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ALASKA'S COAL PROVINCES AND RESOURCES

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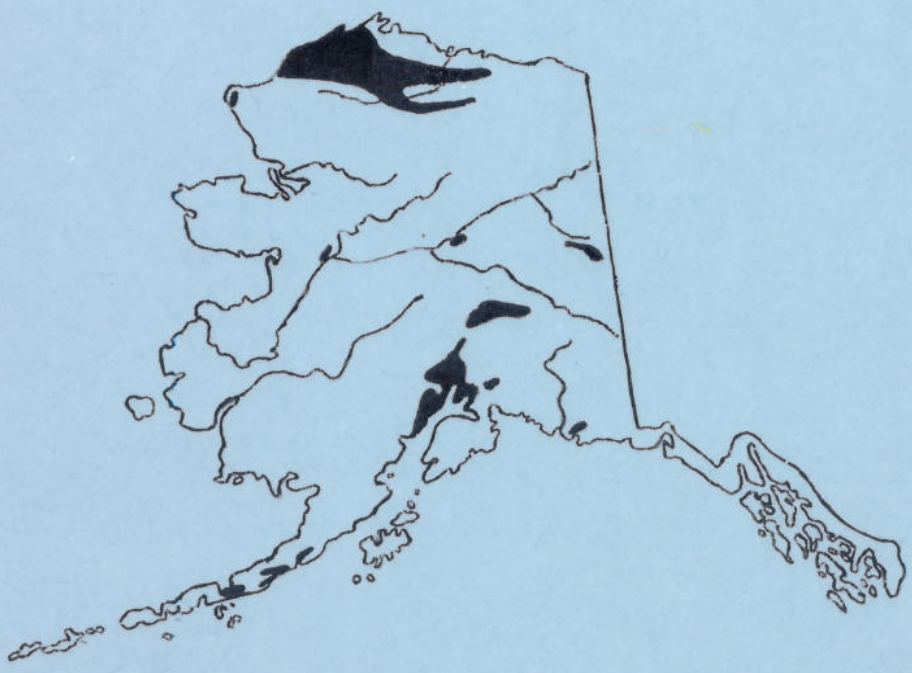

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Alaska's Coal Provinces And Resources

ABSTRACT

Alaska has vast resources of lignite to anthracite grade coals, chiefly of Cretaceous and Tertiary age, occurring in several major fields or basins covering millions of acres. These resources may account for up to 48 percent of the total United States coal resource base and up to 22 percent of the world resource base. Current total identified resources amount to 160 billion short tons. Undiscovered resources (hypothetical and speculative) range upward from 5 to 5.5 trillion short tons. The three largest coal provinces of the state are Northern Alaska, the Cook Inlet-Susitna Lowland, and the Nenana Trend. Although the majority of Alaska's coals are of bituminous and subbituminous ranks, anthracite does occur in the Bering River and Matanuska fields.

INTRODUCTION

Although there has been a recent notariety attached to Alaska's coal, in fact, they have been studied and mined for over a century. Coals have been utilized during these years for local use, to power river steamers, whaling ships, and as the major fuel source for some communities. Coal was mined near the village of Atkasuk or Meade River (fig. 1) in northwest Alaska, and extracted for use by whaling ships and cargo freighters at Corwin Bluff (fig. 2) on the Chukchi Sea coast. Captain C.L. Hooper is reported to have taken on 20 tons of coal here for his ship, the Corwin, in 1881. Coals have been used for years by placer miners of the Dutch and Peters Hills areas (fig. 3) of the northern Susitna Lowland (Sanders, 1981). The Cache Creek Dredging Company operated the Short Creek Mine on a small tributary of the Yentna River beginning in 1916 to supply power for its dredge. The underground coal mine at Suntrana (fig. 4), which operated from 1922 till 1962, was the largest coal mine in the Alaskan Territory around 1940 (Naske and Triplehorn, 1980). The Gold Run Pass Mine (fig. 5), now operating intermittently, opened in 1955 north of Sanderson Creek, a tributary to Lignite Creek. Several hundred tons of coal were produced from a small operation in the Jarvis Creek Field in 1958. The first coal mine in Alaska was opened by the Russian-American Company in 1855 near Port Graham on the Kenai Peninsula. Alaska even had its own 'Boston Tea Party' in 1911 at Cordova to protest federal coal policies.

