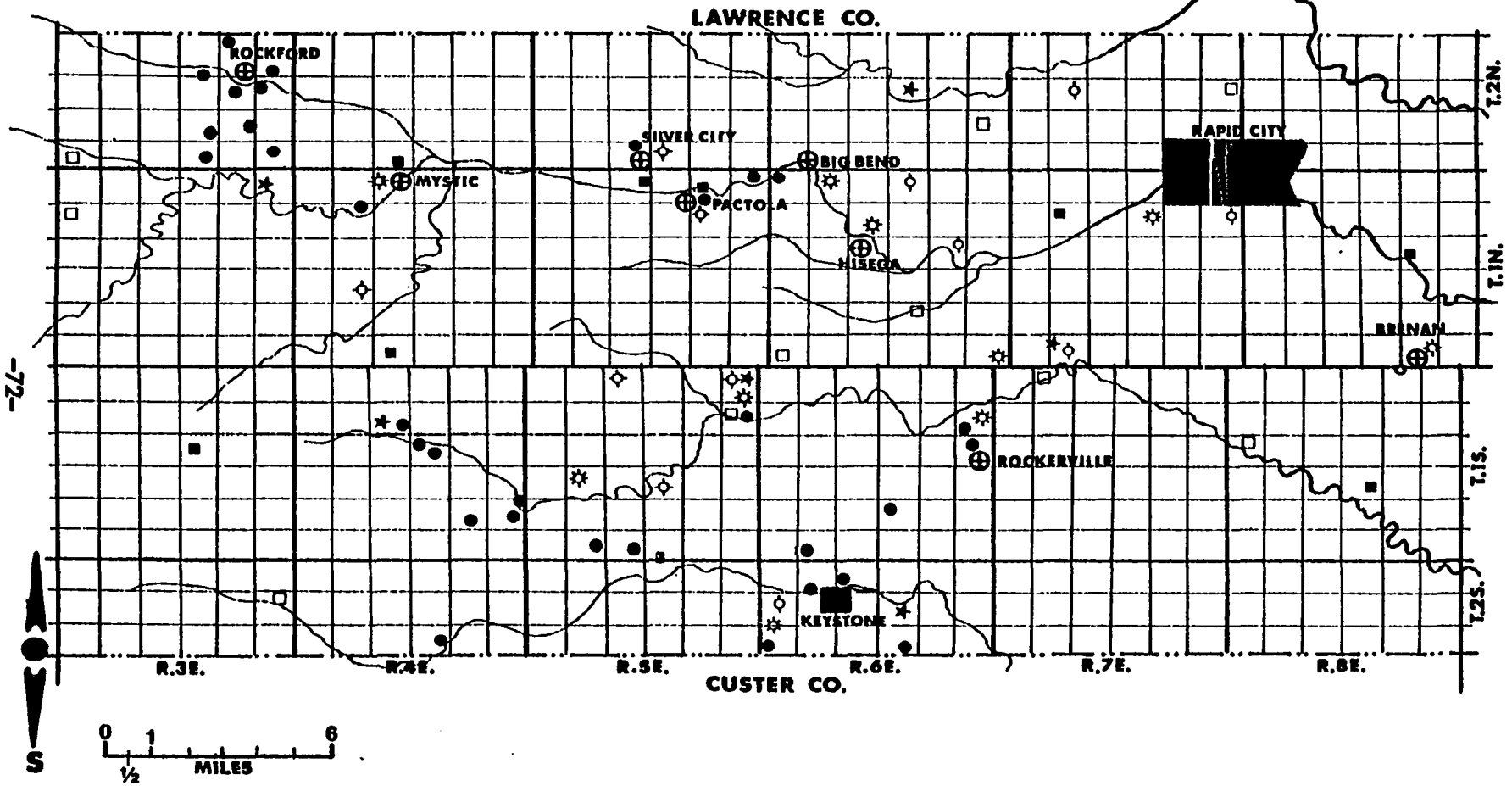

FIGURE 16

KOVATS
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SETTLEMENT TYPES, CUSTER COUNTY, S.D.

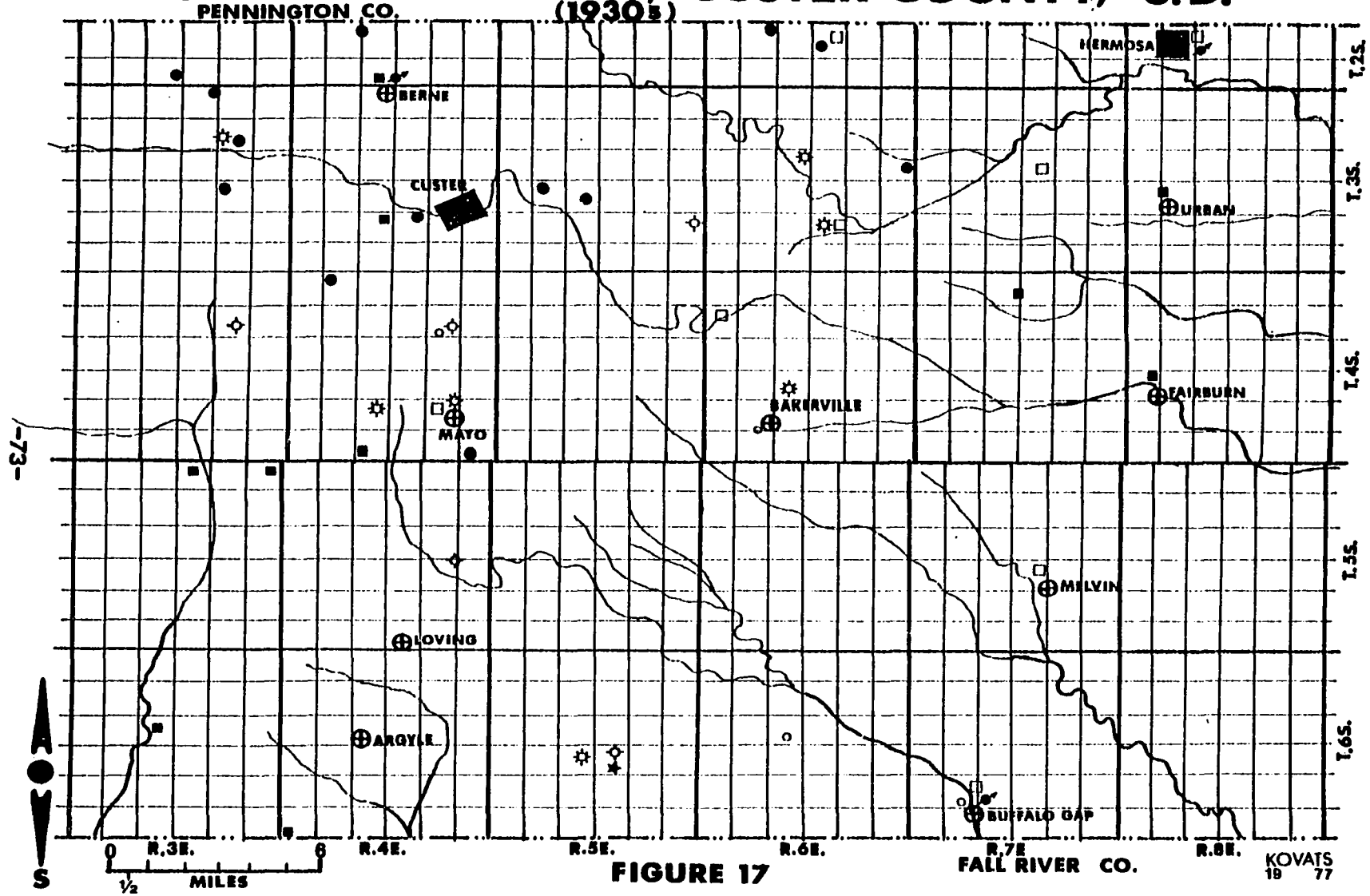

FIGURE 17

many as 97 percent of the mining camps existed for only brief periods. Approximately 25 percent of the settlements are difficult to locate today because of the frequent changes in name or location, destruction by fire or flood, or actual dismantling of buildings for removal to other camps. Their names remain only in early newspapers. Towns, camps, or hamlets in the Hills were abandoned for many reasons. Depletion of ore reserves was the main one, but legislative action, mismanagement of resources, legal disputes, law suits, natural disasters, water shortages, lack of capital investment, or being by-passed by a railroad were additional causes. The lure of bigger stakes elsewhere frequently left a town deserted. The death of one town, however, often marked the birth of another.

The following observations can be made about first-generation settlements: They were few in number, linear and narrow so as to conform to the topographic constraints, and they were located in the vicinity of mineral resources. These shoestring gulch settlements were based on placer mining. Deadwood, Blacktail, Central City, and Trojan are examples.

The second-generation towns were more often clustered or agglomerated and built in valleys and on hiilsides close to the lode mines. Rochford, Galena, and Lead are examples. These towns are hillside settlements located four to six miles from the original placer diggings.

The third-generation towns were dispersed "hamlet" types with functions other than mining. These towns were meadow settlements based on timber, church activities, or the boy scouts. Placer camps were nearer to the farming or ranch settlements, whereas the timber camps were nearer to the lode mining towns.

With the coming of the railroad, the pattern changed. Promising towns and camps attracted the railroad, other towns were side-tracked, and new ones were formed. While mining promoted haphazard colonization, the railroad helped to exploit the natural resources more fully and systematically, and thus increased the density of settlements, and promoted functional diversification and filling up of space. Although the railroad conformed to the already existing towns by connecting them, and modified substantially the alignment of cities and patterns of distribution by superimposing a linear pattern, more towns were created by the railroad than were eliminated, and thus the railroad became a stabilizing factor (Fig. 18). John C. Hudson's theory of "colonization fill-in campetition, invasion-spread-elimination" would seem to apply to rural settlements of the Black Hills.[13]

Custer

The location and growth of Black Hills settlements were affected by local resources and economic conditions as well as by influences such as governmental policies, corporate interest, and capital inflow. The ups and downs of Black Hills mining camps can perhaps best be illustrated by Custer, Rochford, and Crook City. Custer came to exist as a result of the first gold stampede in the Central Hills between the fall of 1875 and the spring of 1876, and Rochford and Crook City stemmed from the first gold rushes in the Northern Hills.

Custer, the earliest of all mining towns, was founded on August 10, 1875, only five days before the eviction of the miners by General Crook.

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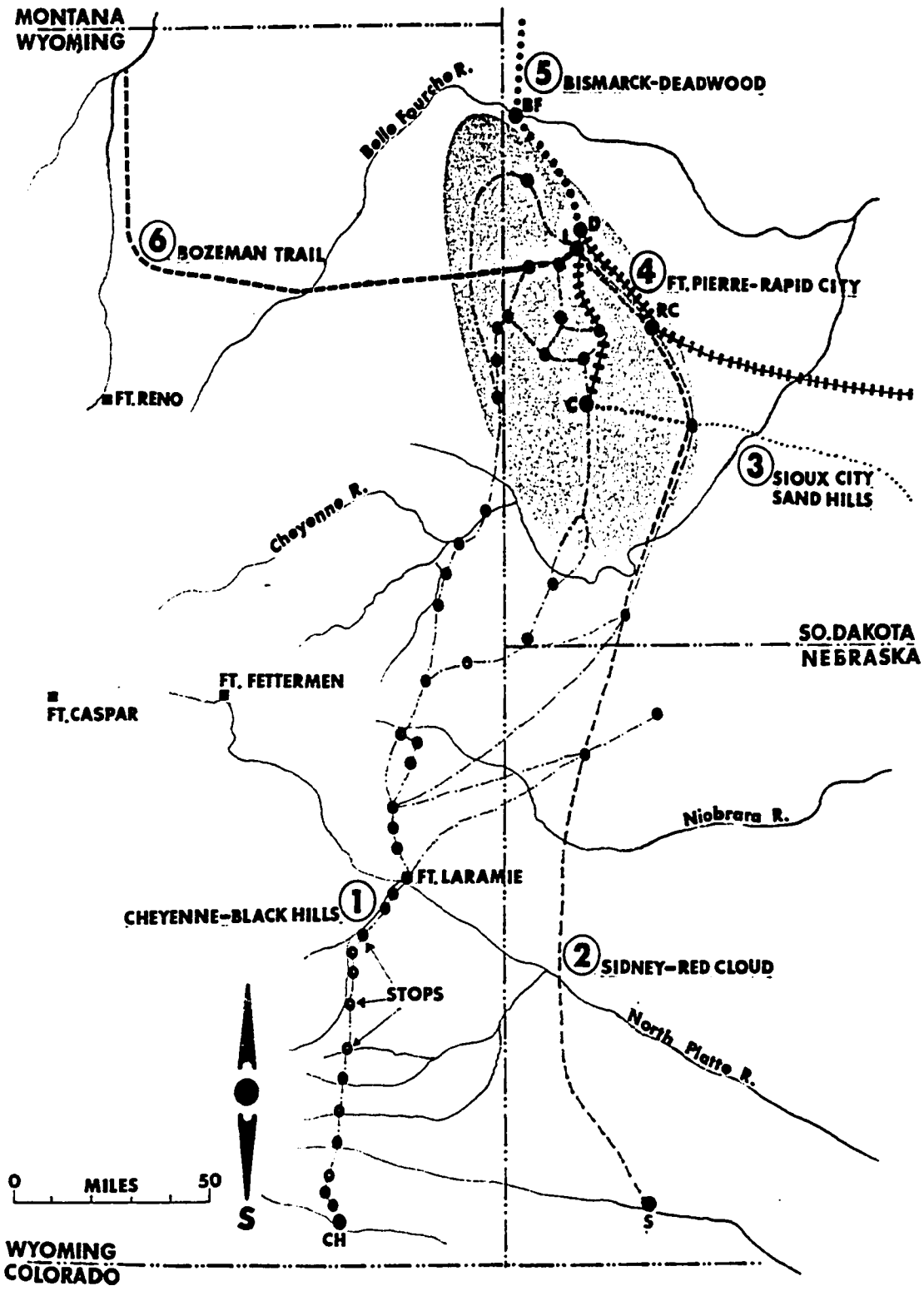
[13] John C. Hudson, "A Location Theory for Rural Settlement," Annals, Association of American Geographers, Vol. 59 (June, 1969), pp. 365-381.

STAGE LINES & WAGON ROADS TO THE BLACK HILLS



SOURCE: SEE FOOTNOTES IN THE TEXT

FIGURE 18

KOVATS 19 77

The townsite company responsible for Custer created a gridiron street pattern and town lots. This entrepreneurial display of "showcase" politics was designed to impress the government in order to secure a speedy land grant. Instead, the company succeeded in impressing General Crook, who left behind a few guards, most of them Chinese, to protect the equipment from theft and prevent claim-jumping when the prospectors left Custer voluntarily.

In the fall of 1875, the miners returned and Custer grew rapidly, despite the fact gold panning during the mild winter of 1875-76 produced only moderate profits—an average of $6 per day.[14] By January, 1876, Custer had a population of about 1,000, and by April, 1,400 additional miners had arrived with 200 wagons. A small smelter, assay office, sawmill, and a hotel were constructed. In March, the city's government was organized with a mayor, judge, and law enforcement officials. During the same month the town had six general stores, two bakeries, seven saloons, and other establishments; 300 log cabins and many tents lined the streets, and there were at least another 300 cabins under construction. The largest excitement was created when the first gold shipment left for Cheyenne in May.

Then in the early summer of 1876 gold was discovered in Deadwood Gulch, and attention swiftly turned toward the Northern Hills. Custer became depopulated within a few days. Custer's rapid decline was also brought on by the exhaustion of surface placer gold in French Creek. To exploit the deep placers, large capital investments were required, and expensive hydraulic equipment was needed to make mining profitable. This depletion of poor man's gold prompted miners to leave for bigger stakes.

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[14] Watson Parker, Gold in the Black Hills, p. 71.

Custer did not become completely deserted, however, and those who remained turned to commerce, trade, banking, publishing, education, county government, and other services. In August, the city government was reorganized, a school was opened, and two newspapers (the Custer Herald, and shortly thereafter, the Custer Chronical) were published. Custer became an important supply and outfitting town for Deadwood.

In 1878 hard-rock mining put an end to pick-and-shovel placer mining in the Northern Hills, and some miners began to return to Custer to work on the more difficult but still fiseable deep placers left behind some two years before. Also, several new although small and sporadic gold discoveries in the vicinity helped to create a second boom period—which was soon followed by a depression brought on by speculation, swindling, mismanagement, and the loss of faith in "get rich quick schemes." Recovery from this depression was slow and gradual, but Custer kept its momentum as a retail trade, education, administration, and service center. In the 1880s and 1890s, local pegmatite, mica, and feldspar mines and limestone and sandstone quarries sustained the town's economy. And today tourism is a major source of income.

Custer typifies the cyclical nature of economic prosperity and decline of most Black Hills towns: Gold is discovered, a town is founded, there is a short-lived but dramatic boom, then a sudden decline. This is followed by a sporadic or intermittent return by miners to exploit old deposits and new but smaller deposits which results in a second boom of a more subdued and limited nature. Then there is another depression as a consequence of the depletion of gold (or other resources), and unless

the town undergoes functional changes through developing viable industries it becomes a ghost town (Fig. 19).

Rochford

Rochford exemplifies this cyclical nature of settlement evolution. It had its beginning as a placer town. The first cabins were erected in 1876, although its foundation as a townsite was a year later. In 1878 the town had an estimated 500 inhabitants with approximately 100 log cabins and tents, excluding a cluster of tent camps within a two mile radius.[15]

Unlike most camps, Rochford had no hotels, dance halls, nor gambling establishments, which made it the "quietest town"—until 1879 when businessmen from Deadwood built two hotels, five general stores, and organized two newspapers, The Central and Rochford Miner. A sawmill was also constructed and a school district established. Placer diggings were soon depleted. The prosperity, however, was to be based on quartz ledge mining between 1878 and 1880. There were some 100 lode claims in the vicinity with several successful mining companies producing ores and keeping offices in Rochford. For a time the future seemed very promising, even better than the prospects for Lead. Rochford competed with Deadwood for Rapid City business and supplies.

Rochford's decline began in 1881 when claim jumping, speculation, confused management, lack of capital, and litigation halted the growth, and when high-grade ore deposits were simultaneously depleted.

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[15]These included Sitting Bull (Mystic), Ochre City, Montana City, Florence, Golden Centre, Elkhorn, Tigerville, Montezuma, Nahant, and Myersville.

THREE-STAGE CYCLE OF SETTLEMENT EVOLUTION IN THE BLACK HILLS
(A DESCRIPTIVE MODEL)

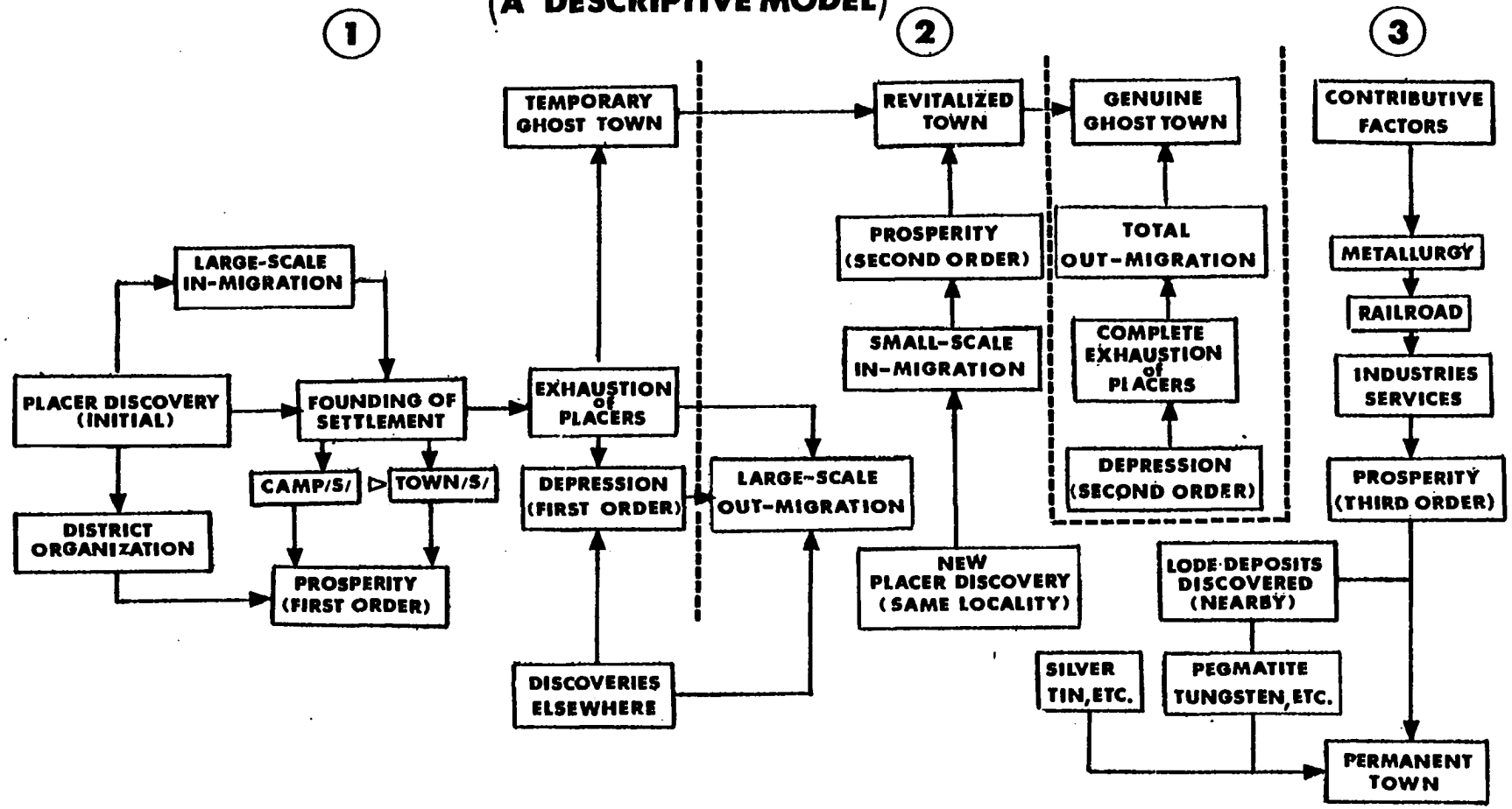

FIGURE 19

KOVATS 19 77

Crook City

Crook City, one of the oldest camps in the Northern Hills, had a similar fate. The site was probably an Indian camp before General Crook made it a base camp for fighting the Sioux. In 1875 a fortified stockade was built, and in 1876 a townsite was laid out on trails that converged from Fort Pierre and Bismark. Crook City was envisioned to be a trade center for the Northern Hills. A bright future was predicted when Crook City established the first school in the area. For a few months the town competed with Deadwood for the county seat. The boom period from 1876 to 1877 was related to farming, trade, and construction. Then a few prospectors from Crook City discovered placer gold in Whitewood Gulch, drawing away population from Crook City. By 1878 Crook City had declined.

In 1879 a very short-lived secondary "Kerosene Boom" ensued, but by 1880 another depression had set in as the newly constructed Deadwood-Sturgis road side-tracked Crook City. In 1882 a grist or flour mill was built by St. Louis entrepreneurs, and this, in addition to farming, grazing, and the school, had a stabilizing effect on the city. In 1887, because of an unsuitable grade, the railroad bypassed the town in favor of Whitewood. Crook City also lost its competition for the county seat, and its demise gave life to Whitewood.[16]

State and County Organization

The organization of counties in the Black Hills was preceded by several legal disputes. During the 1875-1876 period when many of the placer deposits were discovered, the Black Hills was still a part of the Sioux

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[16]Irma H. Klock, Gold Camps and Mines in the Northern Hills (Lead, South Dakota: Seaton Publishing Company, 1975), p. 3.

Reservation, and no steps could be taken to form any legitimate government. In July of 1876, previous to the official opening of the Hills for settlement, and while a treaty with the Indians was being negotiated, two petitions were circulated by the miners already in residence. One called for the organization of a new territory (and eventually a state) to be called either Eldorado or Lincoln, and the other sought to create a county named Lawrence in honor of Col. John Lawrence.

The new territory would have included the area between the 101st and 109th meridians and the 43rd and 46th parallels, or a compactly outlined area of about 100,000 square miles.[17] Despite the efforts of various promoters, the territory bill failed. In 1886 the question of admission and division of Dakota Territory came up, but the idea of establishing the Black Hills as a separate state failed again. This movement points out the different and conflicting interests (that persist to the present) between agricultural Dakota Territory and the mining Black Hills.

Between 1877 and 1892 the Black Hills counties were organized. Today, the Black Hills mining region includes six South Dakota counties and three Wyoming counties. Of these, Lawrence (Northern Hills), Pennington (Central Hills), and Custer (Southern Hills) counties are entirely within the Black Hills. Butte, Meade, and Fall River counties have from five to 30 percent of their territories within the limits of the Hills, and in Wyoming approximately 50 percent of Crook, 15 percent of Weston, and two percent of Niobrara counties can be considered part of the Black Hills.

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[17]Rev. Peter Rosen, Pahasapa, or the Black Hills of South Dakota (St. Louis: Nixon-Jones Printing Co., 1895), p. 422.

The "mineral counties," those which produced most of the precious metals between 1876 and 1940s, were Lawrence, Pennington, and Custer, in a decreasing order of importance. Practically all of the feldspar, mica, and lithium-bearing minerals came from Pennington and Custer counties. Butte, Meade, and Fall River counties in the Black Hills foothills produced mainly construction materials such as sand and gravel and were considered agricultural counties. Crook and Weston counties produced some coal, while significant quantities of bentonite and other clay products were exploited for local, regional, and national needs.

Lawrence County

Lawrence County was, and still is, the center of gold mining activities in the Black Hills. Organized in 1877, it was originally encompassed by the two branches of the Cheyenne River on the east, the Wyoming border on the west, the Belle Fourche River on the north, and Pennington County on the south--some 87 miles east-west by nearly that north-south. However, the agriculturally-oriented legislature of Dakota Territory made three counties from the original Lawrence County: Butte and Meade counties were formed in 1883 and 1889, respectively. Thus, by taking away close to 60 percent of the original county, Lawrence was left with 720 square miles, the smallest county of the Hills.[18]

Despite its small size, Lawrence County is diverse. Approximately 30 percent is hilly or mountainous and heavily forested, and the county has an average elevation of 6,000 feet. The remainder is open and undulating with alternating small basins, valleys, and plains--where

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[18]State-wide Educational Services, Early History of South Dakota, Report No. F-69, November, 1969 (Vermillion, South Dakota: University of South Dakota, 1969), p. 68.

the range of elevation is between 2,000 and 3,500 feet. The most rugged part of the county, in fact of the Black Hills, exists within an eight miles radius of Deadwood. Streams descend from 150 to 200 feet per mile, providing yet-to-be-exploited energy for hydroelectric power.[19]

After 1876 Lawrence County captured and maintained its lead as a gold-silver producer. Approximately 85 percent of the producing mines were located within seven miles of Lead. The most productive mines were those of the Homestake Mineral Belt, a mineralized ground two miles wide and six miles long located in the center of Lawrence County. This county had the largest number of mineral districts. There were 89 major gold-silver mines and 30 silver-lead mines. Excluding small mining undertakings, there were 165 mines in operation during this period (Table 8).

Lawrence County also had the largest number of settlements and ghost towns. There were 65 ghost towns of which about 75 percent were gold mining camps or hamlets, 14 percent were railroad communities, and 11 percent were timber-lumber camps.[20] The county was also the most densely populated in the Black Hills. In 1896, for example, 27,000 people lived in the county, constituting 51 percent of the Black Hills population.[21]

Pennington County

Pennington County, named in honor of John L. Pennington, Governor

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[19]Department of Immigration, South Dakota, A Plain Official Story Of Its Resources and Opportunities, by Irwin D. Aldrich, Pierre, South Dakota (1921), p. 24.

[20]Parker Watson and Hugh K. Lambert, Black Hills Ghost Towns, Sage Books (Chicago, Illinois: The Swallow Press, Inc., 1974), p. 215.

[21]Tallent, p. 357.

UNDERGROUND & OPEN PIT MINES, BLACK HILLS (1876–1960)

METALLIC DEPOSITS

COUNTY / ACRES	Au	Au-Ag	Au-Ag-Pb	Au-Ag-Pb-Zn	Au-Ag-Pb-Sb	Au-Ag-Fe	Au-Ag-W	Au-Ag-Sn	Au-Ag-Cu	Au-Cu-U	Au-Fe	Au-Cu	Au-W	Ag-Pb	Fe	Sn	Sn-W	Cu	TUNGSTEN
LAWRENCE 460,800	5	89	7	1	1	1	5	1			3	1	2	30	3		5		2
PENNINGTON 1,024,000		87	2						13	1				2	21	51		7	22
CUSTER 2,240,000		53														6			2
BUTTE 832,000																			
MEADE 1,030,000																			
FALL RIVER 1,036,800																			
CROOK 1,854,080																			
WESTON 1,541,120																			
NIOBRARA 1,672,960																			
TOTAL	5	229	9	1	1	1	5	1	13	1	3	1	2	32	24	57	5	7	26

NONMETALLIC DEPOSITS

COUNTY / ACRES	Mn	FELDSPAR	FELDSPAR-MICA	FSPAR-BERYL	MICA-BERYL	MICA	Li-MICA	Sn-Li-FSPAR	BERYL	BENTONITE	FULLER'S EARTH	GYPSUM	LIMESTONE	SAND/GRAVEL	COAL	GRAPHITE	URANIUM	Nº OF MINES	Nº OF DISTRICT
LAWRENCE 460,800								1		2		1	3	2				165	13
PENNINGTON 1,024,000				17		12	14					2	6			1		258	7
CUSTER 2,240,000	3	112	41	26	11	51	22		18		1	5	1	8				360	2
BUTTE 832,000										4				1				5	
MEADE 1,030,000													3	8				11	
FALL RIVER 1,036,800												4		8	1			13	
CROOK 1,854,080										268				3	4		6	281	6
WESTON 1,541,120										391				4	2		6	403	4
NIOBRARA 1,672,960										24				8				32	2
TOTAL	3	112	41	43	11	63	36	1	18	689	1	12	13	42	7	1	12	1528	34

SOURCE: U.S BUREAU OF MINES, 1953

TABLE 8

KOVATS 1977

of the Territory of Dakota, was created on January 4, 1875, and was organized on March 5, 1877.[22] Four boundary changes between 1877 and 1883 produced a county of 1,600 square miles--approximately 80 miles east to west by 20 miles north to south.[23] The western half is hilly or mountainous and is forest-covered, while the eastern half is open country of rolling prairie. Elevations range from 4,500 to 6,000 feet above sea level.

The county had five major mining districts: Rochford, Keystone, Rockerville, Hill City, and Silver City. A large percentage of the mines were located within five miles of the town of Keystone. A six mile wide mineral belt between Harney Peak and Rochford produced most of the county's lead, gold, silver, copper, and tin. The lumber industry also played an important role in the county's economy.

Custer County

Custer County, named for Gen. George A. Custer, was created on January 11, 1875, and organized on April 13, 1877. Several boundary changes occurred between 1877 and 1883 before it attained its present 1,200 square miles.[24] Approximately 25 percent of the county is covered by dense timber, mainly Norway pine. About 70 percent of the county is classified as open grassland with gently rolling topography. Since 1879, the City of Custer, situated in the geographic center of the county, has been the county seat.

Custer County was the site of the original gold rush to the Hills and was once an important mining county, but the deposits of placer gold

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[22]Tallent, p. 311.

[23]McClure, p. 440.

[24]Ibid., p. 441.

soon proved disappointing, and instead grazing, wheat and corn production, and the lumber industry became the major sources of income.

Despite the fact that the first official gold discovery occurred in this county, minerals such as feldspar, mica, and lithium-bearing pegmatites were to constitute the county's important mineral resources. Gold came to be mined in Custer County from pegmatites, metamorphic, and diorite-syenite type rocks, but only small quantities of free gold were found. The lode type of gold was associated mainly with sylvanite, altaite, clausthalite, tetrahedrite, and other rare tellurides and selenides which were difficult to sample, assay, mine, and extract. The spotty, irregular, and discontinuous nature of the deposits presented additional problems. A lack of capital development also handicapped the mining industry in Custer County as attention was centered in the Northern and Central hills gold mining districts. The majority of the mines are within a five mile radius of the City of Custer. Between 1876 and 1930, Custer County had 112 feldspar mines, 41 mica-feldspar mines, and 53 gold-silver mines (Table 8).

Mining Districts

There were numerous mining districts in the Black Hills. The exact number of the districts is very difficult to ascertain because of the confused and varied use of the term "mining district."[25] Based on size and the number of establishments, there were 34 mining districts in the Black Hills. Lawrence County had 13, Pennington had seven, Custer had two, and there were 12 in the other counties (Table 8).

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[25]"Mining district" is defined as a mining area of variable size which contains an agglomeration of claims, mines, and associated settlements, and has at least one principal town or camp which has essential establishments or services, such as mill, grocery store, or post office.

As an example of the confusion of the number of mining districts in Lawrence County, a survey of the literature reveals between five and 19 districts. In this dissertation, 13 mining districts organized between 1876 and 1893 will be discussed. Data are summarized in Table 9 and in Figure 20. Neal M. Denson discussed five mining districts, Irma H. Klock mentioned 19, The Black Hills Weekly Mining Review listed 17, Paul T. Allsman listed 18, and the Chicago and Northwestern Railway Passenger Department mentioned 12 districts.[26]

Four years after the official opening of the Black Hills there were already ten important mining districts organized (Table 9). With one exception, these mining districts were organized between 1876 and 1883. There were also 25 gold mining companies in Lawrence County and the majority owned placer as well as lode claims. There were also about 813 individuals or families owning mineral lands. The consecutive number of mineral lots reached 250 in 1880.

Based on the milling capacity, the number of claims, and the number of employees, there were two leading mining companies in 1880 in Lawrence County. The majority of producing mines and claims were located within a five mile radius of Lead-Deadwood. The most active mining districts included Lead-Deadwood, Blacktail, Two-Bit, and Yellow

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[26]U. S. Congress, House, Minerals and Water Resources of South Dakota, by Neal M. Denson, 88th Cong., 2nd Sess., 1964, p. 295, Irma H. Klock, Yesterday's Gold Camps and Mines (Lead, South Dakota: Seaton Publishing Co., 1933), Black Hills Mining Review, March 4, 1901, Paul T. Allsman, Reconnaissance of Gold-Mining Districts in the Black Hills, South Dakota (South Dakota: n.p., 1940), Chicago and Northwestern Railway, The Black Hills, South Dakota: The Richest Hundred Square Miles in the World (1916), pp. 20-23.

MINING DISTRICTS, LAWRENCE CO., S. D.

	AREA IN MILES	DISC.	ORE MINED	NATURE OF ORE & ORE VALUE	BOOMS	DEPRES.	NO OF COMP.	MAJOR COMPANIES	PRINCIPAL CREEKS	PRINCIPAL TOWNS	OTHER TOWNS
LEAD-DEADWOOD (WHITEWOOD INCL.)	2 x 4	1876	Au Ag W	RECENT PLACER FOSSIL PLACER CEMENT ORE SILICEOUS REFRACTORY REPLACEMENT $5–7/TON	1876–1878 (PLACER) 1879– (LODE)	1915–16 1942–45	30	HOMESTAKE DE SMET HIGHLAND IMPERIAL DWD-TERRA HIDDEN FORTUNE	DEADWOOD WHITEWOOD BLACKTAIL BOBTAIL SHEEPTAIL	LEAD DEADWOOD	TERRAVILLE PLUMA CENTRAL CITY
BALD MOUNTAIN (RUBY BASIN, GREEN MOUNTAIN)	2 x 5	1877	Au Ag	QUARTZ LODE REPLACEMENT SILICEOUS TELLURIDES BLUE ORES RED ORES $3–5/TON	1879–1900 1886–1898 1887–1895 (RAILROAD) 1934–1959	1917–22 1959–	27	GOLDEN REW. HORSHOE MOGUL RELIANCE BALD MOUNTAIN	NEVADA FANTAIL STEWART BOX ELDER TERRY ANNIE	TROJAN (PORTLAND)	TERRY ASTORIA GREENWOOD PLUME
GARDEN CITY-MAITLAND	3 x 2	1876	Au Ag	AURIFEROUS LIMONITE REPLACEMENT SILICEOUS $5–7/TON	1902–1914 1934–1940	1914–34 1941–	17	BELTRAM PENOBSCOT MINNESOTA CANYON CORP.	ELKHORN BLACKTAIL SHEEPTAIL	GARDEN CITY	MAITLAND MIDLAND
TINTON	2 x 3	1876	Au Sn Pb Ta	PLACER TIN, GOLD LODE TIN GOLD COLUMBITE TANTALITE $2–6/TON	1876–1877 1888 1901–1905	1906	12	OHIO-BEAVER GOLDEN EMPIRE AMERICAN TIN B.H TIN THE TINTON	POTATO BEAVER BEAR	TINTON	FOREST CITY BEARTOWN NUGGET CITY BEAR GULCH
NORTH LEAD	1 x 1	1876	Au Ag W	SILICEOUS REFRACTORY $3–6/TON	1893–1913	1917	6	THE CUTTING HIDDEN FORTUNE	DEADWOOD		
YELLOW CREEK	2 x 1½	1876	Au W	PLACER, LODE GOLD PEGMATITE $2–5/TON	1879–1910 1916–1918	1911 1919	5	WASP 2 BISMARCK CONS.	YELLOW WHITEWOOD ALDER	FLATIRON	ELEVENTH HOUR

TABLE 9

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TABLE 9
(CONTINUED)

	AREA IN MILES	DISC.	ORE MINED	NATURE OF ORE & ORE VALUE	BOOMS	DEPRES.	No OF COMP.	MAJOR COMPANIES	PRINCIPAL CREEKS	PRINCIPAL TOWNS	OTHER TOWNS
ROUBAIX (GERMANIA, ELK CREEK)	1 x 1	1878	Au Ag Pb	PLACER GOLD GALENA TYPE QUARTZ LODE $2-4/TON	1878–1881 1883–1890 1920-1934	1905 1934	4	UNCLE SAM CLOVER LEAF ANACONDA	HAY ELK	ROUBAIX (PERRY)	ALLERTON BUCKS ANTHONY LEWISVILLE CATERVILLE QUARTZ CITY NEW BERLIN BROWNSVILLE
SPRUCE GULCH	1 x 1	1877	Au Ag Pb Zn	PLACER GOLD QUARTZ LODE GALENA $4-6/TON	1877–1883	1932 1949	15	HIGHLAND LEX.HILL B.ELDRIDGE	SPRUCE SAWPIT		
GALENA (UNION HILL)	1 x 1½	1876	Au Ag Pb	PLACER GALENA, CONTACT REPLACEMENT $2-6/TON	1877–1883 1886–1902 1937–1942	1905 1943	14	G. REWARD UNION HILL GILT EDGE GALENA	BEAR BUTTE	GALENA	VIRGINIA CITY BEAR BUTTE
RAGGED TOP (CROWN HILL)	2 x 2	1886	Au Ag Pb	CARBONATE BRECCHIA BLANKET $4-6/TON	1896–1906 1912–1916	1916 1938	9	BALMORAL CLEOPATRA SPEARFISH G. DEADWOOD STANDARD	JOHNSON JACKASS SPEARFISH CALAMITY	BALMORAL	CYANIDE PRESTON DACY ANCHOR II
SQUAW CREEK (CARBONATE INCL.)	2 x 1½	1882	Au Ag	BLANKET CARBONATE CONTACT TELLURIDE $4-6/TON	1884–1886 1888–1891	1894 1914	8	CLEOPATRA RELIANCE	SQUAW SPEARFISH IRON	CARBONATE	
TWO-BIT	1 x 1	1877	Au Ag	QUARTZ LODE TUNGSTEN $3-5/TON	1897–1913 1937–1939	1913 1940	9	FRANCH MINT HARDIN	TWO BIT PEEDEE BOULDER	TWO-BIT	
STRAWBERRY HILL	1 x 1	1893	Au Ag	QUARTZ LODE AURIFEROUS LIMONITE PLACER GOLD $3-6/TON	1894–1899 1901–1909	1910	4	GILT EDGE GOLDEN CREST	RUBY BEAR BUTTE STRAWBERRY	ORO FINO	

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MINING DISTRICTS, LAWRENCE CO., S. D.

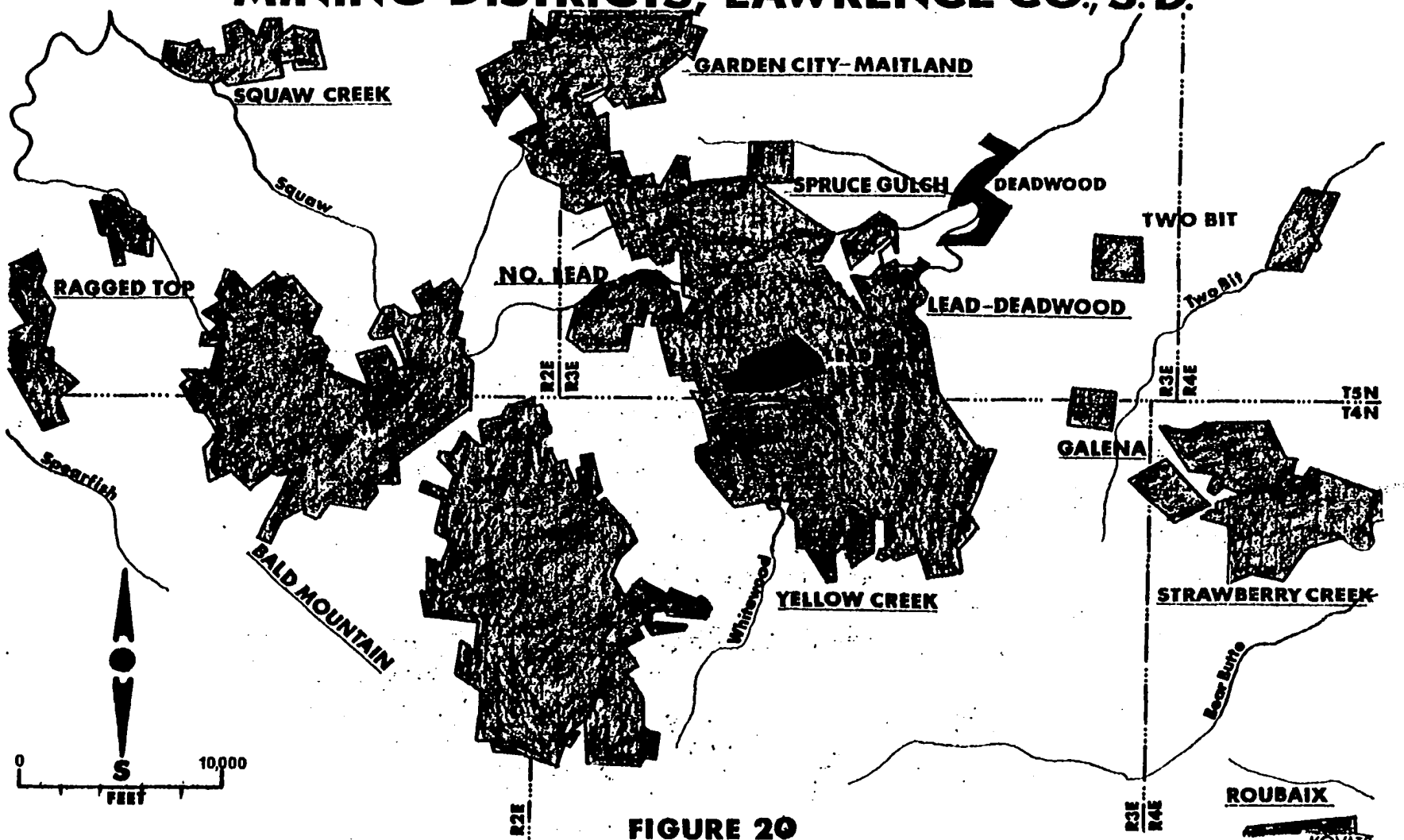

FIGURE 20

Creek. The total acreage of mineral lands under company ownership reached 168.4; the largest acreage under a single company was 20.0 acreas; the smallest was 1.0 acre.[27] By 1890 the maximum mineral acreage owned by a single company increased to 150.0 acreas, while the total mineral land acreage reached 1,298.1 acres--representing a six-fold increase in the mining space.[28] The leading mining companies also increased from two to four, and the number of mineral properties was doubled. Townsite, real estate, and other businesses were quickly organized with their main offices located mostly in Deadwood and Lead. In 1890 there were approximately 1,223 individuals owning mineral acreages (Table 10). Another indication of expansion was the number of mineral lots which grew from 250 to 577.

The Lead-Deadwood Mining District

The Lead-Deadwood Mining District is situated in the center of the so-called "Homestake Belt," and has produced approximately 80 percent of the gold in the Black Hills. Mining began with placer workings in Deadwood gulch in 1876, but the placer gold was exhausted within a few months and gave rise to quartz lode mining which continues to the present. The Homestake Belt is approximately two by four miles in area, extending in a northwest-southeast direction. The ore is of low-grade and is worth from 50 cents to $5 a ton. The gold is disseminated in

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[27] Tax List--Mineral and Agricultural Land (Deadwood, South Dakota: Lawrence County Courthouse, 1880).

[28] Ibid., 1890.

MINING COMPANIES & MINERAL LANDS, LAWRENCE COUNTY, S.D.