PRODUCTION

Figure 6 shows the amount of coal produced yearly in Alaska since 1915. Early production was dominated by underground mining, while surface mining encompasses the total production today. More coal was produced in the mid-sixties than at present reflecting its use by Elmendorf and Fort Richardson. Currently, the Usibelli Coal Mine (fig. 7) produces 800,000 short

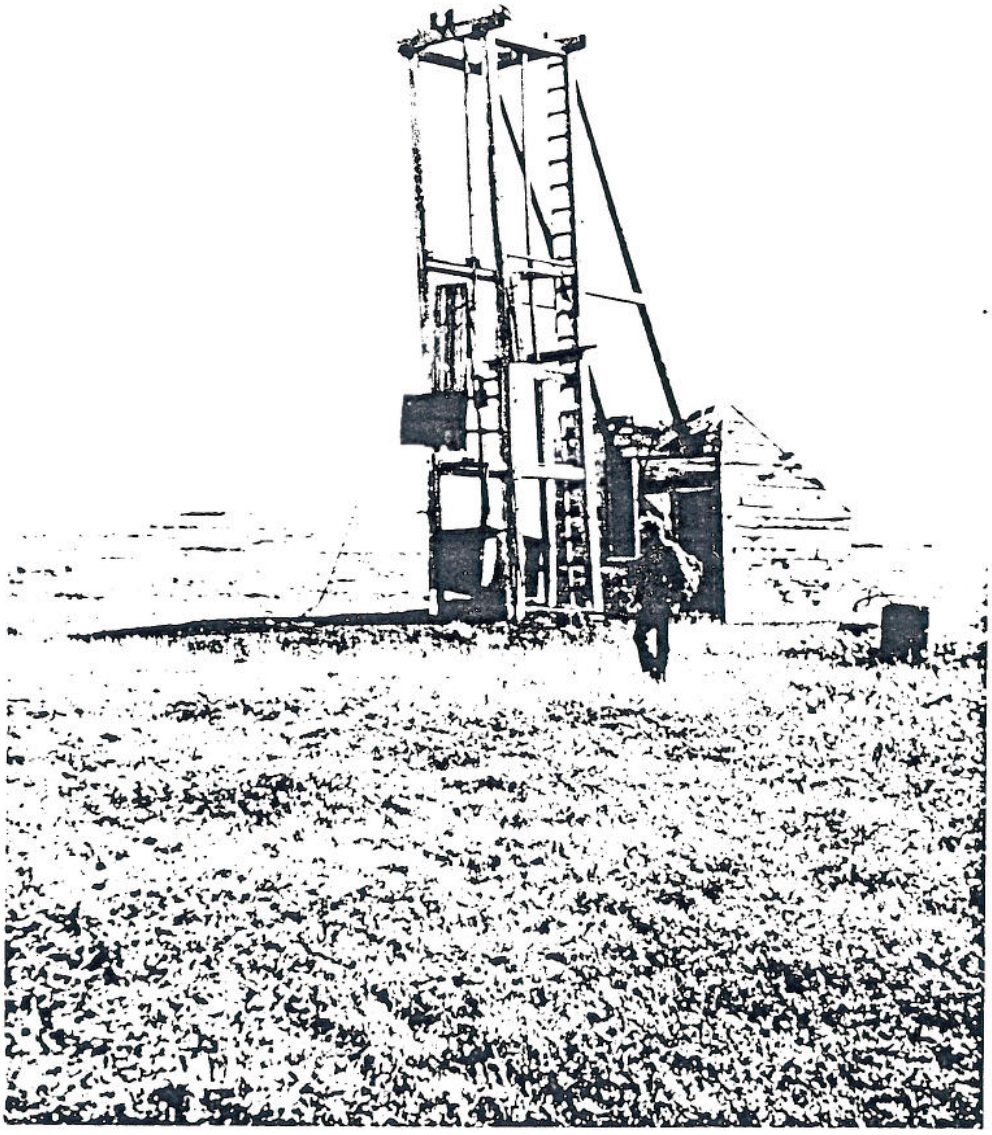


Figure 1. Site of previous coal mining near village of Atkasuk or Meade River, northwest Alaska (courtesy J. Callahan).

Figure 2. Site of coal extraction by ships at Corwin Bluff on the Chukchi Sea coast (courtesy J. Callahan).

Figure 3. Coal outcrop near Peters Hills, northern Susitna Lowland.

Figure 4. Site of Suntrana Mine (1922-1962) on Healy Creek, Nenana Coal Field (Bunnell Collection, University of Alaska Archives).