	1880	1890	1895	1900	1905	1910	1915	1920	1925	1930	1935
NUMBER OF MINING COMPANIES	25	68	84	100	128	140	133	115	100	85	56
NUMBER OF NEW MINING COMPANIES	–	57	49	36	59	31	22	16	6	8	1
NUMBER OF SURVIVING COMPANIES	–	11	35	64	69	109	111	99	94	77	55
NUMBER OF CEASED COMPANIES	–	14	31	22	37	20	28	34	20	23	35
NUMBER OF LEADING COMPANIES	2	4	6	10	13	22	15	11	8	5	3
MAX. ACREAGE OWNED BY A SINGLE COMPANY	20.0	150.0	705.3	2631.5	2646.5	2115.3	4334.6	6782.3	6147.8	6001.5	5817?
RANGE OF ACREAGE OWNED BY COMPANIES	1.0-20.0	1.0-150.0	.4-705.3	.2-2631.5	.2-2646.5	.4-2115.3	.4-4334.6	.3-6782.3	.3-6147.8	.3-6001.5?	.3-5817?
TOTAL MINERAL LAND OWNED BY COMPANIES	168.4	1298.1	3538.8	6006.5	16787.8	22067.9	24618.4	25462.8	20862.6	18643.1	17660.3
NUMBER OF INDIVIDUALS OWNING MINERAL LAND	813	1223	1631	2010	1192	1522	1150	992	802	796	?
EXPANSION OF MINING SPACE		+750%	+475%	+375%	0%	-20%	+100%	+50%	-10%	-2.5%	?

SOURCE: COURTHOUSE RECORDS, DEADWOOD, S.D.

TABLE 10

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very fine grain in the Precambrian Homestake Formation which is composed of a lower metamorphic facies, sideroplesite schist, and a higher metamorphic, cummingtonite facies. The total Precambrian sequence is approximately 20,000 feet thick and consists of six formations. In addition to the large volume of low-grade ore reserves, the Homestake Belt ores were the first to be mined by underground methods. Since 1876 there were better than 30 major mining companies operating in this Belt. Presently the Homestake Mining Company owns most of the mineral ground in the Homestake Belt and is the only producer of gold.

Yellow Creek Mining District

This district is located approximately two miles south of Lead and has an area of two miles by one and one-half miles. It was one of the earliest mining districts to be discovered and mined. Both placer and lode gold were mined but boom periods were of short duration.

Galena Mining District

The Galena Mining District is located approximately six miles southeast of Lead and is among the smallest of the mining districts in Lawrence County—one by one and one-half miles in area. Mining began with placer workings along the Bear Butte Creek in 1876-1877 and lasted until 1881. In 1886, mainly the galena type ores were mined, with some silver being mined until 1902. Ore reserves were not large enough to maintain prosperity, and by 1905 most mining activities ceased. Some 14 mining companies operated in this district with an average lifespan of two years.

Squaw Creek Mining District

The Squaw Creek Mining District is situated two and one-half miles northwest of Lead and is approximately one and one-half by two miles in area along Squaw Creek. A small district called Carbonate is included in the Squaw Creek District. Carbonate and sylvanite (telluride) types of ore were discovered in 1882. Productive mining was short-lived, however. Prosperity lasted from 1885 until 1891, with the final decline occurring around 1912. There were eight mining companies active in this district and ten companies in the adjoining Carbonate District. Problems leading to the decline were the high cost of mining, poor road conditions, the lack of supplies, the sale of delinquent stocks, declining ore reserves, and the fluctuation and drop of silver prices in the early 1890s.

Spruce Gulch Mining District

This district is located near the Two-Bit District and is some two miles northeast of Lead. It is a small district along the Spruce Gulch, not more than a square mile in size. Prospectors moved into the gulch at the same time the famous Deadwood Gulch placer deposits were discovered in 1876. After seven years of placer mining between 1877-1883, the district declined. Lode gold and galena type ores of low grade were found in small quantities.

Tinton-Nigger Hill Mining District

This mining district is located in western Lawrence County, close to the Wyoming border and some 14 miles from Lead. The district was noted more for its tin deposits than for its gold. The district includes an area of approximately two by three miles. Discovery occurred in 1876,

but mining, without any real boom periods, began in 1900 and lasted until 1905. There were some 12 mining companies in this district, and about 50 percent of the companies mined placer and lode tin ores. Gold production at any given time was small.

Elk Creek-Roubaix Mining District

This is one of the smaller, outlying districts, and is located some nine miles southeast of Lead. The area is about one mile by one mile and lies mainly along Elk Creek. Placer gold was mined here between 1878 and 1881. Subsequently, quartz lode mining occurred without any spectacular results. The district is occasionally called the Germania Mining District. Among the four companies operating there, only one mined profitably between 1898 and 1905. Intermittent and small-scale mining lasted until the mid-1930s, when the district closed.

Summary

The first immigrants during the early phase of the gold rush were of Old-American stock, primarily from the southern states and from New England. These American-born immigrants were engaged in agricultural pursuits in eastern South Dakota, but migrated during the drought years. A few were drawn to the placer diggings of the Black Hills, but most of them returned to an agrarian existence.

The second immigrant group was composed mainly of recent foreign immigrants who were attracted by vacant lands in South Dakota and mining opportunities in the Black Hills. Only a few could afford to be engaged

in livestock industry. Most of the foreign-born immigrants remained in South Dakota, although they frequently changed occupations from farmer to ranch hand and from miner to agricultural laborer. In the 1880s, an average of about 7,000 newcomers per month arrived in South Dakota. Until about 1890, the agricultural elements of South Dakota and the Black Hills population came mainly from the Midwest and Europe. After 1891, however, the neighboring states, such as Kansas and Nebraska, began to contribute migrants, many of whom were first-generation Americans.

The great influx of miners lasted until 1878 and leveled off after that due to the shift from placer to lode mining. Agricultural South Dakota provided a continuous supply of unskilled laborers for the Black Hills mines. Skilled labor was drawn mainly from other mining states, both neighboring and distant; professional people and administrative personnel came mainly from the Midwest, East Coast, and West Coast; and capitalists, promoters, and financiers came mainly from urban America. Skilled and unskilled laborers were of practically all nationalities.

The invasion and settling of the Black Hills was promoted by vigorous newspaper advertisements and by railroad companies, with especially favorable reports being given in the Sioux City Times, the Iowa Register, Chicago Inter-Ocean, New York Tribune, and Harper's Weekly.

Migration to the Black Hills hastened also county and state organization. A large majority of the towns had their origin as placer camps, and a few survived as permanent settlements without changing in function and creating other industries. Commerce, farming, government, and railroad were among the main stabilizing factors. Practically all of the towns had several cycles of "bust and boom" conditions. Few enjoyed a continuous growth as did Lead.

CHAPTER V

GOLD MINING HEYDAY: 1891-1920

The 1891-1920 period was by and large the Black Hills gold mining heyday: Lode gold production rose, then fell during the period, and meanwhile silver mining became an important adjunct to lode gold mining, even though it fluctuated in production in response to price; moreover, mechanization and electrification of mining procedures came to characterize mining.

Lode Mining

Only rarely was placer mining very profitable, so men began to look for lodes or veins of gold which were being eroded. The real profits were in lodes. Unfortunately, a good deal of capital was required to mine the lode deposits, and few men had the needed funds.

In seeking gold the experienced miner would look for white, rose, or iron-stained quartz, which he ground up in an iron mortar and then panned to see if he had found gold. Miners wanted to lift ore as little as possible; they usually tunnelled at the base of a mountain so that the ore cars could run from mines and mills by gravity. This process was known as "shrinkage stoping" (see appendix).

In hardrock mining, a pick and shovel were useless. Black powder blasting was used--a process which proved to be very risky. To achieve

the greatest effect, all planted powder had to go off simultaneously. One method miners used to insure this was to cut each fuse a little shorter than the previous one and to use a "spitter"—a piece of fuse shorter than any of the attached ones—to light the rest. Miners had a tendency to be overly frugal with the powder, which meant that large hunks of ore had to be blasted again to make them moveable.

As shafts went into the ground, timber beams and braces had to be installed to support the mountain above. Carelessness caused most mine injuries. Cave-ins were common. The cave-in problem was finally solved by the Homestake Mining Company by filling up worked out cavities with sand "tailing"—the residue left after the gold was extracted from the ore. This process was known as "back filling." The stages in gold mining technology are summarized in Table 11.

Population and Settlement

The Black Hills gained in population until the outbreak of World War I, when decreases set in. The agricultural population of the state meanwhile was growing much faster than was the industrial or mining population. The U. S. Bureau of Census showed the following figures:

Date	Black Hills	State	Percent of State Population
1890	28,619	328,808	8.7
1900	32,685	401,570	8.7
1910	49,361	583,888	8.5
1920	43,490	636,547	6.8

The decrease in the Black Hills population after 1910 can be attributed to the following: The use of machines in mining lessened the need for labor, and mining now required fewer transitory and part-time laborers.

STAGES IN THE GOLD MINING TECHNOLOGY

1874–1877	1878–1890	1891–1905	1906–1920	1921–1930
PLACER	LODE			
PICK-AND-SHOVEL METHOD OF MINING; FLUME, SLUICE BOX, ARRASTRA TYPE OF CRUSHER USED.	HARD-ROCK MINING (INITIAL STAGE) SINGLE AND DOUBLE JACK METHOD	HARD-ROCK MINING (INTERMEDIATE STAGE)	HARD-ROCK MINING (ADVANCED STAGE)	HARD-ROCK MINING (MODERN STAGE)
LOCAL RAW MATERIALS ARE UTILISED. POOR TRANSPORTATION; ANIMATE POWER USED IN THE HAULING.	APPLICATION OF SOME MACHINERY IN MINING AND MILLING.	TIME OF GREAT CHANGE AND EXPANSION.	COMPLETE MECHANISATION IN ALL PHASES OF MINING.	
RECOVERY OF GOLD: 60—70% (WASTE PILES LATER REWORKED BY HYDRAULIC METHOD WITH 20—30% RECOVERY)	MAINLY HAND AND DRY DRILLING.	LARGE CAPITAL INVEST.	GREAT DIVERSIFATION	SELF-SUFFICIENCY
DEPTH OF MINING: SURFACE WITH TUNNELS AND DISCOVERY SHAFTS.	MINE WORKINGS ARE SHALLOW; NO VENTILLATION.	MECHANISATION NEARLY 100%.		
	SELECTIVE AND HIGH-GRADE MINING.	ORE GRADE DECREASES; TONNAGE MINED INCREASES.		
	RECOVERY: BY AMALGAMATION 75%	RECOVERY BY: CHLORINATION, CYANIDATION 94%.		RECOVERY: 96%
	CRUSHING CAPACITY: 2.5–5.0 TONS PER DAY PER STAMP.	A NEW DORR CLASSIFYER AND MERRILL ORE PROCESS INTRODUCED.		WET TYPE DRILLING. DIAMOND DRILLING
	MINE WORK: SQUARE-SET TIMBER STOPE.	CRUSHING CAPACITY: 8 TONS/STAMP		
	MINING CAPACITY: 1–2000 TONS PER DAY.	MINE WORK: SHRINKAGE STOPE INTRODUCED.	SHRINKAGE AND CUT-AND-FILL STOPING	CUT-AND-FILL STOPING MAINLY
	ANIMATE POWER STILL IMPORTANT.	ELECTRICITY INTRODUCED. STILL DRY DRILLING.	NEARLY COMPLETE ELECRIFICATION	
	DEPTH OF MINES: 200–600 FT.	CAPACITY: 4000 TONS/DAY	CAPACITY: 8000 TONS/DAY	
		DEPTH OF MINES: 800 FT.	DEPTH OF MINES 2200 FT.	DEPTH OF MINES 3–4000 FT.

SOURCE: SEE FOOTNOTES IN THE TEXT

TABLE 11

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Some of the mining population of the Black Hills was drawn to the Alaskan gold discoveries between 1896-1908, and between 1915-1923 migration to South Dakota dropped from 3,000-5,000 newcomers per month to 800-1,000 newcomers per month--reflecting the end of expansion in the Great Plains agricultural frontier.[1]

Changes in sex ratios and in the agricultural and mining occupational composition also occurred during this period. The proportions of adults grew, and the ratio of men and women became more equal. For example, rural South Dakota in 1890 had 120.4 males to 100 females; in 1900 the ratio was 117.0 to 100; in 1910 it was 118.2 to 100; and in 1920 and 1930, it was 110.5 and 108.3 to 100, respectively.[2] Mining communities in the Black Hills invariably had higher male to female sex ratios than did the agricultural communities in South Dakota, however.

With the exception of a few church and Boy Scout camps and a few resort towns, all settlements were established and the principal transportation-communication lines were completed during the 1891-1920 period. A few mining centers, such as Lead and Deadwood, prospered and grew steadily; others, such as Hill City and Custer, changed functions and survived; and still others were either by-passed by the railroad or were abandoned by the mining industry--and became ghost towns.

Mining Districts

Eventhough there were boom conditions in most of the mining districts which overlapped from one period to the next, six mining districts in

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[1] John P. Johansen, Immigrants and Their Children in South Dakota (Vermillion, South Dakota: Department of Agriculture Experimental Station, Rural Sociology Department, Bulletin 302), p. 6.

[2] Ibid., p. 8.

Lawrence County prospered mainly during the 1891-1920 period. These mining districts are described below.

Bald Mountain Mining District

The Bald Mountain mining district areally is somewhat larger than the Lead-Deadwood area. It is two miles by five miles, and as a producer of gold was second between 1876 and 1930. It is situated west and southwest from the Lead-Deadwood district. Its structure and mineralization are complicated by Tertiary igneous intrusions into the Precambrian and Paleozoic sequences. The ore is silver-rich and contains unusual types of mineral assemblages, such as tellurides. This district was customarily subdivided into sub-districts including Ruby Basin, Portland, and Trojan.

Some 27 major and numerous small mining companies were active between 1891 and 1918. Practically all mining operations ceased by 1918, however, because of the high cost of mining and because of the shortage of skilled labor as a consequence of World War I. A short revival of mining occurred between 1934 and 1942. By 1954, all mining activities had ceased.

Garden City-Maitland Mining District

The Garden City-Maitland mining district is located two and one-half miles northwest of Lead and encompasses an area of approximately three by two miles. Eventhough gold was discovered in this area in 1876-1877, serious mining occurred only after 1901. The ores are similar to those of the Bald Mountain area: spotty, siliceous, oxidized, and mainly of the replacement types in the contact zone between Precambrian and Cambrian formations. Seventeen major mining companies were active in this district, and the major producing period was between 1902 and 1914. Intermittent mining activities, exploration, and sampling continued until

1942 when, by action of the War Production Board, all mining activities were halted. At the present time, most of the mineral ground of this district is controlled by the Homestake Mining Company.

Ragged Top Mining District

The medium-sized Ragged Top mining district in Lawrence County encompasses an area approximately two miles by two miles, and is situated six miles west of Lead. Its discovery in 1886 was late compared to other mining districts. Most mining activities began in 1896. Small placer ores were exploited in the late 1890s. These were soon exhausted, however. Considerable tonnage of the galena and carbonate ores were discovered in the Paleozoic rocks. The gold ores were in irregular pockets and pinched out fissures, and were expensive to mine, so selective high-grading of ores became the standard mining procedure in the district between 1896-1900. Intermittent mining, but mostly sampling and prospecting, occurred between 1912 and 1916. Since 1916, no production came from this mining district. Between 1896 and 1916, nine major companies produced gold in a discontinuous manner.

North Lead Mining District

This district is located on the western margin of the Lead-Deadwood district, and adjoins the Homestake properties a little more than one and one-half miles from Lead. It is only a little more than a square mile in size and is one of the oldest districts in Lawrence County. The district contains a wide variety of ore types, the cement and refractory (siliceous) types being most abundant. Significant mining activities came about as a consequence of inventions in metallurgy, such as the chlorination and cyanidation of refractory ores in the early 1890s. In 1899, tungsten

ore was discovered, giving boost to the mining industry, and by 1900 six major companies mined gold. After two decades of continuous mining, the district declined and the mineral lands were gradually taken over by the Homestake Mining Company.

Two-Bit Mining District

The Two-Bit mining district was one of the earliest to be discovered in Lawrence County. Situated about three miles east of Lead along Two-Bit Gulch, the district is only one square mile in area. Placer gold was discovered in 1876, but only in small quantities. Quartz gold and silver with tungsten and zinc ores were mined intermittently between 1896 and 1913. Most of these ores were low-grade and small in amount. Legal problems over water rights with the Homestake Mining Company and poor transportation facilities handicapped the district's development. Nine mining companies operated in this district with mixed results, and before the outbreak of World War I the district became inactive.

Strawberry Hill Mining District

This district adjoins the Galena district and is located five miles southeast from Lead. It is less that a square mile in size and was the last district to be discovered--in 1893. Small ore reserves and the spotty nature of the lode ore deposits made this district an ephemeral mining venture without any real period of prosperity. Four companies operated in this district for brief periods. By 1906 production from Strawberry Hill was no longer significant.[3]

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[3]George P. Baldwin, Black Hills Illustrated (Deadwood: The Black Hills Mining Men's Association, 1904), p. 175.

Mining Industry Changes

By 1890, the heyday of placer mining was over and was replaced by ground mining. The inexpensive but labor-intensive pick-and-shovel mining had given way to a tunnel-and-shaft mining and its increased use of machinery, planning, and mining engineering. Large quantities of timber for shafts and tunnel supports, mill construction, and other types of construction increased the use of forest resources.

Black Hills gold and silver production from 1876 to 1935 is shown in Figure 21 and Table 12. In addition to these precious metals, other minerals were discovered and mined during this period. Tin deposits around Tinton District, for example, were for a short time heralded to be the largest tin source in the United States. This appraisal was unrealistic, tin mining dwindled, and the total amount of tin mined in the Black Hills amounted to less than $100,000 (Table 12). A few mines produced small quantities of copper and iron. Some zinc, manganese, and bismuth ores were also mined. Despite the varied nature of the mineral deposits, mica and feldspar dominated the industry and made the largest contribution to the prosperity of the county. Most of the mica-feldspar mining occurred between 1892 and 1925. In 1900, for example, 66 mica mines were operating in Custer County.[4]

The names of some of the newly organized mining companies hint at the capital inflow. In the 1890s the Boston Manufacturing Company and the Rochester-Black Hills Manufacturing Company were on the tax roles. Eastern "capitalists," as they were known locally, were eager to invest in the gold mining industry.

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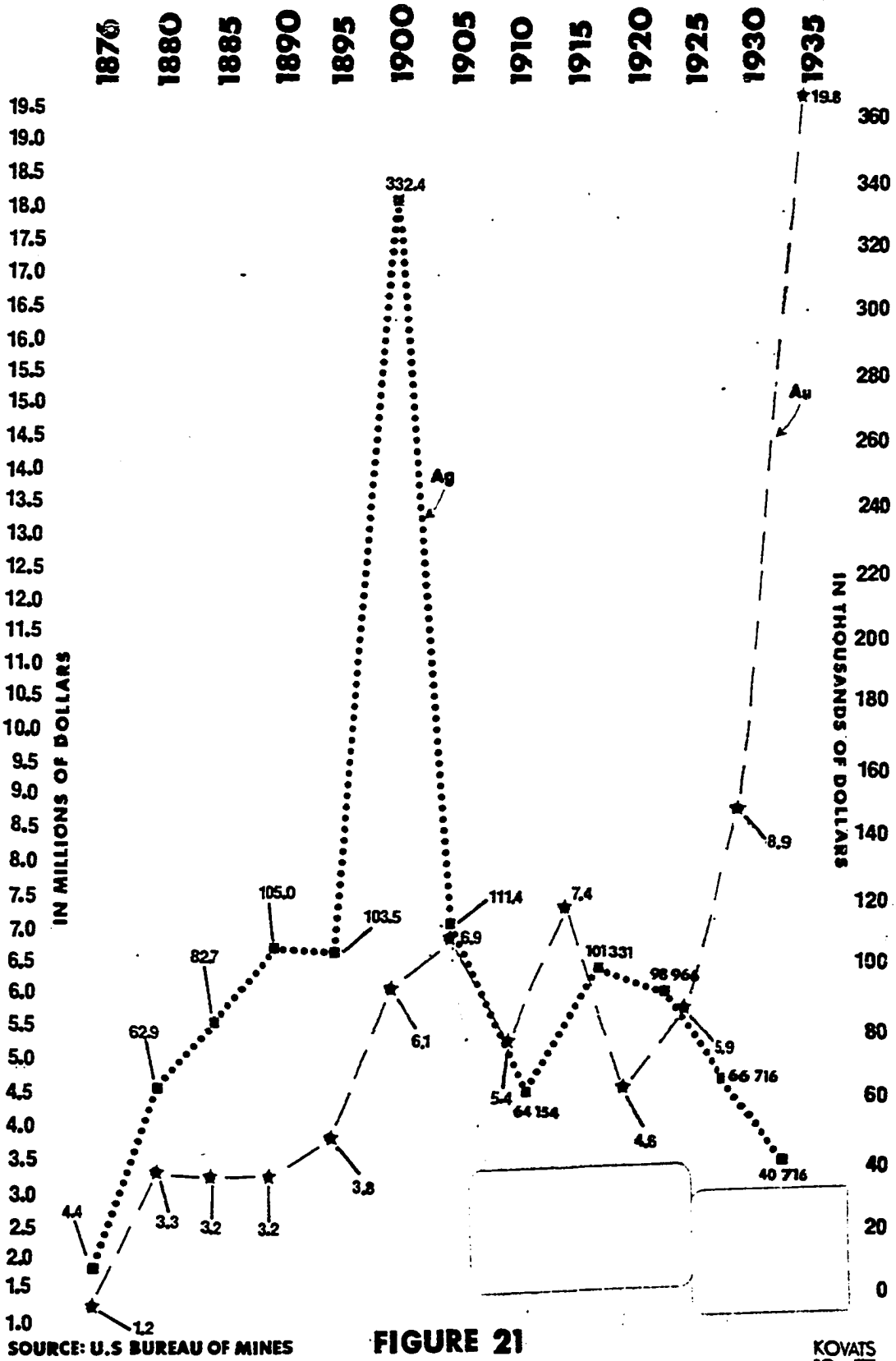
[4] Black Hills Mining Review, Special Issue, Vol. 6, No. 33, August 27, 1900.

GOLD vs. SILVER PRODUCTION, BLACK HILLS



SOURCE: U.S BUREAU OF MINES

FIGURE 21

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TOTAL MINERAL PRODUCTION, S.D. (1875-1934)

PRODUCT	YEARS	AMOUNT		VALUE
GOLD	1875–1934	15 902 134	O	$338 167 648
STONE	1886–1934			12 186 215
SAND/GRAVEL	1909–1934	32 421 289	T	8 442 450
PORTLAND CEMENT	1891–1934	6 045 304	B	8 376 749
SILVER	1875–1934	8 234 979	O	6 634 287
GYPSUM	1884–1934	343 419	T	1 637 525
MICA	1879–1934			1 401 660
TUNGSTEN	1898–1929			1 331 037
LIME	1896–1934	144 719	T	1 304 437
COAL	1895–1934	477 290	T	1 070 392
NATURAL GAS	1889–1934	1 083 871	C	674 323
LITHIUM MINERALS	1898–1934	18 709	T	640 145
LEAD	1881–1932			441 900
FELDSPAR	1923–1934	58 924	T	272 019
PYRITES	?			130 000
TIN	1884–1934	358 862	L	95 410
CLAY	1916–1934	11 246	T	79 453
TANTALUM ORE	1918–1934	80 388	L	54 187
BOG IRON ORE	1893–1925	11 450	T	42 938
COPPER	1897–1918	195 691	L	40 000
ROSE QUARTZ	1889–1934			34 720
BERYL	1914–1934	417	T	20 728
ARSENIC	1924–1925	89	T	7 167
ANDALUSITE/SILLIMANITE	1924–1932	66	T	2 470
POLLUCITE	1928	1 CARLOAD		2 000
ZINC	1906	12	T	1 440
MISCELLANEOUS				50 000
			TOTAL	$383 131 309

O—ozs.
T—tons
B—bbls.
C—cu.ft.
L—lbs.

SOURCE FRANCIS C. LINCOLN, "MINING IN SOUTH DAKOTA", 1937

TABLE 12

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The Lawrence County Example

Lawrence County illustrates the trends reflected in the larger Black Hills mining enterprise. In 1895, 84 companies paid taxes in Lawrence County. Of these, 49 were new companies and 35 were old. Thirty-one companies had ceased to exist.[5] The number of major corporations was six. The largest acreage under one company ownership was 705.3, or more than a fourfold increase from that of 1890. The total mineral land under company ownership almost tripled. This expansion of the mining space resulted from the opening of new mining districts and the staking of new mining claims. As a consequence, lot numbers increased from 577 to 1,018 (Table 10).[6]

By 1895, all the mining districts in Lawrence County had been discovered. Land grabbing and the buying and selling of properties were commonplace. There were about 1,631 individuals or families owning mineral land, and an estimated 40 percent sold acreage to various companies. In addition to gold, silver, and tin, tungsten, copper, and lead were mined.

At the turn of the century, the Lawrence County Mineral and Agricultural Lands Tax List recorded 100 tax-paying mining companies, from which 64 were survivers from 1895 and 36 were newly organized firms.[7] The number of defunct companies was 22 (Table 10). Ten percent of the companies were giant corporations with an average of 500 acres of mineral

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[5] Lawrence County Tax List, 1895.

[6] A mineral lot includes one or more claims; thus the size of a lot is variable. A normal claim is 300 by 1,500 feet. The figure of 1,018 includes both company and individual owned mineral lands; in addition to townsite, real estate and other businesses.

[7] Lawrence County Tax List, 1900.

lands. The largest company owned 2,631.5 acres in Lawrence County. The lot number increased from 1,018 to 1,244. Company-owned mineral ground now had increased to 6,006.5 acres, almost twice that of 1895. Individually-owned mineral properties numbered 2,010, and 45 percent of the owners sold part or all of their property between 1895-1900.

Persistent growth characterized only a few companies. The successful companies included the Homestake Mining Company, the Deadwood-Delaware Smelting Company, and the Golden Reward Manufacturing Company. Companies such as the Father DeSmet Company and the Caledonia Company, which had been very successful in the 1880s, declined in prominence in the 1890s, and much of their property was taken over by the Homestake Mining Company. High taxes, mismanagement, the rising cost of mining, and insufficient quantities of high-grade ore reserves were among the main reasons for their decline.

By 1905, the following had developed: The number of companies had increased from 100 to 128; 59 were new companies, representing a five-year growth recrod. The number of bankrupt companies (37) was also at an all-time high in Lawrence County mining history (Table 10).[8]

The largest acreages under one-company ownership remained almost unchanged: 2,631.5 acres in 1900 and 2,646.5 acres in 1905. The total mineral land under company control increased substantially, however. By 1905, the acreage was 16,787.8 as compared to 6,006.6 acres in 1900--a better than 270 percent increase. Individuals paying taxes numbered 1,192, of which 198 had sold properties. Data on the size of mining companies in Lawrence County are summarized in Table 13.

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[8]Lawrence County Tax List, 1905.

THE SIZE OF MINING COMPANIES IN LAWRENCE COUNTY, S.D.

MINING LAND IN ACRES	1880	1890	1895	1900	1905	1910	1915	1920	1925	1930
2-30	25	24	56	62	57	58	55	49	42	37
31-60	-	7	11	19	25	28	27	23	16	13
61-150	-	9	10	10	24	24	27	21	22	18
151-200	-	-	1	1	4	4	5	4	5	4
201-500	-	-	1	4	9	13	7	9	7	6
501-1000	-	-	1	3	4	8	6	3	3	4
ABOVE 1000	-	-	-	1	4	5	6	6	5	3
TOTAL	25	40	80	100	127	140	133	115	100	85

SMALL
MEDIUM
LARGE
COMPANIES

SOURCE: COUNTY COURTHOUSE, DEADWOOD, S.D

TABLE 13

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Lot numbering increased from 1,244 to 1,836, indicating the expansion of mining space and the unprecedented number of new mining companies. Small mining companies from .2 to 150 acres, still dominated the numbers—in 1900, there were 91 small companies, and 106 in 1905. There was, however, a slight shift toward companies with medium and large acreages (Table 13).

The number of active companies reached an all-time high in 1910: 140, of which 109 were old companies and only 31 were newly organized firms.[9] The largest acreage owned by one company decreased somewhat, but was still above 2,000. Mining space increased by about 5,200 acres over that in 1905. The increase is also indicated by the large number of lots. Mineral acreage controlled by mining companies and corporations amounted to 22,067.9, or somewhat less than five percent of Lawrence County (Table 10).

Companies of more than 200 acres increased from 17 in 1905 to 26 in 1910, eventhough small companies also increased (Table 13). Only 20 companies were eliminated, compared to 37 in 1905. Approximately 20 percent of the companies controlled acreages between 30 and 60 acres, and 63 percent owned less than 30 acres. In 1910, there were 26 companies with acreage above 200. Thus, both small and large companies increased in size during the five-year period.

Among the leading corporations, the Clover Leaf, Branch-Mint, Golden Reward and the newly organized Anaconda mining companies were noteworthy. In the 1890s the Homestake Mining Company became the leader in mineral lands owned, gold production, and employment, and it has maintained that leadership to the present day. In 1915, the number of individual-ownership companies (1,522) reached an all-time high.

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[9] Lawrence County Tax List, 1910.

There were 133 mining companies in Lawrence County in 1915, of which only 22 were new and 111 were surviving companies. The number of companies to cease operation was 28 (Table 10).[10] Even though the number of leading companies declined from 26 to 19, the largest acreage under one-company control doubled from 2,115.3 acres in 1910 to 4,334.6 acres in 1915.

Mineral acreage under company ownership showed only a slight increase—from 22,067.9 acres in 1910 to 24,618.4 acres in 1915. This somewhat more than 2,000 acre increase is also indicated by the moderate increase in lot numbers—from 1,964 to 2,060.

The number of small companies remained the same as in 1910, medium-sized firms decreased by five, and large companies also decreased somewhat. The number of corporations controlling more than 1,000 acres increased, however (Table 13). In 1915, individual or family ownership declined from 1,522 to 1,150, of which 131 (12 percent) sold mineral properties.

In 1920 the number of mining companies was 115; 16 new companies had been formed, 34 had gone bankrupt or were reorganized, and 99 had survived (Table 10).[11] Small companies were reduced from 109 to 93; medium-sized companies remained the same; yet large companies above 500 acres were reduced from 12 to 9 (Table 13).

The maximum acreage under a single company increased substantially—from 4,334.6 to 6,782.3 acres, an all-time high. The total mineral land

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[10] Lawrence County Tax List, 1915.

[11] Ibid., 1920.

acreage increased only slightly--from 24,618.4 acres in 1915 to 25,462.8 acres in 1920. The total mining company mineral acreage and the maximum acreage controlled by a single company between 1880 and 1930 are given in Figure 22.

The 1920 tax list gave 115 companies, 99 of which were survivors and 16 new companies. Bankruptcies numbered 34.[12] This 30.5 percent rate of bankruptcies was related mainly to the rising cost of mining and labor shortage as the consequence of World War I. Small companies were reduced in number, whereas the largest acreage of company ownership increased from 4,334.6 to 6,782.3. The total company-controlled mineral lands also increased by some 850 acres (Table 10). By 1920, 992 individuals owned mineral land in Lawrence County, or 158 less than in 1915. The number of small, medium, and large companies, and the size of their properties, are shown in Table 13.

Summary

The 1891-1920 period was critical in Black Hills gold mining because underground mining became the main source of wealth, the use of machines in mining became widespread, electricity was introduced, and as mines deepened new mining techniques were applied. These changes created new problems including the acquisition of capital, the allocation of mineral resources, and the introduction of safety regulations and mining engineering. Moreover, changes in the nature of gold mining and in mining/milling technologies affected the composition of the mining labor force, and at the same time a significant drop in the in-migration was noticed.

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[12] Lawrence County Tax List, 1920.

MINING COMPANIES & MINERAL LANDS
LAWRENCE COUNTY, S.D.

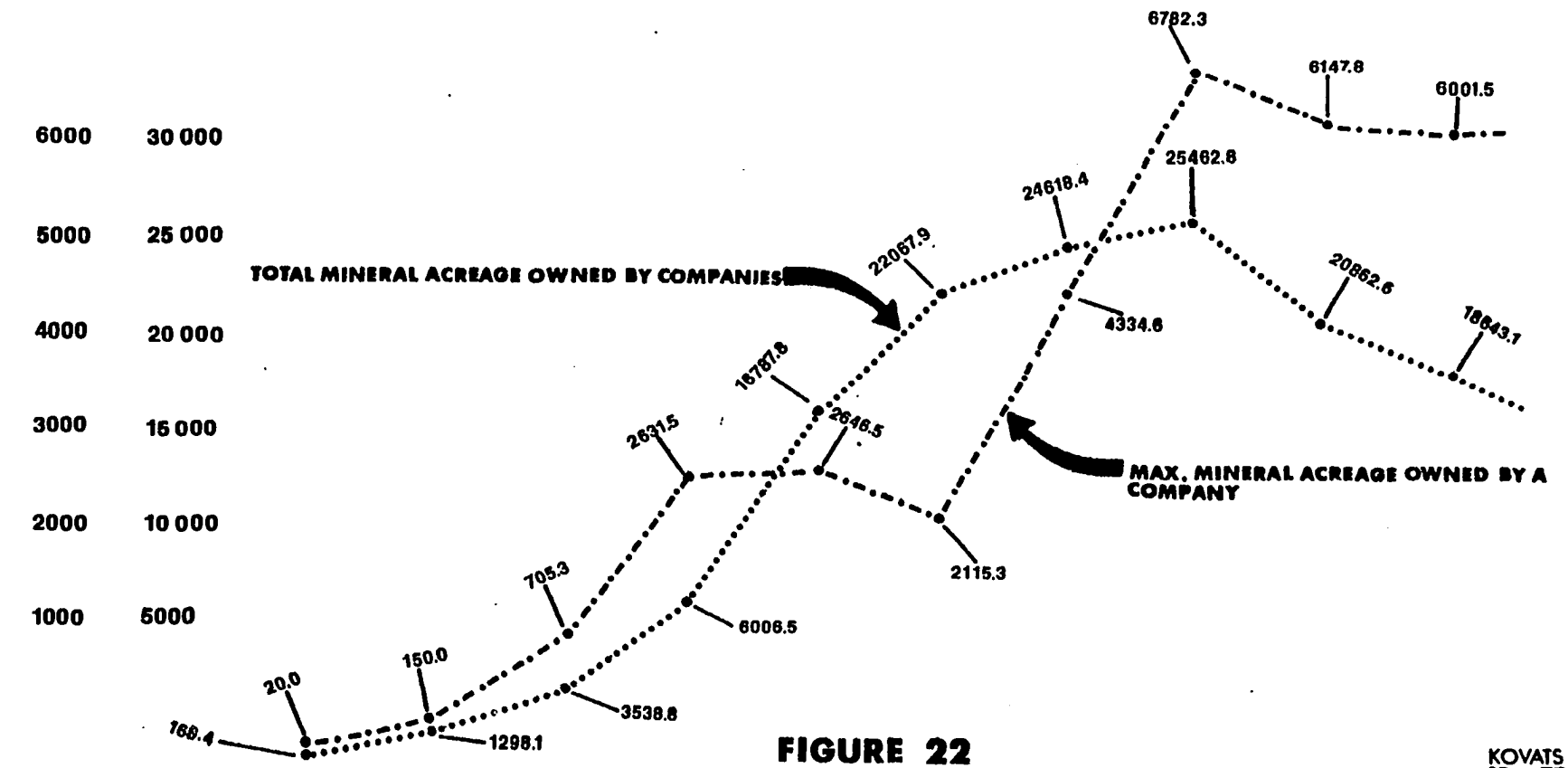

FIGURE 22

KOVATS
19 77

In 1910, gold and silver production reached $5.4 million and $64,154 respectively. By 1910 the maximum acreage under a single company management increased from 4,334.6 acres to an all-time high of 6,782.3 acres, and a peak was reached in the total mineral acreage owned by companies (25,462.8 acres).

Eventhough the number of companies reached a maximum during this period, most survived for only a short time. The majority of companies were integrated into several, large, mining corporations. The Homestake Mining Company took the lead in absorbing mining companies and mining properties.

CHAPTER VI

GOLD MINING DECLINE AND REJUVENATION: 1921-1935

Black Hills mining underwent additional change after 1920. The number of large, medium, and small companies kept declining, particularly after 1925 (Table 13). This general decline came about through the exhaustion of gold and silver ores near the surface, the continued deepening of the mines, and the necessity to apply sophisticated mining technology to make mining profitable. As mining became difficult and expensive, marginal and declining companies were eliminated and mining space in the Black Hills was consolidated under virtually single-company domination.

Population and Settlement

Even though a large number of mining companies went bankrupt and the mining industry in the Black Hills underwent drastic reorganization and technological change, the population of mineral counties showed an increase. Some change in the total mining population was inevitable. However, Lawrence County, for example, had 13,029 inhabitants in 1920, 14,920 in 1925, and 13,920 in 1930. This five-year decline in Lawrence County reflected the changes in the composition of mining population. The mining industry which previously attracted large numbers of foreign-

born immigrants, now began to rely on fewer but better educated and professional people who were mainly American-born, and so the immigration of the foreign-born decreased. For example, the county had 2,564 foreign-born in 1920, 2,302 in 1925, and only 1,783 (most of them miners) in 1930 (Tables 5 and 6). The decrease in the in-migration of foreign-born can also be noted in the state. The foreign-born proportions in South Dakota were as follows: 12.9 percent in 1920 and 10.4 percent in 1925.[1]

Population statistics pertaining to specific Black Hills occupations between 1915 and 1935 are revealing. Some of the "old" professions such as livery man, blacksmith, and miller declined or ceased altogether, while others such as engineer, lawyer, and machinist grew. A decline in the number of railroad employees was also noticeable. Farmers, agricultural laborers, and unspecified laborers showed a substantial increase in most of the Black Hills counties until the late 1920s, and then declined because of the Great Depression. The mining population in Lawrence County, for example, which was 1,752 in 1915, decreased to 1,004 in 1925, and increased to 1,352 in 1935 (Table 14). Because the value of gold has the tendency to increase during economic depressions, Black Hills gold mining was stimulated during the depression years.

Urbanization in South Dakota showed steady increases after the 1880s. In 1915, 36.8 percent of the state's population resided in cities over 2,000; in 1920, this percent was 37.2, and by 1925, it was 39.0.[2] The trend still continues. Mining towns of the Black Hills showed a great deal of variation in the process of urbanization, however. For example, Deadwood and Custer,

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[1] Fourth Census of the State of South Dakota, 1925, p. 4.

[2] Ibid., p. 8.

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SPECIFIC OCCUPATIONS, 1915-1935
(BLACK HILLS COUNTIES)

		AGR. LABORER	BANKER	BLACKSMITH	CONTRACTOR	ENGINEER	FARMER	HOTEL KEEPER		HOUSEWIFE	LABORER		LAWYER	MACHINIST	MERCHANT		MINER		RR. WORKER	STOCKMEN		STUDENT		TEACHER		RETIRED
							★	M	F		M	F			M	F				M	F	M	F	M	F	★
BUTTE	1915	39	9	11	14	6	1085	5	10	1249	199		8	1	46	2	4			359	4	449	464	4	42	22
	1925	24	11	7		13	1119	3	2	1623	219	19	3	26	49	2	5		16	53	2	406	314	6	100	29
	1935	57	19	6		17	1003	8		1727	950		11	46	66		4		9	176		192			77	91
CUSTER	1915	4	4	7	2	1	361	5	5	700	94		2	4	28	1	6	53	19	307	30	242	226	7	46	58
	1925	6	7	7	3	4	941	3	4	854	133		2	19	26	4	3	6	15			80	74	9	22	14
	1935	1	8	8		8	747	2		1268	484		8	33	43			30	14	89		786			66	37
FALL RIVER	1915		12	7		11	790	13	6	1293	358		14	21	67	6	1	9	96	44	7	383	380	13	45	45
	1925	1	5	6	6	9	391	10	3	869	240	11	17	26	74	4	8	6	174	43	7	86	113	9	46	19
	1935	23	9	6	4	19	959	46		1804	439		12	39	120			4	97			1	1366		106	106
LAWRENCE	1915	1	21	57	49	86	711	22	8	3548	856		46	90	229	16	184	1782	296	27	1	1166	1331	29	117	161
	1925	80	29	47	89	45	561	9	6	3500	794	80	16	174	156	19	47	1694	129	12	2	1109	1209	89	178	196
	1935	19	22	46		77	819	15		4566	1232		22	207	2061			1852	44	25		2664			250	116
MEADE	1915	8	4	10	4	8	2018	3		2054	63	1	8	8	30	1	2	1	6	163	1	692	600	2	67	20
	1925	28	8	11	9	7	2167	4	2	1892	296	2	8	33	62	2	3	8	19	88	4	406	367	19	121	64
	1935	46	8	8		4	1979	14		2063	899		12	53	116	4		16	13	205		1074			167	96
PENNINGTON	1915	1	21	16	19	16	1111	14	10	2226	864		13	22	87	4	19	190	47	267		771	762	29	161	85
	1925	1	26	16	41	46	1396	17	8	2702	662	17	20	68	89	21	46	58	127	132	34	972	829	56	204	151
	1935	16	19	24		16	1865	30		4279	1662		27	31	271		7	63	148	417		2469			239	83

★ M PLUS F

SOURCE: THIRD, FOURTH & FIFTH CENSUS OF THE STATE OF SOUTH DAKOTA 1915, 1925 & 1935

TABLE 14

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previously important centers of mining, gradually changed their economic functions and became retail, service, and tourist centers. Lead remained essentially a one-industry town and reflected in population the changes taking place in the gold mining inustry between 1915 and 1935 (Figure 23). Rapid City, the "Gateway to the Black Hills," was established as the center of commerce, education, and services, and showed a steady growth. Spearfish, a college town with minor services and industries, and Hot Springs, an administrative center and resort town, grew impressively between 1920 and 1935 (Figure 23).[3]

Most mining towns in the Black Hills stagnated, declined, or were abandoned by 1920. Only a few towns in the vicinity of newly discovered mineral deposits (for example, tungsten and pegmatite) experienced short-lived revival or prosperity. Some of the mining towns such as Keystone and Hill City became tourist centers.

Mining Industry Changes

In Lawrence County between 1920 and 1935, the number of small mining companies (those owning less than 150 acres of mineral land) decreased, medium size companies (151-500 acres) held their own, and large companies (over 500 acres) decreased (Table 13).[4] The total number of companies decreased from 115 in 1920 to 100 in 1925, and by 1930 and 1935 there were only 85 and 56, respectively (Table 10 and Figure 22). Only one new mining company was organized in 1935, whereas in 1920 the number of newly organized companies had been 16 (Table 8 and 10).

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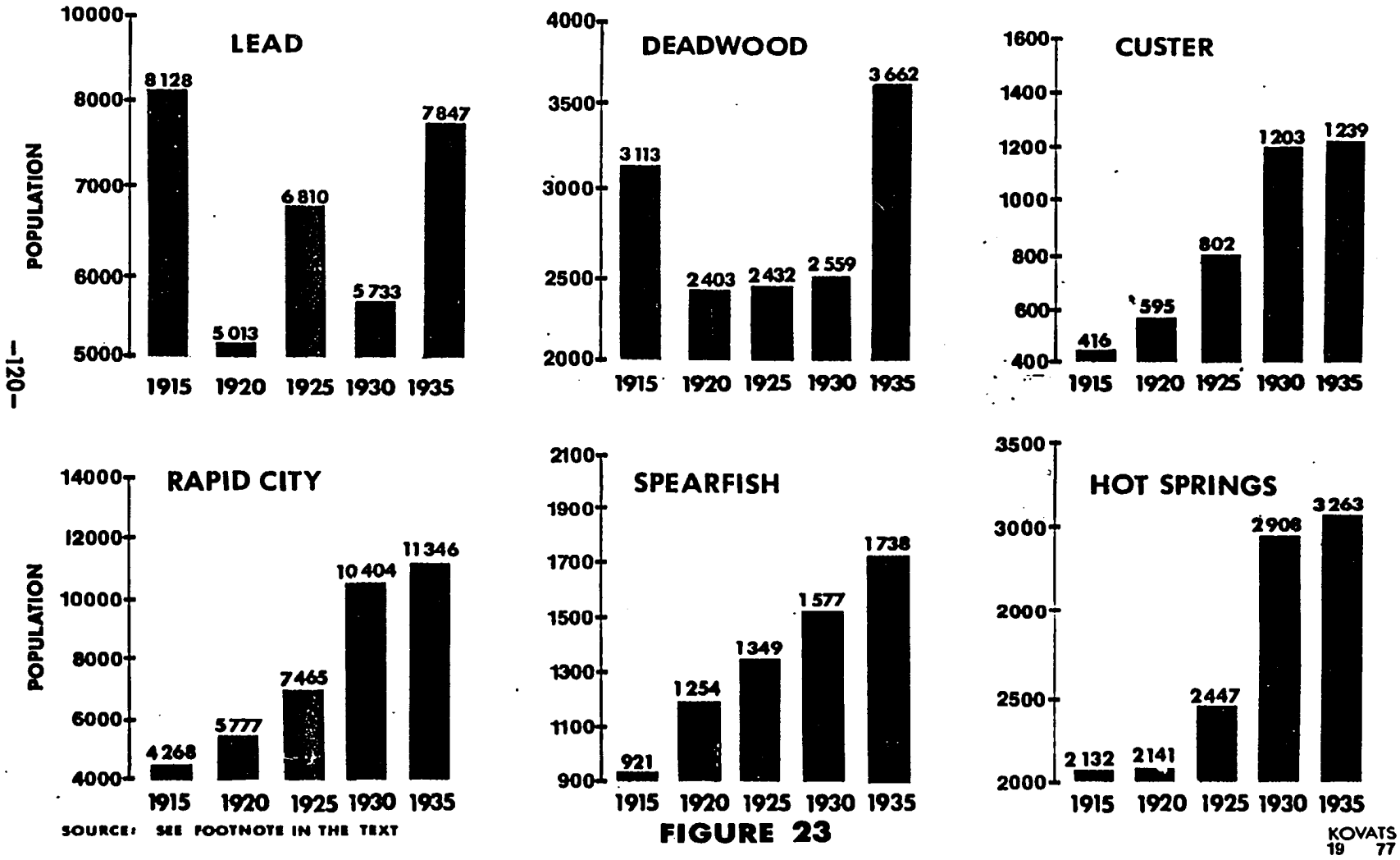
[3] Fourth and Fifth Census of the State of South Dakota, 1925 and 1935, Table III, pp. 9-11, and Table III, pp. 11-15, respectively.