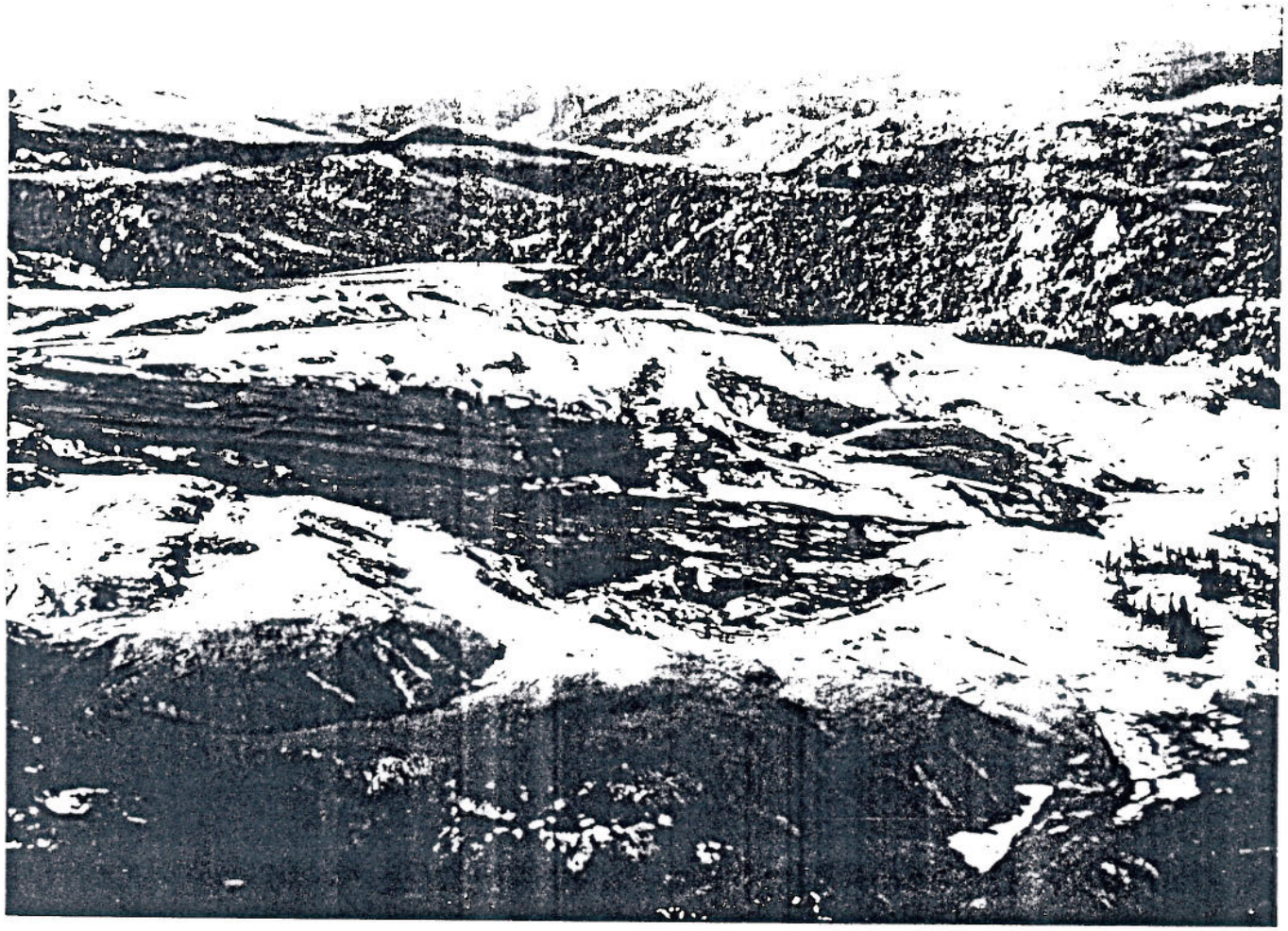


Figure 5. Site of the Gold Run Pass Mine pit, Nenana Coal Field.