[4] Lawrence County Tax List, 1930.

SELECTED CITIES



SOURCE: SEE FOOTNOTE IN THE TEXT

FIGURE 23

KOVATS 19 77

After peaking in 1920, the mineral acreage owned by companies greatly declined. The maintenance of marginal mining properties became prohibitive because of the high taxes. So large acreages were disposed of, abandoned, or sold for watershed, cropland, and timber usage. Acreage owned by any single company reached a maximum in the 1920s (Figure 22). The number of individuals holding mining property also decreased--from 992 in 1920 to 796 in 1930 (Table 10).

In the 1920s and 1930s, a small and short-lived boom occurred in the Roubaix, Galena, and Maitland districts. The only mining district to grow significantly was Lead which was dominated by the Homestake Mining Company. By 1930, Lawrence County had 165 major mines, of which 94 were gold-silver mines and 30 were silver-lead mines. However, only a dozen or so mines were producing, for the rest had been mined out, abandoned, or intermittently mined. The density of mines in Lawrence County is illustrated in Figure 24.

Even though the number of mines (258) was much higher in Pennington County, very little mining activity occurred between 1920 and 1930. Custer County had 360 mines, of which 112 were feldspar, 51 were mica, and 53 were gold-silver mines (Table 10). The most profitable mines were mainly the feldspar, lithium, and mica ones which began to produce in 1924 (Table 12).

The lode gold production in the Black Hills ($4.6 million) was at an all-time low in 1920, but by 1925 it rose to $5.2 million, to $8.9 million by 1930, and to a record $19.8 million in 1935. The increase in the price of gold from $31 to $34 per ounce in the early 1930s spurred gold mining, and this lasted to World War II.

DENSITY OF GOLD MINES, LAWRENCE CO., SOUTH DAKOTA, 1930s

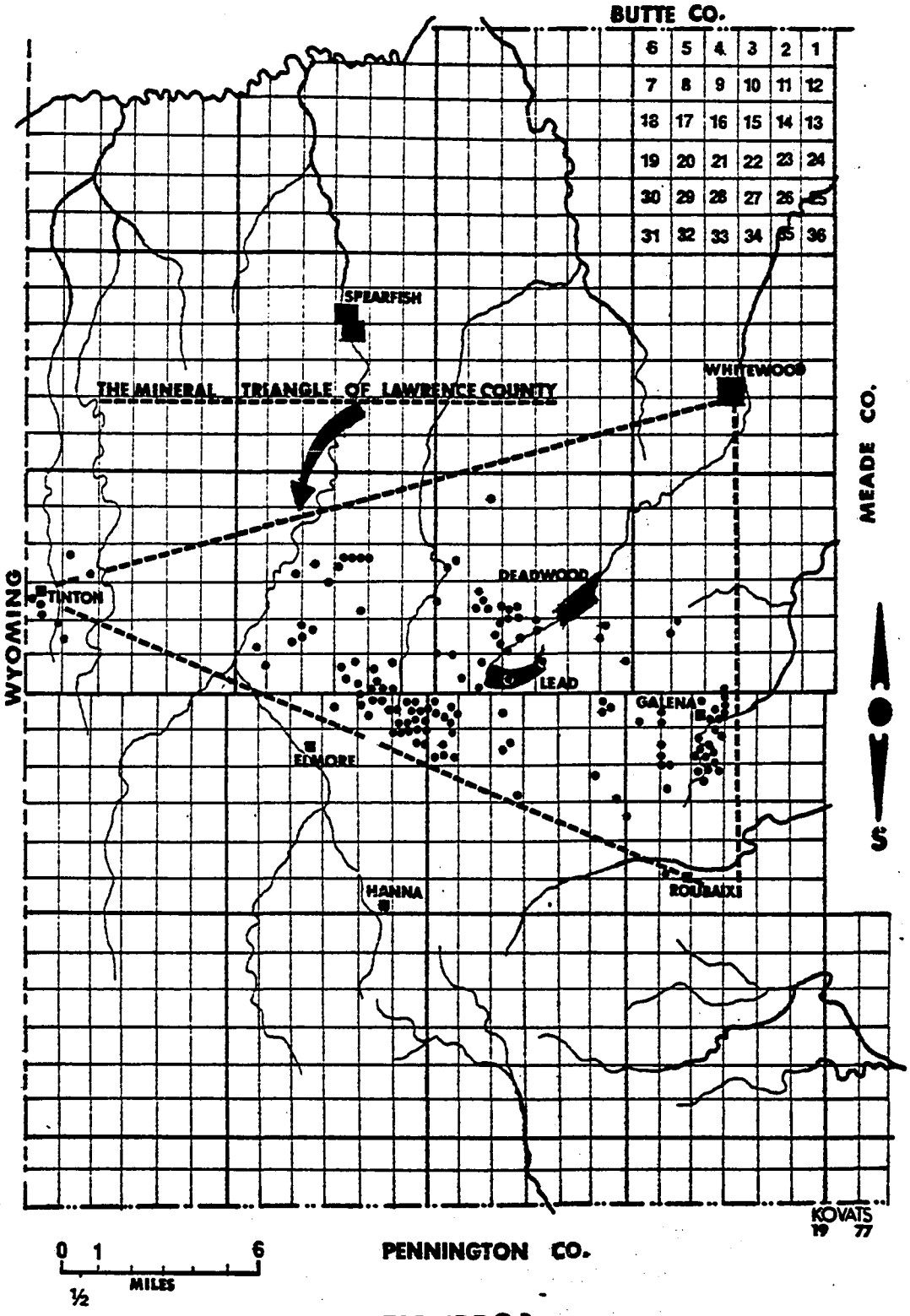


FIGURE 24

Summary

Mining in the Black Hills underwent significant changes between 1920-1935: 1) Mechanized production, particularly in the Homestake mines, resulted in lay-offs of unskilled and semi-skilled labor, and with it foreign-born in-migration decreased; 2) the mining industry came to be dominated by a few giant corporations, particularly the Homestake Mining Company; 3) consolidation was achieved or small companies were acquired, and marginal companies went out of business; 4) increased production costs, high taxes, and other economic factors contributed to the consolidation; and 5) large mineral acreages were disposed of or changed hands.

CHAPTER VII

THE HOMESTAKE MINING COMPANY

The Homestake Mining Company is one of the oldest, most successful, and best known gold mining companies in the United States. Its success story has been analyzed and described countless times through mining journals, articles, newspaper editorials, and pamphlets. Since its inception, the Homestake Mining Company served as an example to other Black Hills companies for its farsighted management, production, profitable mining, and for its readiness to invest and adopt advanced mining technology. The "Success and Longevity Chart" (in the gold mining industry) is based on the Homestake example (Figure 25).

Company History

The lengthy and continuous history of the Homestake Mine, today situated in the southeastern part of Lead, South Dakota, began with the discovery of an outcrop or ledge in Gold Run Gulch on April 9, 1876. The discoverers were Moses Emanuel and Henry (Hank) Harney, who had come from Montana with two other partners, Fred Emanuel (the brother of Moses) and Alexander Engh. Moses Emanuel, an experienced hard-rock miner and world traveler, came to the Northern Hills with the Deadwood Gulch stampede. He was searching for lode gold while the ground was still snow-covered, though melting, and seeing a quartz vein outcrop on the side of

SUCCESS & LONGEVITY CHART

(IN THE GOLD MINING INDUSTRY)

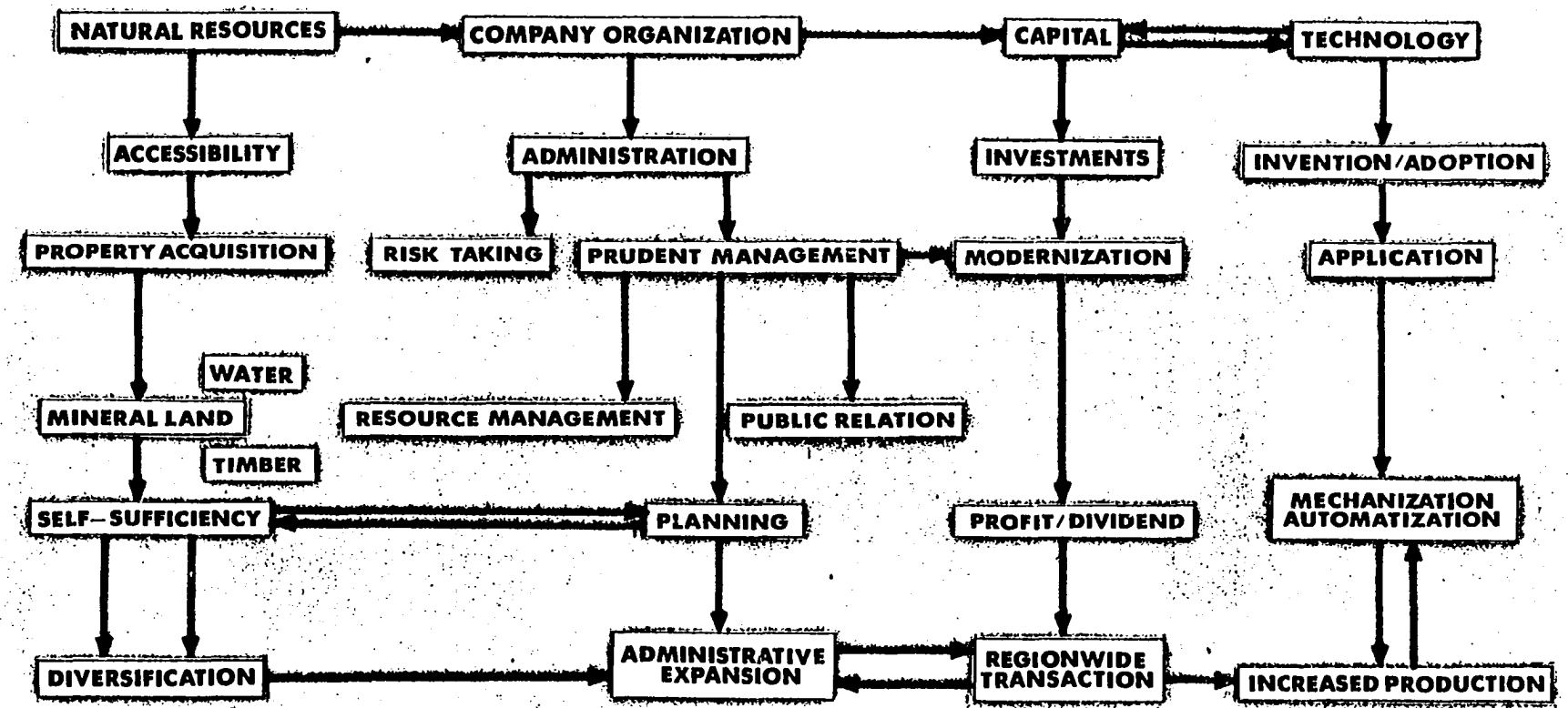


FIGURE 25

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the gulch, he supposedly turned to his partner, Harney, and said, "Hank, this is surely a homestake." The term "homestake" meant, in miner's parlance, enough money to return to the "States" in style. The claim, and hence the mine, was thus named "Homestake."

A mine generally could not be sold without some developmental work to prove its worth, and so the business-minded Moses Emanuel ("Manuel" for short) dug a discovery shaft and performed some open-cut work on the claim which was four and three-forths acres, a mere fraction of a normal claim. An access road to the mine, and an arrastra (a crude crusher) were built, and during the winter of 1876-1877, some $5,000 worth of gold was taken out from the mine.

Several other promising mines, such as the Highland and Golden Star, were also discovered in close vicinity to the Homestake claim, creating excitement beyond the boundaries of the Northern Hills. Rumors soon reached California and two prominent San Francisco capitalists, George Hearst and J. H. Haggen, dispatched an agent in June of 1877, to examine and negotiate for promising mining properties. The Homestake and another property were bonded and then purchased by the California syndicate.

The exact amount paid for the Homestake claim is not known, but an estimate of $105,000 seems reasonable.[1] The Homestake Mining Company was organized on November 5, 1877 and was incorporated under California law with capitalization at $10 million (100,000 shares at $100 a share).[2] Four other

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[1] Tallent, p. 381.

[2] Baldwin, p. 124.

corporations were then organized in 1878, and these were absorbed into the Homestake by 1880, although for some time they were considered separate companies.[3]

With the acquisition of mining properties around Lead, both water and timber lands were also acquired and secured at an early date. Extensive ditch and flume construction was undertaken, and every "miner's inch" of water was claimed.[4] A continuous timber supply from the forest around Lead was secured by a narrow-guage railroad built in 1879--the first railroad in the Black Hills. A sawmill that produced an average of two million running feet of timber per year; the Homestake was one of the largest single timber users in the Northern Hills.[5]

The Homestake's success was greatly enhanced by large-scale mill construction. During the first half of 1877, two custom mills were erected, the first quartz mills in the Black Hills. Other mills were soon constructed. By the end of the 1880s, the combined mill capacity of the Homestake Mines was 900 stamps, or 3,000 tons, per day, representing about 70 percent of the total Black Hills mill capacity, and making Lead the leader and the "City of Mills."[6]

Although valuable mining grounds, adequate water and timber supplies, and sensible mill construction were considered the bases for early successes,

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[3]The organized corporations were: Golden Terra Mining Co., January 24, 1878; Giant and Old Abe Mining Co., September 25, 1878; Deadwood-Terra Mining Co., October 4, 1878; and Highland Mining Co., October 4, 1878.

[4]"Miner's inch" refers to a unit flow of running water in a unit time, first used in California placer mines.

[5]Tallent, p. 384.

[6]Black Hills Mining Review, Vol. 3 (September 13, 1897), p. 4.

the continued growth and expansion of the Homestake Corporation could not have been achieved without conservative but farsighted management that developed a large-scale, systematic strategy to mine vast, low-grade ores, and to provide for continuous investment for improvements, research, and modernization of mining and milling techniques. These prudent decisions made the Homestake the leading operation at an early date; the Homestake set the example for the gold mining industry in the Black Hills and even the entire country.

By 1880, $450,000 in dividends were being paid on a total production of $1,305,903 in gold bullion. Production as well as dividends remained fairly constant until 1890. These were important signs of stability. In general, gold production ranged from $1.1 to $1.6 million per year, while dividends ranged from $150,000 to $676,000.[7]

Large-scale investment in developments consumed a large share of profits. In the 1890s, the less expensive phase of lode mining came to an end as the high-grade ores near the surface were mined out, mainly by the open-cut method. The plunging veins in the deeper levels carried lower grades of gold ores which had to be retrieved by costly shaft sinkings, cross-cuts, and tunnel developments, and for these procedures most mining companies lacked capital. Between 1892 and 1894, the Homestake Corporation bought up a number of small companies, investing $521,170 in mining properties, and thereby increasing its ore reserves from eight to 20 years at the going rate of mining.[8] In 1895, $3 million were again invested in

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[7] Joseph H. Cash, Working the Homestake (Ames, Iowa: The Iowa State University Press, 1973), p. 21.

[8] Ibid., p. 22.

mining grounds, mills, research, and technological improvements.[9] By the late 1890s, the company had acquired a near-monopoly on all the promising mining grounds around Lead. Additional mining claims were purchased from both individuals and companies in 1899-1900, which cost $1.6 million, so by this time the corporation controlled 584.5 acres of mining ground--a three and one-half fold increase from the acreage owned in 1895 (Table 15).

In 1902, the Deadwood-Terra mining complex, which included the famous DeSmet mine, came under Homestake control, as did the once productive Caledonia mine. These acquisitions practically completed the consolidations of the big mines in the Homestake mineral belt. Expansion did not cease with these significant acquisitions, however. The Homestake Company moved into other mining districts, such as the Whitewood district, where in 1912, two giant companies, the Columbus and the Hidden Fortune, were taken over. The Oro Hondo mine was incorporated in 1925.

The ultimatepurpose of these acquisitions was to give Homestake complete and competition-free control over the entire ore belt in the region. This also meant centralized operations, unilateral management, long-range stability, and greater profits and efficiency. The combination of new properties, increased ore reserves, and an emphasis on modern mining technology increased production and revenue from which the increased taxes and cost of mining were met. In fiscal year 1902-1903, for example, $5 million worth of gold was mined, compared to $2.6 million in 1897. Dividends paid jumped to $819,000 from $676,000 paid in 1895. These and other statistics are presented in Table 15.

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[9] The Black Hills Mining Review, Vol. 1 (November 18, 1895), p. 6.

THE GROWTH OF THE HOMESTAKE
(1878 – 1930)

	1878	1879	1880	1882	1885	1887	1890	1892	1895	1897	1900	1902	1905	1907	1910	1912	1915	1917	1920	1922	1925	1927	1930
NUMBER OF CLAIMS	2			6			12		28		96		218		241		306		401		379		502
ACREAGE OF CLAIMS	8.7			30.0			54.2		133.8		584.5		2646.5		2115.3		4334.6		6782.3		6147.8		7000.0
NUMBER OF STAMPS	80	200	580	620						700	720		900		1000				1020		1200		1600
NUMBER OF MILLS	1	2	3							4	5		6							12		8	6
MILLING CAPACITY	240	600	1660	1860		2000		2600	2700	3000	3900		4000	4100		4300			4500	4600		7490	7660
NUMBER OF SHAFTS	1				2			3						6			5			4		3	2
DEPTH OF MINES	100	400			800		700		940		1000		1250	1800			2000	2200		2370		2400	2900
TONNAGE MINED	35 000	70 000	180 000		213 000		285 700		395 500		620 400		938 000		1.5		1.6		1.3	1.6	1.5	1.4	1.3
PRODUCTION BY VALUE	1.3				1.6					1.8	4.2	5.0					7.7		4.4		5.9	6.6	8.4
FOOTAGE DRIVEN																		19 320	7 737			21 199	
UNDERGROUND WORKS	2			5		7	11		25		30	38	40		50		55		59	62	64	66	73
ORE VALUE/TON MINED	$9.20		6.50	5.73	5.82		4.55		4.63		4.50	3.53	3.75		3.50		3.15		4.00		4.55		6.15
ORE RESERVES									10	25						30							
PAYROLL									56 000		200 000			195 000									
NUMBER OF EMPLOYEES							1500			1800	2000				2600	2500			2200				
DIVIDENDS PAID											1.1				1.3		2.2	1.7	1.5				2.1

TABLE 15

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Efficiency in mining and milling is made apparent when one realizes that ore mined from deeper levels averaged only $3.60 per ton in early 1900s compared to $5.00 to $6.00 per ton in the 1890s. Profits increased at the same time; even the $1.00 per ton ore resulted in a 20 to 30 percent profit.

In 1903-1904 there were 1,000 noisy stamps crushing ore in five mills, and two of the largest cyanide refining mills in the world were continuously operating in the Lead-Deadwood area. By 1905-1906, Homestake was already mining on the 1,550 foot level and had constructed a locally-innovated, modern slime plant in Deadwood to retrieve the last bit of powder-gold from the waste. Old tailings were also reworked profitably after 1895.

The Labor Force

The company maintained good relationships with labor. A local miner's union was organized in the spring of 1877, almost simultaneously with the organization of the company. The Lead City Miners Union, as a charitable and benevolent agency, was organized. . .

> for mutual protection and for the purpose of securing for the men engaged in the hazardous occupation of mining for wages, a just compensation for their labor, and the right to use the fruits of their toil, without let, or hindrance, or dictation from their employers, and to otherwise protect their mutual interest.[10]

The union paid up to $75 for funeral expenses in case of death caused by a mining accident. For those who were unable to work because of illness or injury on the job, the union assumed legal expenses, if needed, and paid a compensation of $8.00 per week for a maximum of 16 weeks. The union,

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[10]Cash, p. 37.

according to the charter, was dedicated to labor solidarity, recruiting miners for work, and providing recreational and other social services. In 1878 and 1892, the union constructed an impressive building on the Main Street of Lead. It contained a number of stores, facilities for club meetings, and a library, and soon became the cultural center of the community.

In 1892, 1894, and 1895, the union drew additional fees from its members to aid striking miners elsewhere, such as at the silver miners of Coeur d'Alene, Idaho; the Anaconda Copper miners of Butte, Montana; and even striking railroad workers. Such actions meant interference, to which the Homestake expressed objections. The company did not disapprove of unionism, however. Good pay, stability, and job security prevented friction for the time being, and generally cordial and polite relationships existed between the company and the union. However, the company would not recognize the union as a bargaining agent for all the miners and insisted on the "open shop" system--that is, non-union workers were also hired with almost the same frequency as union members. Until 1909, problems between labor and management were amicably settled and no outstanding differences existed on vital matters such as the wage scale. In 1904, the Homestake established the labor department which assumed the task of hiring and firing, previously done by shift bosses who occasionally were discriminatory. Also, in 1906, the eight-hour work day was accepted for all Homestake workers for the same wages previously earned under the 10- and 12-hour days.

The first, and by far the most serious, labor dispute began in 1909 when the union requested that all non-union workers join the union.

As a counter measure, and to avoid a strike, the superintendent ordered the mine and mills shut down from November, 1909 until January, 1910. This action precipitated heated argument, agitation, violence, and panic. Ultimately, the lockout became the demise of the union. Most miners disassociated themselves from the union, while hard-core unionists were expelled and moved elsewhere.

Following the collapse of the union, Homestake willingly took over some of the functions the union had performed, and it extended social services toward miners and the City of Lead. In 1910, the Homestake Aid Fund Association was founded. Between 1912 and 1914, a three-story recreational building was constructed of brick on Main Street at the cost of $250,000. In 1917, a retirement and pension system was introduced, hospital services were expanded, and medical, surgical, and obstetrical care was improved. In 1920, a new pay scale went into effect because of inflationary trends, and a new system of contract mining was introduced to provide more incentive, income, and efficiency in mining operations. A new hospital was added to the old one in 1923, and a research project on silicosis was implemented. In the later part of the 1920s, $1.5 million was invested in community welfare work. Churches, regardless of denomination, received $7,500 yearly. The maintenance of the hospital and the recreational building cost $65,000 and $35,000, respectively, while the pension system was sustained by $35,000 a year.[11] During times of agricultural distress, such as crop failure, loss of livestock, or other calamities such as were suffered during the harsh winter of 1930, seasonal or part-

[11] Bruce C. Yates, "The Homestake as an Economic Factor in the State," The Black Hills Mining Engineer, Vol. 20 (March, 1932), p. 79.

time work was made available for agricultural workers who came from some 35 counties of South Dakota; these people constituted up to 26 percent of the Homestake labor force.[12]

Data are available on the ethnic composition of the Homestake labor force because, since the organization of the company's labor department, systematic records have been kept on ethnicity. Until about the mid-1880s, the majority of the professional lode miners were mainly American-born. Many came from the copper mines of Michigan, the iron mines of Minnesota, and the gold mines of the West, bringing to the Black Hills the much-needed experience and techniques of underground mining. Others came to the Homestake directly from the Cornish mines of England when they heard about the good wages and steady, available work. The Cornish miners earned the name of "Cousin Jacks" from their practice of encouraging others to migrate by finding jobs for their "cousins," who invariably seemed to be named Jack. They were the most experienced members of the labor force and were attuned to all dangers of lode mining and frequently became shift bosses or foremen. The Scots, Welsh, English, and Irish were also well-represented. Assimilation into the work force and the community was relatively easy because they all spoke English.[13]

The ethnic composition of the work force began to change around the late 1880s when a sizable number of Italians began to arrive mainly from northern Italy. They faced language and skill barriers and so worked as common laborers. At about this time, Serbs and Croats and a few Montenegrans from Dalmatia who called themselves Yugoslavs arrived. For the most part these immigrants came directly from the old country, and

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[12]Yates, p. 74.

[13]Cash, p. 31.

they preferred to live together on the hillside of Lead along Guinn Avenue, which became known as "Slavonian Alley." These foreign-born maintained their customs longer than did other immigrants, and their assimilation was more difficult. Brides were often imported through marriage brokers or relatives in the old country.

Scandinavians also began to migrate as early as the 1870s, but their presence was not conspicuous until the 1890s, when their population was almost equal to the Cornish.[14] Most numerous among the North Europeans were the Finns. In 1891, two-thirds of the miners did not speak English, but by 1924 three-fourths of the labor force was English-speaking and Anglo-Saxon.[15]

One of the major problems besetting the Homestake and other gold producers was keeping up production despite rising costs. The price of gold had been decided by either the world market or by governmental decree. The gold mining industry had no control over the price of steel, machinery, dynamite, and various supplies essential to mining and milling. The only variable the mining industry could control was the cost of labor. In a low-grade ore operation such as the Homestake, the cost of producing an ounce of gold must stay below all costs, including wages. At the Homestake wages went up, yet profits were maintained by constantly upgrading technology and management. This required planning and continuous large-scale investment. Farsighted allocation of resources and diversification began to pay off in times of crises, particularly in the late 1920s when industrial America headed toward an unprecedented economic depression.

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[14] Cash, p. 32.

[15] Francis C. Lincoln, "Half a Century of Mining in the Black Hills," Engineering and Mining Journal, Vol. 122 (August, 1926), p. 214.

In fact, while the great depression brought economic disaster to most Americans, the Homestake prospered in spite of gold prices stabalized at about $25 per ounce(devaluation of gold from $20 to $35 per ounce occurred in 1935).

As the mines went deeper, the labor force was increased. In the late 1890s, the company employed 2,200 workers. The growth had been fairly steady, having gone as high as 2,800, but in general staying at about 2,600 until technology made it possible to produce increasing quantities of gold with fewer men. Even with the need for fewer men, the labor force increased. Between 1900 and 1930 the level did not go below 3,000.[16]

While many gold mines such as those inColorado and California shut down, worked intermittently, or with reduced capacity, the Homestake prospered, especially after 1925. By this time, Homestake had become the single largest gold mine in the United States. The second was the Yuba Consolidated Goldfield of California, and the third was the Juneau Mining Company of Alaska. South Dakota was the fourth largest producer of gold after California, Colorado, and Alaska.[17]

In addition to its large labor force, the annual amounts of gold produced, and the depth of the underground tunnel networks, raises, and crosscuts testify to the magnitude of the Homestake operation. In the 1890s, for example, there

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[16]Cash, p. 36.

[17]U.S. Department of Commerce, Bureau of Mines, Gold and Silver; General Report of Mineral Resources of the United States, by J. P. Dunlap (Washington: U. S. Government Printing Office, 1928), p. 731.

were approximately 20 miles of combined underground works; by 1905, 40 miles, and in the early 1920s, 62 miles. There were 66 miles in 1927 and more than 70 miles in 1930 (Fig. 26).

A record footage was drilled between 1910 and 1915. In 1915 alone 24,331 feet of developmental drifts in the form of crosscuts and raises were driven.[18] However, the developmental works declined by two-thirds in 1920 due to a disastrous mine flood, but after 1926 record driftings were again achieved. Although the Homestake consistently produced from about 60 to 85 percent of the gold in the Black Hills between 1878 and 1915, only from 1923 on did the company become the sole producer of gold. Lead as a one-company town dates from 1916.

Summary

The Homestake Mining Company played an important economic role in the economy of South Dakota, and has in time grown into the single largest gold mine in the Western Hemisphere. Success was achieved through the early acquisition of mining grounds, timber, and water resources, and by aggressive but conservative management. Among the main reasons for the Homestake's unprecedented success were systematic expansion of mining and milling operations on a large-scale based on vast, low-grade ore reserves, continuous investment in technology, and good labor and community relations.

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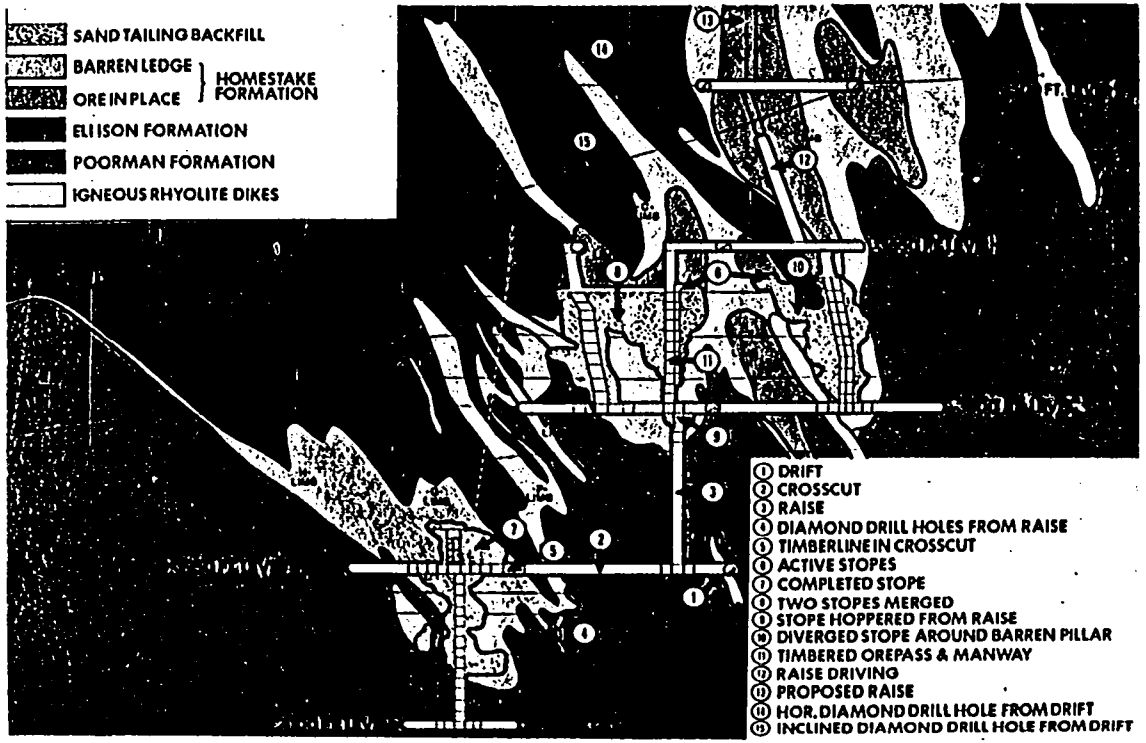
[18] U. S. Department of Interior, Mineral Resources of the United States: Gold, Silver, and Lead in South Dakota, Part I, 1916, by Charles W. Henderson (Washington: U. S. Government Printing Office, 1919), p. 273.

A CROSS SECTION OF THE HOMESTAKE MINE, 9-LEDGE



SOURCE: HOMESTAKE CENTENNIAL, 1876-1976

FIGURE 26

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CHAPTER VIII

THE MINING MODEL

The foregoing account of Black Hills gold mining can be conceptualized in a general mining model. This proposed model is based on the unfolding of competitive forces between individuals and companies in a mining region and on the development of areal zones on mining intensity. The mining model is descriptive, qualitative, and mainly inductive in nature. It is useful in generalizing about the Black Hills, and as will be seen in Chapter IX, it can be applied to other mining regions that had discontinuous metallic deposits and classical mining frontier conditions.

The Model

The mining model is based on several assumptions, and from these several evolutionary competitive stages are postulated. The basic assumptions upon which this model is built are as follows: 1) frontier conditions with abundantly available resources such as gold; 2) unrestricted migration; 3) free and uncontrolled competition for resources; 4) private ownership; 5) no governmental restraints; and 6) relative depression-free economic conditions in the gold mining industry.

Given the above conditions, it is postulated that gold mining activities pass through four major competitive states: 1) individual

vs. individual competition; 2) individual vs. company competition; 3) company vs. company competition; and 4) single-company domination. For the first three stages, competition takes place on a local or inter-local scale--that is, within one or several adjacent mining communities which are in close proximity and are situated within the boundaries of the macro-mining space. The fourth stage, or that of one-company domination, may give rise to an inter-regional level of competition if several major centers evolve during the same time period (Fig. 27).

It is proposed that under frontier conditions, competition starts (Stage I) at a micro-mining space level. During a "rush," individuals or groups of individuals in partnership stake out claims and are in competition with each other for more mining ground and other resources. However, mining laws and sheer physical endurance limit the activities of individuals and groups. One cannot claim more mining property, water rights, etc., than the laws prescribe, nor can one work beyond his physical capacity.

In time, the unsuccessful individuals will be eliminated as competitors because of the natural inequities in tenor, volume, and distribution of ore deposits; mismanagement; bad luck; and so forth. Some successful individuals eventually form companies (Stage II). These compete among themselves as well as with the remaining individuals who still own or operate potential mining grounds. With the organization of companies, the economies of scale is changed, because under corporate ownership the possibility exists for greater land acquisition, more mineral exploitation, and hence larger profits. Competition is now on a larger macro-mining space level.

The almost complete elimination of individual ownership of actual or potential mining grounds marks the beginning of more intense company

STAGES OF MINING SPACE EVOLUTION

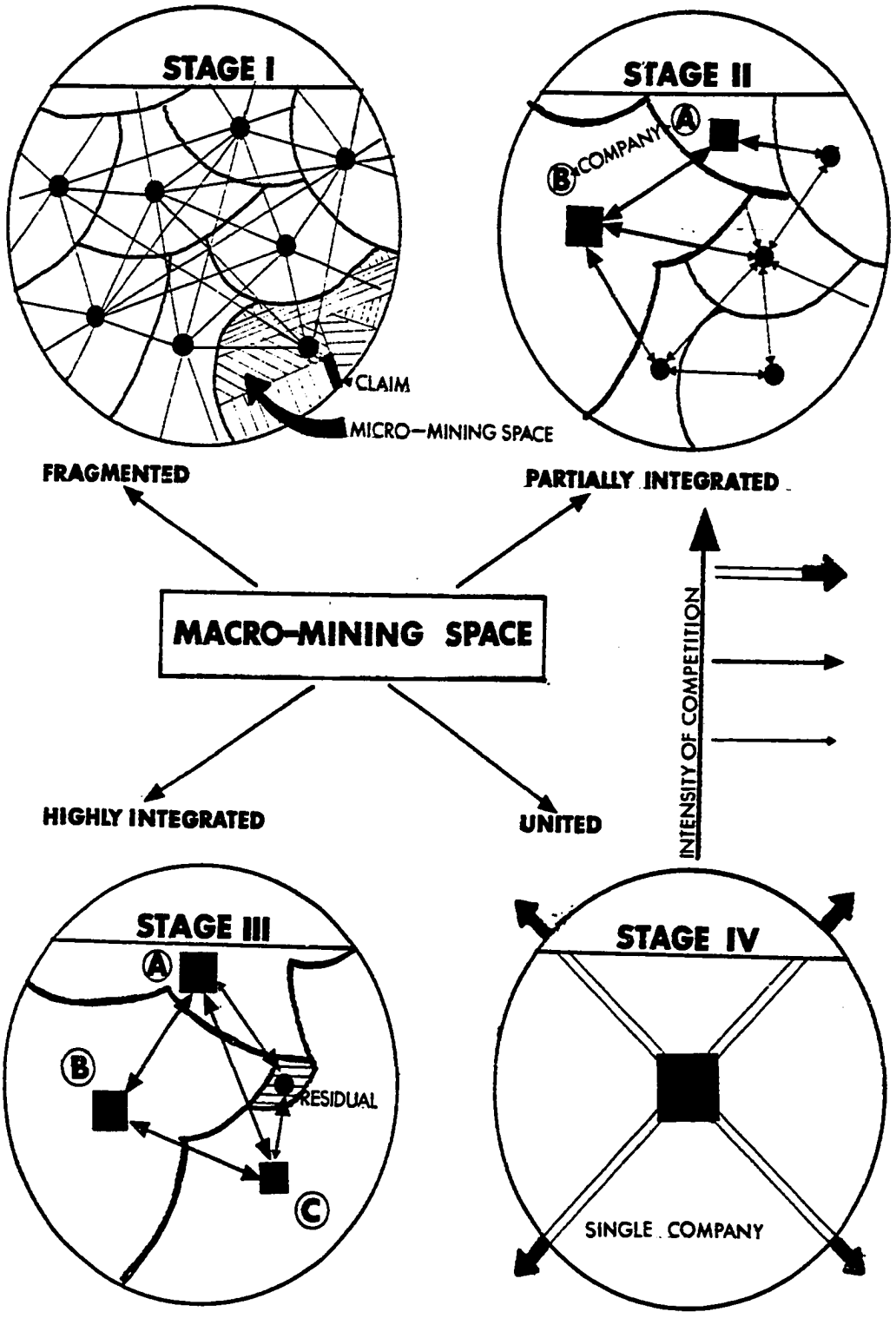

FIGURE 27

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vs. company competition (Stage III). In this stage the weak companies will be eliminated through purchase, manipulations, litigation, and other means.

With the elimination of weak companies, a highly integrated macro-mining space results, and when the entire, or nearly entire, macro-mining space comes under single-company domination, consolidated or unified macro-mining space is created (Stage IV). The organization and domination of macro-mining space is the ultimate goal of the most aggressive company. Macro-mining space consolidated under a single company's domination will set the stage for inter-regional levels of competition and organization.

It is not implied that all mining centers will go through all four competitive stages. In the more recently established mining centers that have ore deposits of high value, it is possible that competition for resources could start at the third or even at the fourth stage because of land occupation, changed ownership patterns, the high cost of initial investments, operation costs, large volume production requirements to produce continuous profits, etc. All these would generally prohibit the average individual from participating in the competitive mining process.

Competitive Stages

It is thought that the first two stages belong in a frontier time interval with the associated social and economic conditions, while the last two stages represent more modern conditions. This stepwise, four-stage competition process is considered as the temporal part of the general mining model. What follows is a listing of the major characteristics of each stage:

Stage I: Individual vs. Individual Competition

1) Massive in-migration results in sudden land occupance of the macro-mining space by the first-generation of mainly placer miners.

2) Land holdings are fragmented through mining claims into numerous privately held micro-mining spaces, and rapid exploration of accessible ores, spot-check exploration, and high-grade ore mining are undertaken.

3) A great deal of labor input and minor capital investment are characteristic. Simple mining technology is utilized, and in inclement regions mining activities may be interrupted or seasonal.

4) Buildings are h[redacted]cted of local raw materials. Small, temporary shelte[redacted]s are randomly built, or tents are used. [redacted]e in close proximity.

5) Incipie[redacted]lop that are generally isolated and have a [redacted] development.

6) A few oft[redacted] Scarcities in food, clothing, tools, and othe[redacted]ate inflationary prices.

7) Unstable social conditions and varied ethnic composition normally prevail. Population shifts for bigger stakes are commonplace and the "settling mentality" is virtually nonexistent.

8) Individual decision-making in the mining process and other activities such as individual action and "ad hoc" community action in response to lawlessness, claim jumping, etc., are characteristic.

With the exhaustion of placer deposits, mining communities, unless they assume some other life-sustaining function, will be abandoned and turn into ghost towns. If, however, mining changes from placer to

lode mining, then Stage II may commence with changes in population, settlement, and style of mining.

Stage II: Individual vs. Company Competition

1) A drastic decline in in-migration of first-generation miners takes place because most of the potential land is claimed or occupied. Both placer and lode claims are staked and worked now, but lode mining becomes the more enterprising venture. Many individuals who had bad luck with placer and lode mining will sell out or abandon claims; even some of those few who were lucky sell properties for immediate profits because they lack the means to exploit fully the ore deposits.

2) Instead of fragmentation of land holdings, a visible concentration of mining claims now takes place, marking the beginning of property consolidation through purchase and speculation. A few enterprising individuals go into partnership and form companies in order to increase profits or to entice capital from outside. The micro-mining spaces are gradually acquired and integrated into a partially concentrated macro-mining space. Employer-employee relations begin to evolve. Spot-check explorations continue, but in a more systematic way. High-grade ore mining is still the main source of wealth.

3) There is much labor input in mining, but substantial capital investment for developments also becomes a necessity. There is also more planning with increased exploration and expansion of mining activities. Much of the capital comes from outside the mining area.

4) There is increased variation in the style of home construction as well as an increase in quality and dimensions. Planning for manufacturing to support or supplement the mining industry begins, and land use

Stage I: Individual vs. Individual Competition

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3) A great deal of labor input and minor capital investment are characteristic. Simple mining technology is utilized, and in inclement regions mining activities may be interrupted or seasonal.

4) Buildings are hastily constructed of local raw materials. Small, temporary shelters of wood, stone, or logs are randomly built, or tents are used. Dwelling and working places are in close proximity.

5) Incipient unstable neighborhoods develop that are generally isolated and have a rather primitive mode-linkage development.

6) A few often mobile services exist. Scarcities in food, clothing, tools, and other consumer items create inflationary prices.

7) Unstable social conditions and varied ethnic composition normally prevail. Population shifts for bigger stakes are commonplace and the "settling mentality" is virtually nonexistent.

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3) There is much labor input in mining, but substantial capital investment for developments also becomes a necessity. There is also more planning with increased exploration and expansion of mining activities. Much of the capital comes from outside the mining area.

4) There is increased variation in the style of home construction as well as an increase in quality and dimensions. Planning for manufacturing to support or supplement the mining industry begins, and land use

becomes more diversified.

5) A few of the old neighborhoods expand, and new ones are created around the lode mines. There is greater separation of dwelling and working spaces as compared to Stage I. Population begins to stabilize, but it does not necessarily increase in number. Unemployment and inflation are not as high as in the previous stage. Paths evolve into street patterns, and a "Main Street" evolves. Visible concentration and segragation of some ethnic groups is also characteristic—for example, Chinese or Cornish sections of town. Linkages and nodes become rather well-established. Railroad construction may be partly or nearly completed, but freighting by wagons and stagecoach is still the main means of transportation.

6) Services also expand and become stationary, and specialization increases. Banks, grocery stores, barber shops, medical and educational facilities, and entertainment facilities (bars, saloons, theaters, etc.) are established with concurrent competition in the evolving secondary and tertiary industries. Church activities are by now also well organized.

7) Social conditions begin to stabilize as law enforcement becomes more efficient. Social and occupational stratification begin to take definite trends. The idea of permanent settling and of job security are more important now, since the lode mining population is not as migratory as the prospector-placer miner of the previous stage. This second-generation of miners is more highly skilled, perhaps more educated, and of more varied ethnic background.

8) Both individual and company decision-making is characteristic of the mining process and related activities. The causation of the change

and the transition from Stage II to Stage III lie in the process of elimination of most of the single, individual owners of mining ground, and the aggregate of the remaining individual owners becomes insignificant in terms of acreage controlled, production, wealth generated, etc. Companies alone are now the conspicuous and influential entities in the mining communities, since they provide most of the jobs and the payroll.

Stage III: Company vs. Company Competition

1) Individual ownership of potential mining ground changes to company or corporate ownership through purchase or other forms of acquisition, giving rise to inter-company competition for the domination of the macro-mining space, although a few individuals still survive. Competition for resources, technological improvements, innovations, and labor, etc. is most keen.

2) Mining claims (micro-mining spaces) are now consolidated into company-owned blocks, and the adjoining peripheral lands are also purchased for speculation, "security," and for uses indirectly related to mining such as timber, water supply, and housing development. Demand for land of all kinds results in increased land values. The wage-earning labor force is drawn primarily from the local or adjacent areas.

3) Large-scale expenditures on investments are made. Efficiency in administration and in production increase substantially through indigenous innovations, adoptions, or experimentation. Advanced technological applications now make mining and milling of low-grade ores feasible, and thus conservation and systematic "enbloc" mining are characteristic. Continued explorations with assessments, inventories, and long-range planning are important facets of mining in this stage.

4) Construction is at high level. A relatively dense concentration

of stores and service centers line the main streets. Mining towns have many comfortable homes and other buildings. Characteristic features of the mining towns are created in this stage.

5) The neighborhoods are well-established, the population gradually increases (mostly from natural increases), and the number and size of the neighborhoods also increase and have good linkages (street connections, telephones, etc.). Rail connections are complete and road networks are now well-developed.

6) Fully developed service specializations such as hospitals and higher education are characteristic. Most of the major businesses are established in this stage. The mining industry is now diversified and a tendency for self-sufficiency is seen.

7) The social conditions are stabilized. Law enforcement is well-organized, but community and interest pressure groups become more permanent (unions, clubs, Chambers of Commerce, etc.).

8) Companies are now making decisions in nonmining activities. In this stage several giant and numerous medium and small companies compete with one another. The foundations for prosperity and success were already established during Stage II, however. A few large corporations stand out by controlling most of the mining ground, by employing the majority of workers, and by producing most of the wealth. However, bankruptcies are very common in this stage because of the cost of deep-mining, the rising cost of labor, high taxes, and calamities such as fire, floods in mines, mismanagement, and litigation. First, the small and medium-size companies are eliminated, then the giant corporations (except one or two) begin to fold. Work gradually becomes more intermittent or seasonal, and

much exploratory or developmental effort is conducted for new ore deposits in order to extend the lifespan of a given company.

Stage IV: One-Company Domination Stage

1) The keen inter-company competition for natural resources and labor results in the elimination of all companies but a few, and among the few, one corporation stands out by producing more than all others combined. The other corporations gradually go bankrupt, sell out, or fuse into the dominant corporation, thus resulting in a maximum consolidation and theoretical domination of the total macro-mining space. At this stage the scale of competition and organization increases and becomes inter-regional.

2) The company exercises a strong hold on local affairs. Expansion takes place under one organized management. The relationship between the company and the entire mining community or mining communities becomes intimate and sensitive. The success or failure of the company is shared by the mining community.

3) Capital investment theoretically is at a maximum, and so is diversification in order to attain at least satisfactory levels of self-sufficiency. Several target areas are under mining within the macro-mining space. Several related industries which are geared to the needs of mining, such as ore-refining, manufacturing, quarrying, and timber supplement the main industry. The administrative organization is most complex. Connections with other mining regions, often distant regions, are also established. Surplus capital outflows and investments give rise to inter-regional partnerships. The main administrative headquarter is transferred to regional capitals or to a large urban center. Long range planning becomes a prerequisite for efficient growth and survival.

4) Construction of mining shafts, refineries, etc. often becomes "monumental," both on the horizontal and vertical scales. These features on the landscape bear witness to the company's domination.

5) The population stabilizes or grows slowly. New neighborhoods with new shopping and service centers begin to grow on the periphery of the mining town or towns. The skilled labor force, but particularly the administrative labor force, participates in job transfers within the company—which has diversified to include partnership interests in other companies outside the region.