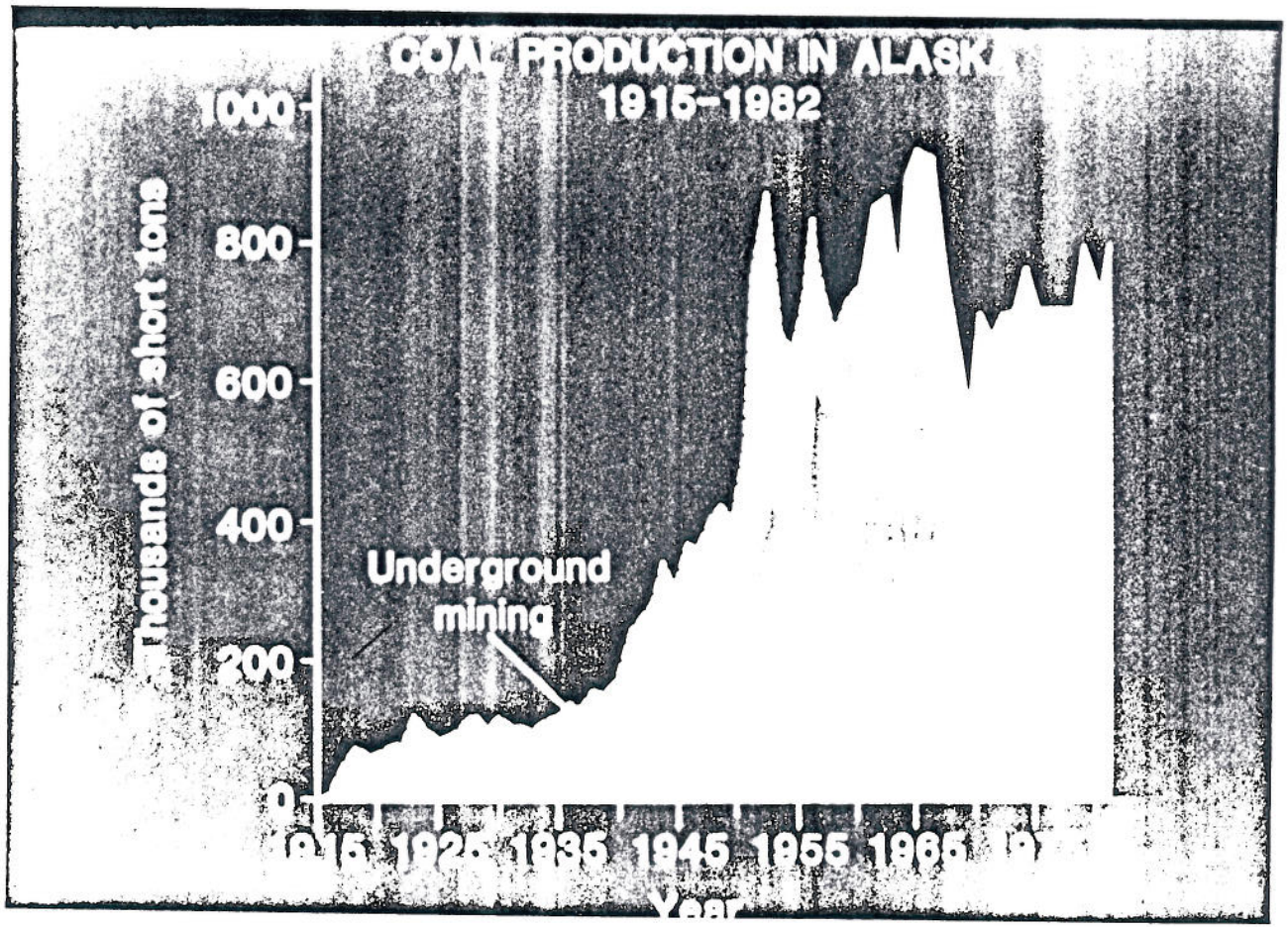


Figure 6. Alaska coal production, 1915-present (adapted from Bundtzen and others, 1982, fig. 9, p. 48).

Figure 7. Poker Flats Pit of the Usibelli Coal Mine and the 'Ace-in-the-Hole' dragline.

tons of coal at the Poker Flats pit of the Lignite Creek Field. The 'Ace-in-the-Hole' dragline, which has a 33 cubic yard bucket capacity, is also shown (Denton, 1981; personal communication, 1982).

PROVINCES, RESOURCES, AND PROSPECTS

The future of coal in Alaska is as speculative as the resources themselves, but one thing is clear. Alaska contains vast deposits of coal. These deposits (fig. 8) are scattered over large expanses of the state underlying millions of acres.

Figure 9, from McGee and Emmel (1979), compares Alaska's identified resources of coal with those of the contiguous United States and the world. Alaska's resources, as depicted here, make up approximately 48 percent of the United States coal resource base and approximately 22 percent of the total world resource base. Resource estimates for coal in this paper will be broken down into two major divisions based on the U.S. Bureau of Mines and U.S. Geological Survey system (fig. 10)---undiscovered resources (hypothetical and speculative) and identified resources (indicated and inferred). Comparing the coal resources for the three major coal provinces of Alaska (fig.11), we can gain an insight into the enormity of the deposits and their relative size. The majority of Alaska's coal resources are of bituminous rank (fig. 12) with a large secondary class of subbituminous coals, and minor lignite and anthracite deposits (McGee and Emmel, 1979).