6) Service specialization continues to grow. The labor force in the supplementary secondary and tertiary occupations now constitutes a substantial portion of the mining town. Amenity-orientation becomes a concern.

7) Law enforcement is well-established, and the company may also have its own law enforcement agency. Civic interest groups, such as the Sierra Club, and other conservation-minded organizations may serve as checks on the company's control.

8) Decisions by a single company administration are characteristic in the mining process and in related activities. Libraries, swimming pools, etc., are financially supported by the company.

The main reasons for change from one stage to the next may be summarized as follows: Events and conditions of each stage are found in Table 16.

Stage I. The uneven distribution of ore resources, mining claims, and land-holdings create disparities, and a few successful individuals form companies which require more ore reserves and larger land holding.

Stage II. Space requirements increase in amount and variety to accommodate the supplementary industries through land consolidation.

TABLE 16
SCALE OF INTENSITY

	STAGE I	STAGE II	STAGE III	STAGE IV
IN-MIGRATION	■■■■	----	.....	.....
LAND FRAGMENTATION	■■■■	.....	----	.....
LAND CONCENTRATION	.....	.....	----	■■■■
LABOR-INPUT	■■■■	----	----	.....
CAPITAL INVESTMENT	.....	----	----	■■■■
PLANNED CONSTRUCTION	.....	----	----	■■■■
NEIGHBORHOOD DEV.	.....	----	■■■■	■■■■
LAND USE DIVERSIFICATION	.....	----	■■■■	■■■■
NODES & LINKAGES	.....	----	■■■■	■■■■
SERVICES, SOC. STABILITY	.....	----	■■■■	■■■■

STAGE I
FRAGMENTED MACRO-MINING SPACE

STAGE II
PARTIALLY INTEGRATED MACRO-MINING SPACE

■■■■ STRONG
---- INTERMEDIATE
..... WEAK

STAGE III
HIGHLY INTEGRATED MACRO-MINING SPACE

STAGE IV
UNITED MACRO-MINING SPACE

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Stage III. Diversification in the mining industry occurs, and companies fuse to obtain maximum efficiency, security and profits.

Zones of Concentration

The "arena" or bounded space in which the competitive forces presumably unfold is the macro-mining space. To develop the spatial aspects of the mining model in terms of ore concentration, distribution, and associated mining activities, it is proposed that the mining centers (or nodes) within the spatio-legal bounds of the macro-mining space be subdivided into "zones of concentration." The proposed three-fold spatial subdivision encompasses the entire macro-mining space within which the postulated four-stage competition and organization takes place. The zones of concentration concept may be described as follows:

Zone I: Zone of High Concentration

This zone is characterized by the highest intensity of exploration and mining activities. It contains the largest ore body, or several significant ore bodies, and it often but not always produces the highest grade ores. It invariably produces the largest ore volumes within the macro-mining space. The land use is intense and land values are highest. Theoretically, this zone contains most of the mining population, has the largest settlements, and was first to be settled and organized. Historically, however, it was not always discovered first. This zone is often located toward the center of the macro-mining space.

Zone II: Zone of Intermediate Concentration

This zone surrounds Zone I. There the ore bodies are more discontinuous and are often mined intermittently and with various degrees of intensity. The mining population resides in small, scattered, mining

communities. Active land use is likewise intermittent or discontinuous. Land values are lower than in Zone I, unless the land contains resources such as timber or water.

Zone III: Zone of Weak Concentration

This zone is farthest from Zone I—sometimes several miles distant. The ore bodies are peripheral, marginal, and normally of low overall grade. This zone is characterized by seasonal mining and by "probing" through tunnels and "feeler holes." The intermittent mining (or, rather, exploratory activity) is often associated with important supplementary enterprises such as lumbering which are directly or indirectly geared to the mining industry. Under frontier conditions, at any given time, the mining population of this zone is a small fraction of that of Zone I or even of Zone II. (The reverse may be true under modern conditions because of efficient transport, less pollution, and the desire for certain amenities such as space.)

It is by no means implied that there exists a one-to-one relationship between the site and situational factors—that is, between the locality of an ore body and the closeness of the mining settlement. Depending upon transportation technology, terrain, personal preferences, and other factors, the ongoing mining activities (working places) are often spatially separated from the settlements (dwelling places) by a considerable distance.

It is also implicit that boundaries of the zones are changing in time due tc exploration and new discoveries. Also, technological improvements in mining and ore refining, and an increased price of the metallic ore or increased demands, etc., will change the boundaries of the zones. Since, in this study, the zone concept refers to the existing amounts and grades of ore as well as to mining activities, depletion of ores may eliminate the zones altogether.

While the zones are in existence, the relationship between them is considered intimate; whatever happens in one zone will affect, in some way, the other zones. For example, because of the decline in production in Zone I due to depletion, increased attention will be given to the other zones, provided the price of ore is favorable and the technology of recovery is economical.

In some ways, this tripartite zonal subdivision of the macro-mining space resembles the internal structure of a city—with its central business district, its zone of transition, and its residential zones.[3] Within the boundaries of macro-mining space, however, there may be more than one set of "zones of concentration." In the case of multiple zones, it is thought that each will be organized in time by separate companies. But ultimately, through fusion, the companies will come under a single company organization. The "zones of concentration" concept is illustrated in Fig. 28 and the Time-Space Mining Model is given in Fig. 29.

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[3] Ernest W. Burgess, "Urban Areas," in Chicago: An Experiment in Social Science Research, T. V. Smith and L. D. White, eds., (Chicago, Illinois: University of Chicago Press, 1929), pp. 114-123.

ZONES OF CONCENTRATION
(GENERALIZED)

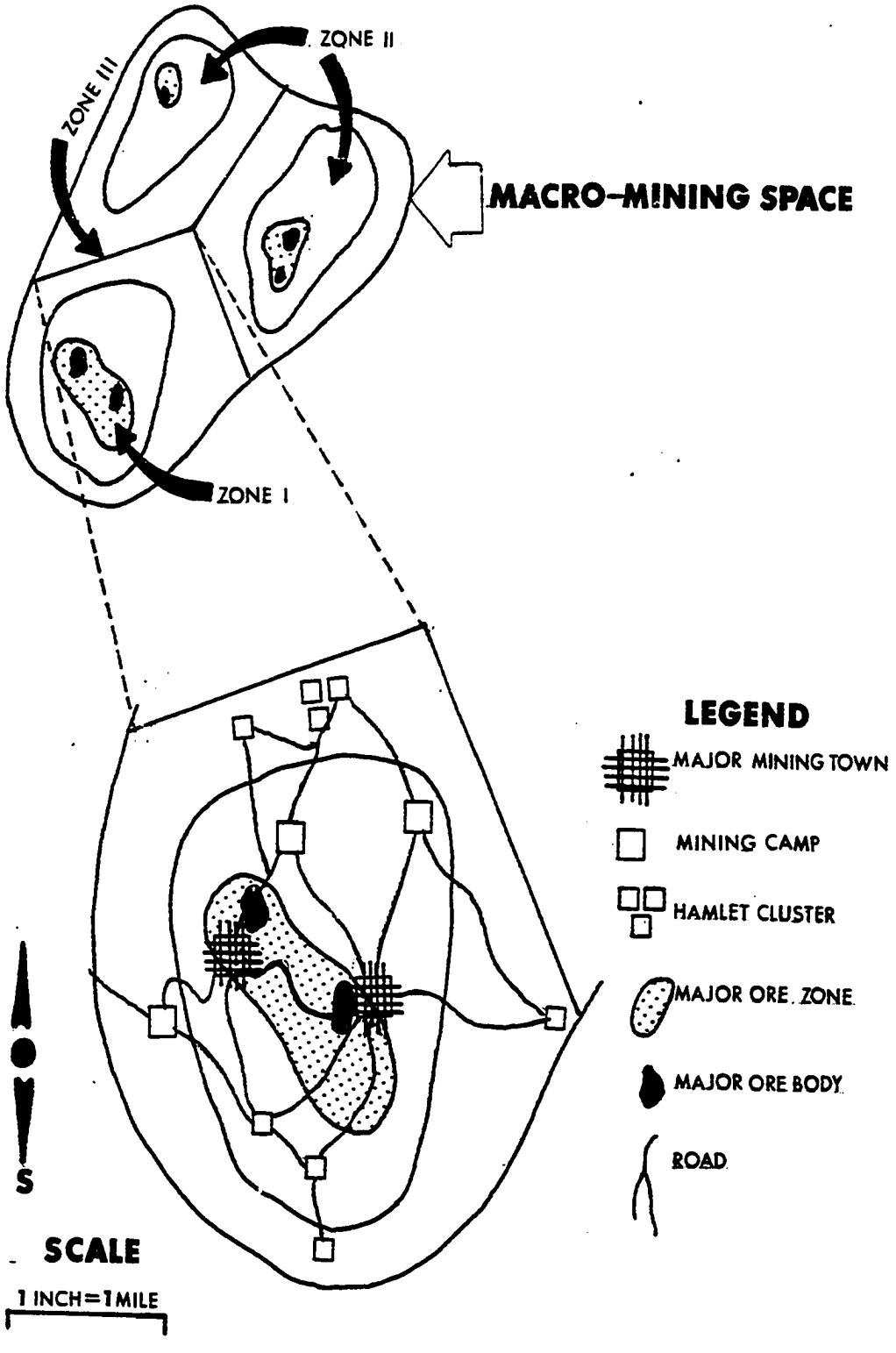

FIGURE 28

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THE SPACE-TIME MINING MODEL

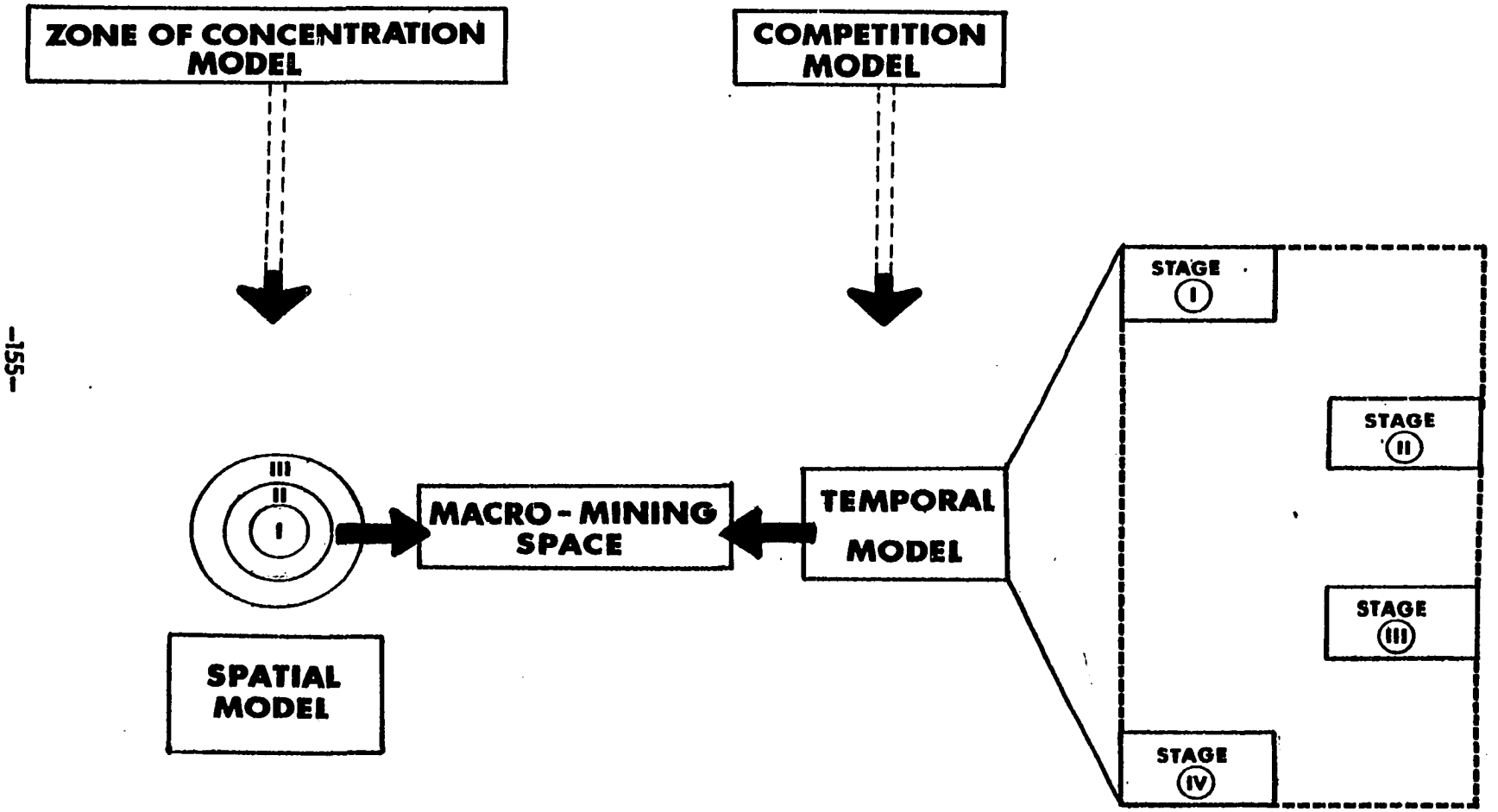

FIGURE 29

KOVATS 19 77

Summary

The mining model is based on several assumptions from which four evolutionary, competitive stages are postulated. The consecutive stages of mining activities and property consolidations are the temporal part of the mining model. The spatial aspects of the mining model are expressed in "zones of concentration;" the four postulated stages of competition and organization take place in three zones into which the macro-mining space has been conceptualized. The mining model should be applied only to discontinuous and metallic deposits, and only for mining regions which had classical mining frontier conditions.

CHAPTER IX

THE MINING MODEL APPLIED TO COLORADO

In this chapter, the foregoing model, which is bassd on the Black Hills mining experience, is applied to the Colorado mining frontier. Comparisons between the Black Hills and Colorado are presented as background for the model's application.

Black Hills and Colorado Comparisons

Mining Frontiers

Black Hills	Colorado
Sudden discovery of placer gold at several places and hasty mining of short duration (1874-1876) resulted in a short-lived placer boom and fragmentation of mining space. Numerous settlements were founded such as Custer, Deadwood, and Hill City. Within a few months depression and abandonment occurred because of the exhaustion of ores and new discoveries elsewhere in the region.	The discovery of a few, rich surface placers near the foothills of the Front Range (Pike's Peak country), and the founding of Auraria, (1858), Denver, (1860), etc., marked the beginning of an eventually very large mining frontier. Several early boom periods and sporadic discoveries were followed by a long depression until explorations revealed placer and lode deposits in the mountainous sections. The discovery of lode gold

This enlarged the mining space. A return to the old diggings to mine the remaining gold and more careful exploration resulted in the discovery of placer deposits in places that were more difficult to reach, and this resulted in additional land fragmentation and mining space extension. This was followed by nearby lode gold discoveries, and soon hard rock mining began and more permanent settlements such as Lead and Yellowstone were founded around the mines. A short-lived silver boom (1876-1878) also helped to stabilize some of the settlements. However, camps grew only if they had adequate resources or if they acquired some other viable economic base when gold or silver were depleted. The stabilization of settlements aided the consolidation of the mining space.

in the interior around Gunnison, Argentine, and Silver Plume created a major gold boom and the mining space was extended several-fold. Rich silver ores located west of the gold camps extended the mining space even more to incorporate regions like Leadville, the San Juan Mountains, and Silver Cliff (1874-1890). Ore smelting technology played a crucial role in this expansion. New lode ores were discovered at Cripple Creek (1890-1896), which gave a boost to mining and enlarged the mining space to its ultimate extent. During the mining frontier's expansion, both fragmentation and consolidation occurred (Fig. 30). Other metallic ores such as copper, lead, and zinc also contributed to the stabilization of settlements and the consolidation of mining space through company organization and corporate control before the Colorado mining industry eventually collapsed in the late 1880s.

GOLD DISCOVERIES IN COLORADO

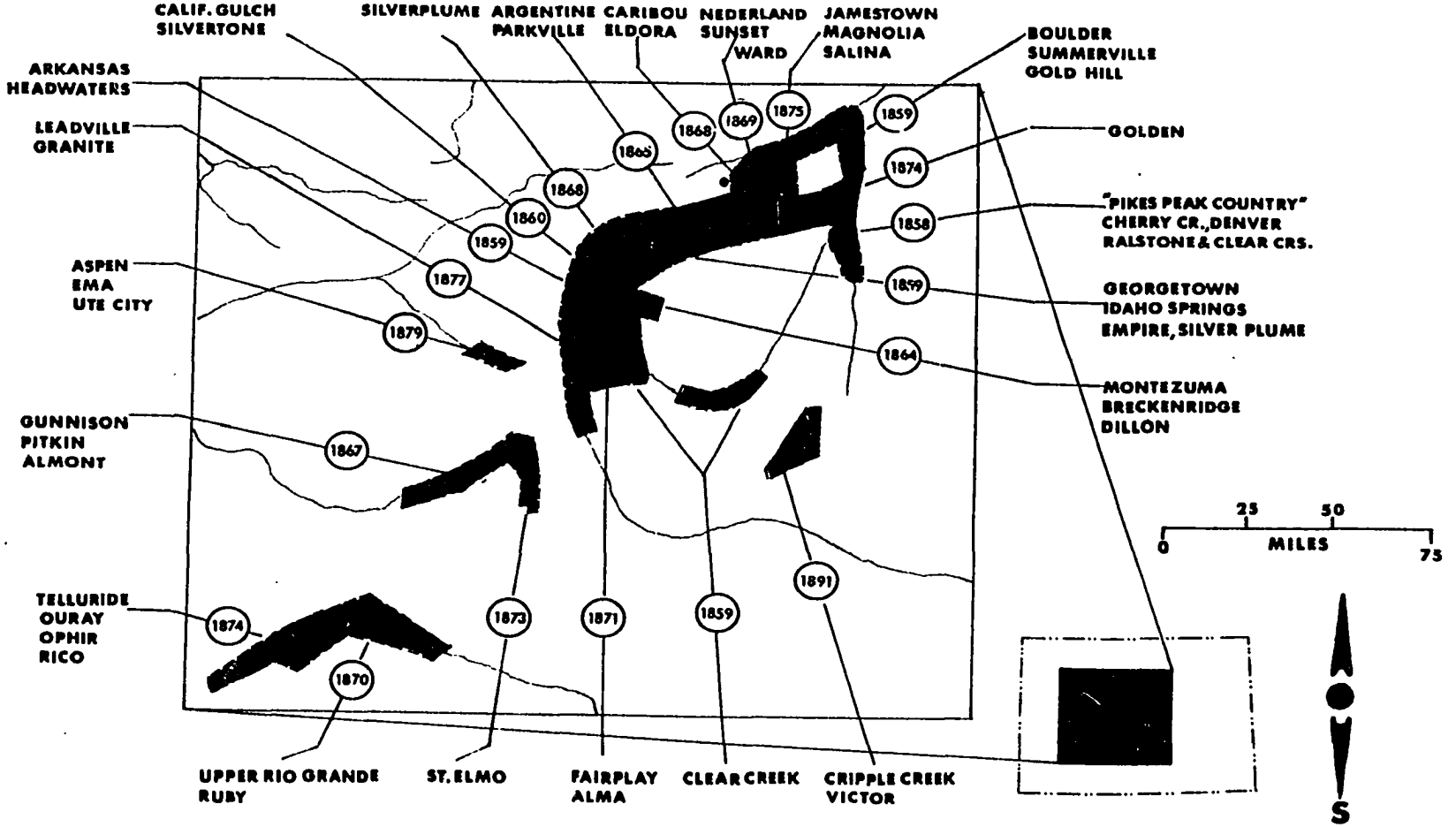

FIGURE 30

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Nature of Terrain

Black Hills	Colorado
Hilly, occasionally very rugged, river-dissected topography; well-watered valleys and heavily-forested slopes and plateaus. Elevation: 5,000-6,000 feet.	Mountainous and very rugged. Stream-dissected and glacier-carved topography with dense forest cover. Elevation: 7,000-10,000 feet.

Area of Mineralization

Black Hills	Colorado
Area: 100 square miles (4 by 25). Ores were spotty and discontinous, with highly variable metal content but relatively pure. Monomineralic ores common. Low silver-gold ratio.	Area: 10,000 square miles (50 by 200). Ore bodies were discontinous but somewhat larger than in Black Hills. Cripple Creek was comparable in size, population, and production with the Black Hills. Precious metals were associated with other metals. Polymetallic ores common. High silver-gold ratio. (Fig. 31)

Nature of Ore

Black Hills	Colorado
Placer gold of several types was common. Blanket and oxidized ores were easy to mine. Abundant "refractory" and disseminated types of ores. Generally very low-grade ores.	Placer gold of several types was mined. Lode ores were complex: pyritic and argentiferous lode ores were most common, including the oxidized varieties of these. Tellurides were

COMPARISON OF MINING SPACES

(COLORADO AND BLACK HILLS, S.D.)

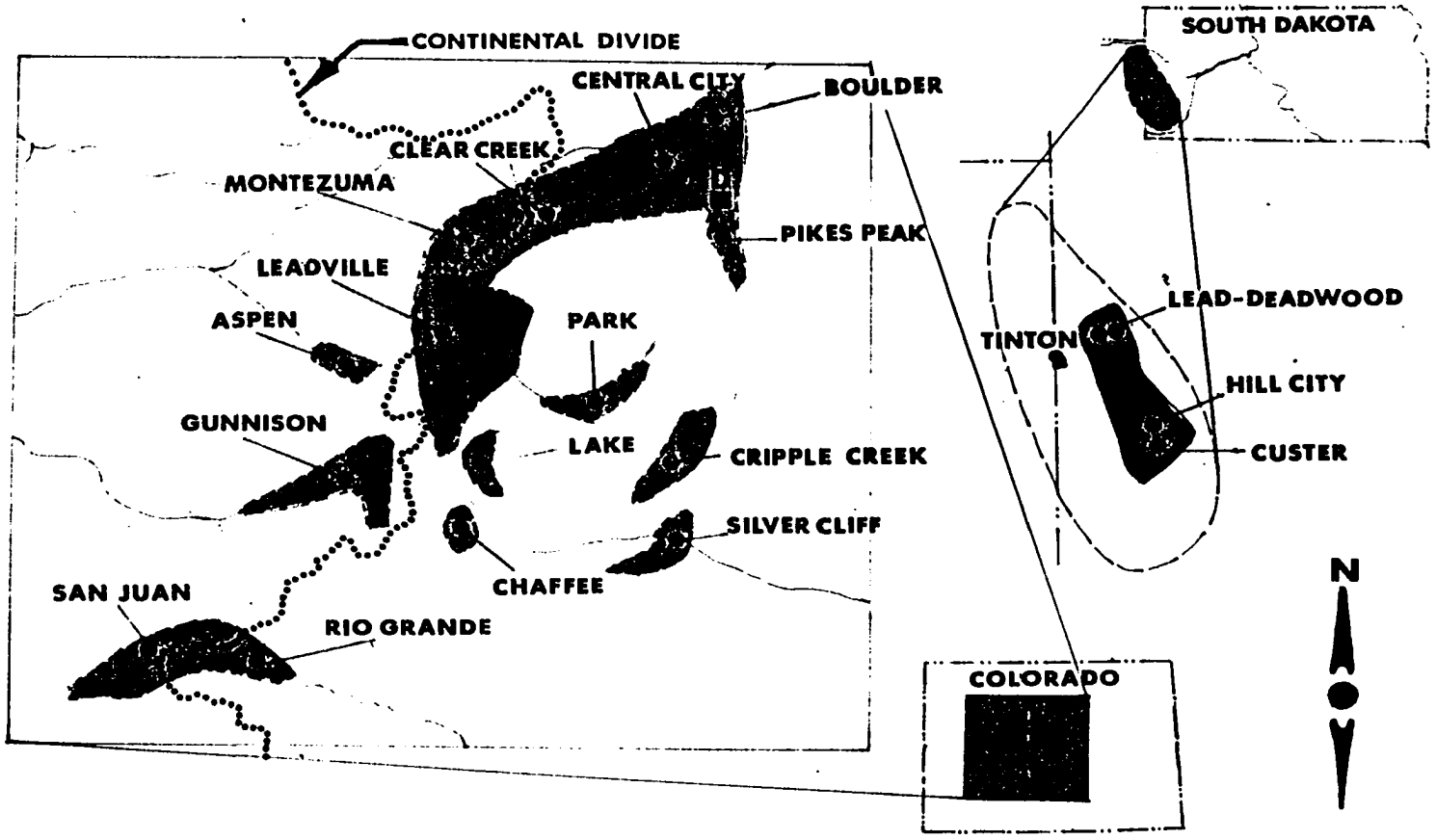

FIGURE 31

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Gold and silver ores occurred together or in close proximity. Large volumes were mined from deep levels, such as 1,000 feet.

abundant and expensive to extract. Gold and silver-bearing deposits were spatially separated. Generally medium to low-grade ores but occasionally high-grade and enriched ores were found close to the surface—at 200-400 feet.

Production

(in Millions of Dollars)

Black Hills

Placer gold	10.0
Lode gold	328.0
Silver	6.6
Others	38.5
Total	383.1

Total Production:
- Placer gold 3%
- Lode gold 97%

Peak Production of Gold:
- 1900-1915: 5.4-7.4
- 1930-1938: 8.9-19.8

Lead District in Lawrence County (Homestake Mine) consistently produced 95% of the total production of Black Hills (Figure 32).

Colorado

Placer gold	30.0
Lode gold	637.3
Silver	497.3
Others	39.7 Cu
	186.4 Pb
	122.5 Zn
Total	1.6 billion

Total Production:
- Placer gold 6%
- Lode gold 94%

Peak Production of Gold:
- 1889-1906: 21.0-28.0

Peak Production of Silver:
- 1889-1893: 17.0-21.0

Cripple Creek in Teller County consistently produced 41-62% of the total output of Colorado.

Population

(involved in the early phases of mining)

Black Hills

1876-1890: 30,000 (Range 25-33,000)

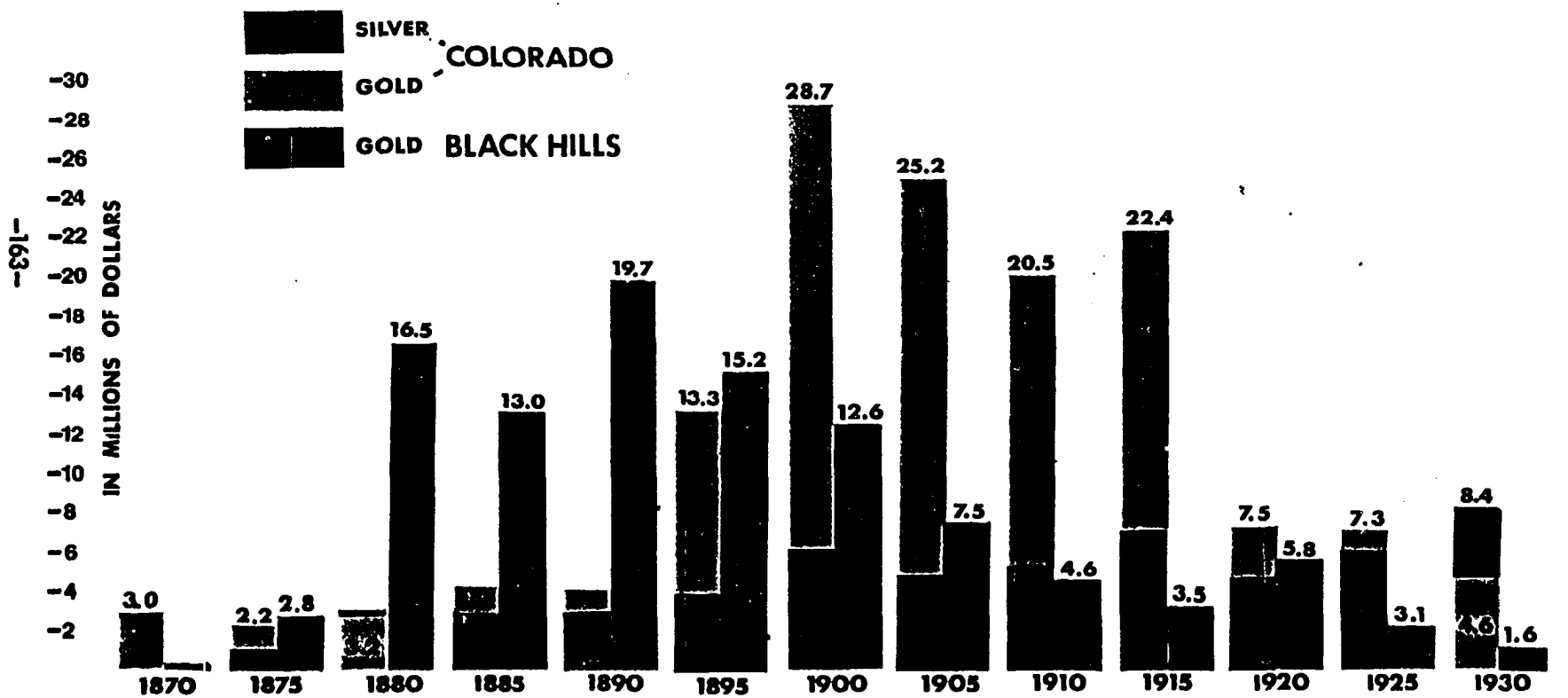
Approximately 30 percent were

Colorado

1858-1865: 100,000 (Range 80-120,000)

About 60 percent were transients and

GOLD & SILVER PRODUCTION



SOURCE: U.S. GEOL. SURVEY MINERAL RESOURCES, 1932
BUREAU OF MINES MINERALS YEARBOOK, 1940

FIGURE 32

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"transient" miners and left the Black Hills; about one-third of the mining population was employed at any given time, and the rest were jobless, idle, or underemployed.

left Colorado, and only 25 percent of the total mining population was permanently employed. The rest were jobless, idle, or underemployed. Colorado had a substantial surplus population.

Mining Districts

	Black Hills	Colorado
Number:	34 (13 districts were in Lawrence County alone)	411 (before World War I) 38 (in the 1930s)
Size:	2-8 square miles	15-35 square miles
Distance:	closely-spaced; average distance between districts estimated at three miles.	widely-spaced; average distance between districts estimated at 25 miles.
Density:	2.9 per square mile	1 per 24.1 square miles (before 1915)

Gold Producing Counties

	Black Hills		Colorado	
Number:	3		32	
Leading Counties:				
	Lawrence	(90% of total production)	Teller	$500 million
	Pennington		Gilpin	90 million
	Custer		San Miguel	65 million
			Lake	60 million
			Ouray	40 million

Gold-Silver Mines

(only important producing mines included)

Black Hills

Number:

1885:	25	
1890:	40	
1900:	100	
1910:	140	(maximum)
1920:	115	
1930:	85	

Density: 4.1 per district
1.4 per square mile

Colorado

Number:

1880s:	6,000	(estimated)
1900:	1,500	(estimated)
1910:	898	
1920:	416	
1930:	334	

Density: 14.5 per district
1.6 per square mile

Major Mining Corporations

Black Hills

Number: 13 (maximum)

Density: 1 per 2.6 mining district

Colorado

Number: 165 (maximum)

Density: 1 per 2.4 mining district

Mining Technology

Black Hills

1876-1900: Surface or near-surface mining, hand drilling, pick-and-shovel method, arrastra, sluice box, underground square-set stoping

1900-1930: Rock drilling, diamond drilling, square-set, shrinkage stoping, and improved variations of these

Black Hills benefited from the standardized mining and milling techniques, and new methods were invented there.

Colorado

1858-1868: Surface mining, pick-and-shovel method, hand drilling, arrastra, sluice box, hydraulic, and dredging

1870s: Underground shrinkage stoping, hydraulic and dredging continued

Hillside tunnel and shaft mining were common. Most Colorado mines and mills were slow to adopt "foreign" techniques of production and processing.

Depth of Mining

(maximum depth between 1876–1930)

Black Hills	Colorado
Depth: 3,500 feet (Homestake Mine)	Depth: 3.000 feet (Portland Mine, Cripple Creek)
Few mines produced between 400–1,200 feet.	The majority of mines produced above 1,000 feet.

Milling-Smelting Capacity

Black Hills	Colorado
Number of Centers: 4	Number of Centers: 8 (plus)
(Lead, Pluma, Deadwood, Central City)	(Leadville, Black Hawk, Denver, Pueblo, Durango, Alamosa, etc.)
Number of Plants: 12 (1877-1930)	Self-Sufficiency very soon achieved and custom processing of foreign ores remained an important money-maker in Colorado.
Sending ores for custom milling was common during the early phases of mining, but self-sufficiency soon was achieved.	Capacity of Individual Mills: 25-600 tons/day
Capacity: 4,400 tons/day (mainly Homestake mills)	Range of Stamps: 5-140 tons
	Total Capacity: 15,600 tons/day
	Silver smelting (and other ore smelting) since the late 1870s
	Number of small chlorination, roasting, cyanidation, and amalgamation plants: 132

Settlements

(Gold and Silver Camps, 1870-1930)

Black Hills

Number of camps: 107

Silver camps: 8

Gold camps: 99

Total settlements of all types: 377

Settlement Density: 1 per square mile

Ghost Town Density: 0.7 per square mile

2.1 per district

Total Settlement Density: 3.7 per square mile

Camp Density: 3.1 per district

The earliest settlements were 200-400 miles from population centers such as Sioux Falls and Denver. No large center comparable to Denver developed in the Black Hills; thus, reliance on distant supplying centers remained a necessity.

Colorado

Number of camps: 1,245

Gold-Silver camps: 395

Ghost Towns: 850

Settlement Density: 0.1 per square mile

3.2 per district

Camp Density: 0.0003 per square mile

0.9 per district

Ghost Town Density: 0.0008 per square mile

2.0 per district

The early settlements were 400-600 miles from major population centers such as Kansas City, Omaha, or St. Louis. However, after the 1880s Denver became the major supplier for the mining and milling industries.

Transportation

Black Hills

The Black Hills had five major railroad companies and four main lines. Most of the tracks were finished between 1881 and 1889. The total network by 1900 was about 500 miles.

Colorado

Colorado had four large railroad companies with 15 important branch lines. A dense rail network evolved within a 60 miles radius of Denver, and by

1930 about 3,500 miles of railroad tracks were in use.

Business Connections and Investments

Black Hills

East and west coast capitalists were the main financiers for the Black Hills gold mining industry. New York, Boston, Philadelphia, and San Francisco stand out as sources for capital investments, also Midwest centers such as Chicago and Minneapolis. Sound investments, the use of advanced technology and far-sighted management, and the integration of mining and milling phases of mining industry were the reasons for profitable mining.

Colorado

After 1864 east coast capitalists were the main contributors to the needed capital in the Colorado mining industry. New York, Boston, Providence, and Philadelphia stand out as capital sources. Later Midwest centers also participated in capital investment. Colorado had an unusually long history of profitable mining. Many giant corporations were organized in both mining and smelting phases of the industry.

The Model's Application

The model, of course, works well in the Black Hills mining region where the four stages and the three zones of concentration were observed. In Colorado the three zones of concentration and at least three stages of evolution were identified. However, only a tendency toward the fourth stage, that is one-company domination, was observed. In the smelting branch of the mining industry, the domination by a giant corporation was nevertheless achieved.

Based upon the study of the Colorado and Black Hills mining industries, I found that the degree of applicability of the mining model will depend upon a number of variables—among which the locational, economic, and technologic stand out. Both "push" and "pull" factors may be present and may play roles in the fragmentation or consolidation of mining space. The variables promoting mining space organization are listed and discussed below:

Size of Mining Space. Large mining spaces extending over several thousands of square miles may have the tendency to increase the life span of placer mining, and thus will enhance the fragmentation of the mining space. Examples are Colorado and California where placer mining under individual ownership lasted a decade or so in part because of the large mining space. Large mining spaces mean sizable mining districts and numerous mining claims under individual and company ownership—and this only translates into greater amounts of time and difficulty for acquisition. The Black Hills had only a few, small mining districts within the mining space, and unlike Colorado the process of integrating the mineralized ground was relatively swift and complete.

Location, Distance, and Density of Districts. The site and situation of mining ground may handicap integration if individual or partnership mining operations are taking place in isolated areas which are also distant from supply centers. Mining is nevertheless feasible under primitive transportation conditions. Under such circumstances, company type of mining producing large volumes of ores, would operate under handicaps. Thus, isolation may produce fragmentation and transport networks; linkages enhance consolidation. Also, widely-spaced mining

districts or spatially separated mining properties make the consolidation more difficult because the "sphere of influence" will be lessened with increased distances, thus promoting continued fragmentation. In Colorado, mining districts were spaced about 25 miles apart, and for every 24 square miles there was a mining district within the mining space. In the Black Hills, average distance between mining districts was 3 miles. Hence, the consolidation in the Black Hills was rapid. By the 1890s, for example, most of the mineral grounds in Lawrence County were under corporate control, mainly that of Homestake Mining Company.

Historical Factor. Historical factors may also handicap consolidation, especially if a succession of discoveries extend over a considerable time span or if the mining frontier has been shifted several times back-and-forth as in Colorado. In the Black Hills several successive discoveries were made yet mining lasted for only a short time before foreign capital was invested and lode mining began under company organization.

Geologic and Resource Factors. Geologic conditions and the nature of the ore deposits may also delay consolidation if the ore is simple in composition, the geology is simple, or the ore can be mined with simple techniques under individual ownership. Rich surface or near-surface methods will retard the consolidation process because more claim owners will work their claims than will sell—that is, the more resources available within the capacity of the individual entrepreneur, the more likely it is the property will be kept, worked, or speculated with. Examples of this were rife in Colorado and California. In the Black Hills, however, the geology of the mineral deposits was complicated and the re-

sources were limited for extended profitable mining by individuals, and company soon took over.

Technological and Economic Factors. Technological and economic factors are considered crucial in the consolidation of the mining space. If, for instance, surface or near-surface mining operations can be made profitable by utilizing simple tools and techniques of extraction (as in case of oxidized, blanket-type ores not deeper than 200 feet thick), property will likely remain under individual ownership. Also, capital for company organization and production may not be available when needed, or scarcity of funds may result in underfinanced mining companies; thus, the lack of sufficient capital for company organization may promote individual mining ventures and then fragmentation of mining space. Colorado is a good example of capital investments being made selectively.

Summary

The comparison of mining frontiers in Colorado and Black Hills revealed many similarities and differences in the origin and evolution of frontier conditions. It appears that the size of the mining space, its location, and its ore nature, the technology of mining, and certain economic variables play decisive roles in the working application of the mining model. All in all, the mining model can be applied with reasonable confidence to Colorado.

CHAPTER X

CONCLUSION

The main purpose of this dissertation was to formulate a general spatial and temporal mining model. The model is based on the Black Hills, one of the smallest and most recent mining frontiers, and is tested in Colorado, one of the largest earlier such frontiers.

This postulated, composite model has four competitive stages. In stage one fragmented mining space is under individual ownership at the beginning of the mining frontier. With the mining out of surface ores using simple techniques, individuals at first compete with companies, and then company-directed, deep-level mining ensues which represents a higher level of organization, the expansion of mining space, and increased production and investments. The ultimate stage is reached with single, corporate control, which comes about through fusion and elimination of the rest of the companies. The ownership and organizational changes in the mining space are accompanied by diversification in the land use, drastic modification in the settlement patterns, and changes in population characteristics.

The model did indeed apply to Colorado. but the following factors make its applicability less than perfect:

The size of the mining space, the distance between the mining districts, and the densities of both the districts and mining claims will have a decisive influence on the outcome of the consolidation process. Small mining spaces and closely-spaced districts have the tendency to promote consolidation or unification of the mining ground under company control and ultimately under a single, corporate domination. Unlike in Colorado, the ore-specific mining spaces in the Black Hills were small, a few square miles in area at most, and the mining districts were also in close proximity. The consolidation began relatively early and proceeded relatively smoothly. The mineralized grounds and districts in the Black Hills were not only smaller and closer to one another but also they were more continuous compared to Colorado; hence, the consolidation was rapid and relatively complete. By the 1890s, for example, the corporate control over most of the mineral ground in Lawrence County and adjacent counties was firmly established.

The "size-density-distance" conditions in case of the Black Hills served as a pull factor or catalyst in the consolidation process, whereas in Colorado, because of the differences in magnitude, the process of consolidation was incomplete or delayed. The mining model appears to work best if the mining space is from small to medium in size, such as in the case of Black Hills, Montana, and Arizona.

Historical factors may also promote or handicap the consolidation process. If, for example, a succession of discoveries extends over a considerable time span, or the mining frontier has been shifted back-and-forth several times, such as in Colorado, there will be a disrupting

or delaying effect on the consolidation because of the renewed fragmentation of the mining space. In Colorado, for example, the mining space was extended and expanded several folds between 1858 and 1891 by a series of discoveries of both placer and lode ores which were organized under individual and company ownership. This "mixed ownership" remained sufficiently strong and persistent in retarding the completion of the postulated competitive stages in the mining model. A similar case can be made for California. In the Black Hills there were also a number of discoveries, but the placer mining lasted only a short time, two or three years at most, before the foreign capital arrived and lode mining began under company organization. Thus, from a historical standpoint, the consolidation of mining space in the Black Hills has been a swift event, particularly the change from individual to company ownership.

Technological and economic factors were also crucial in the consolidation process, particularly the smelting metallurgy. In Colorado, for instance, much of the ore was difficult to recover because of the composition, and so for a long time cheap but wasteful methods of mining prevailed. The application of modern but expensive metallurgy in Colorado came relatively late in history; thus, individual or partnership levels of production had an extended history in Colorado, which again handicapped the rapid consolidation of the mining space.

In the Black Hills, modern smelting metallurgy and underground mining techniques were readily adopted. Accessible and surface ores in the Black Hills were limited in extent. The future lay in the low-grade

and underground ores which required sophisticated metallurgy, deep-seated mining techniques, and generous capital investments beyond the means of individual or partnership capacity. It is not surprising that company or corporate enterprises became the way of the future.

Abundant and easily mined ores extend the life span of the individual ownership pattern, whereas "stubborn" ores requiring modern smelting technologies and underground mining techniques called for company organization, and with it the consolidation of mining space as observed in the Black Hills. In Colorado, even though it was a late development, the integration of mining space evolved in the milling and smelting industry's branch and not in the mining industry proper. There were numerous small, medium, and large-size companies surviving in Colorado by the 1930s, but only a very few giant size smelting companies, such as the American Smelting and Refining Company, operated at this time.

In addition to size, location, technological, and economic factors, advertisement and certain types of business practices also contributed to the consolidation of the mining space or the lack of it. The Colorado gold mines received more bad publicity because of false advertisement, speculations, and bad mine practices than did the Black Hills mines, which frequently discouraged the necessary capital investments for developments. Thus, the capital appeared to be more selective in the Colorado mining industry than in Black Hills, even though malpractices in mining were also common in the Black Hills. Black Hills mines were able to attract capital since the discovery from east and west coast urban America and from Colorado capitalists as well, and dividends and profits were advertised regularly on the stock exchange.

The large-scale capital investments in the Black Hills mines accelerated the process of consolidation. Also, the custom of leasing out existing mines or mineral grounds to enterprising individuals or partnership organizations in Colorado kept the mining space fragmented or at best fostered a partially integrated mining space. Leasing of mines was not a widespread practice in the Black Hills.

Another very important variable which opoosed the smooth integration of the Colorado mining space was the "polymineralic" nature of the ore deposits. In addition to gold, substantial silver ores were mined; also, significant quantities of lead, zinc, and copper deposits associated with the precious metals or were found close to gold-silver deposits. This multi-ore nature of the Colorado deposits introduced the specialization of the mining industry into branch-industries, all of which were important money-makers that were independent of divergent business interests and connections. The Black Hills ores, in any given space, were relatively simple or "monomineralic" in composition, which made the consolidation or integration of the mining space easier and, thus, the functioning of the mining model more comprehensive.

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APPENDIX

ADIT—A horizontal tunnel driven into the side of a mountain through which a mineral deposit can be explored and mined.

BACK—The ceiling of any underground excavation.

BACKFILL—Sand portion of the milled ore used to support the walls of a stope and provide a working platform after removal of the ore.

CAGE—An elevator-type conveyance which moves people and materials up and down a mine shaft.

CHUTE—An opening into a stope through which ore is dropped after it is first mined to waiting mine ore cars for transportation to the shaft.

COLLAR—The term applied to the timbering or concrete around the mouth of a shaft, also used to describe the top of a drill hole.

CROSSCUT—A lateral or horizontal tunnel made underground that cuts across the ore body.

CUT-AND-FILL—A stoping method in which the ore is removed in slices of "lifts" after which the excavation is filled with sand backfill before the next slice is mine. The backfill supports the walls of the stope.

DEVELOPMENT—Bringing a mining property to the production stage.

DRIFT—A horizontal underground tunnel in such a direction that it follows or "drifts" with the ore in an ore vein.

FOOTWALL—the wall or rock on the underside of a stope.

GRIZZLY—A grating placed over the top of a chute or ore pass to stop larger pieces of rock or ore.

HANGING WALL—The wall or rock on the upper or top side of an ore deposit.

HOIST—A machine which raises and lowers the cage and skips in a shaft.

LEVELS—Horizontal passageways or tunnels in the mine leading from shafts. They are established at regular intervals.

PULP—A liquid and ore mixture. A synonym with slurry.

RAISE—A vertical underground tunnel that has been excavated from the bottom up.

SHAFT—An opening cut downward from the surface for transporting personnel, equipment, ore and waste. It is also used for ventilation and as an auxiliary exit.

SHRINKAGE STOPE—A method of stoping which utilizes part of the broken ore as a working platform and as support for the walls.

SKIP—A self-dumping type of bucket used in a shaft for hoisting ore or rock.

SLUSHER—A mechanical drag shovel used to move ore or waste in a stope.

SQUARE SET—A set of timbers used for support in underground mining.

STOPE—An opening underground in which ore or ore waste is blasted and broken.

TAILINGS—Waste materials from the milling process.

WINZE—A vertical or inclined opening sunk from a point inside a mine. Similar to a shaft, but the latter starts at the surface.