The Northern Alaska coal fields (fig. 13) form by far the largest coal resource province of the state and the nation in terms of area and resource base. The deposits can be divided into a largely bituminous subprovince to the south and a wide belt of predominantly subbituminous coals north of this. The site of the Meade River Mine and Corwin Bluff, referred to previously, are also indicated, as are the locations for two other coal-bearing exposures of this region---Kukpowruk River and Elusive Creek. These coals occur within the Cretaceous Nanushuk

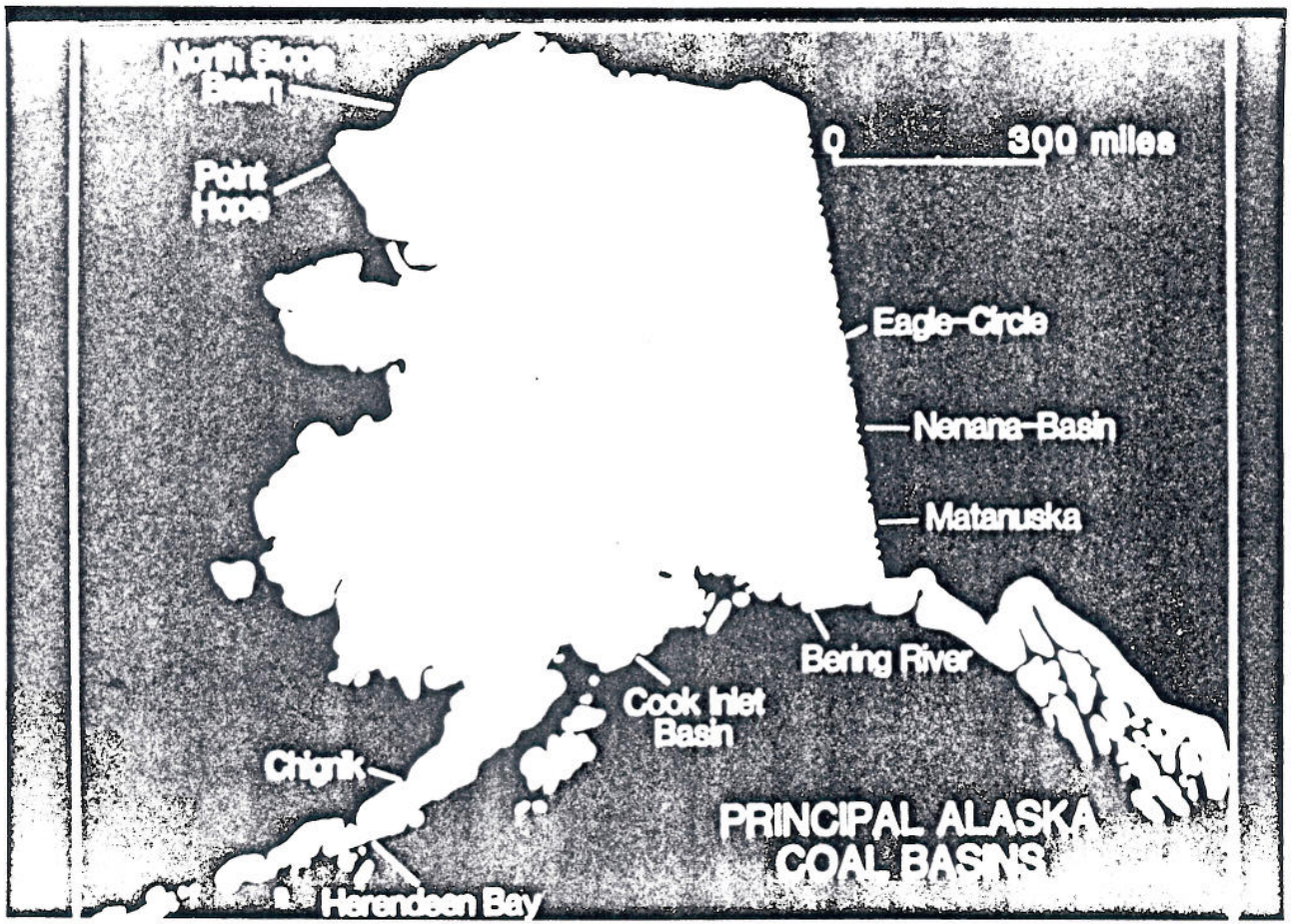


Figure 8. Alaska coal fields (adapted from Conwell, 1977).

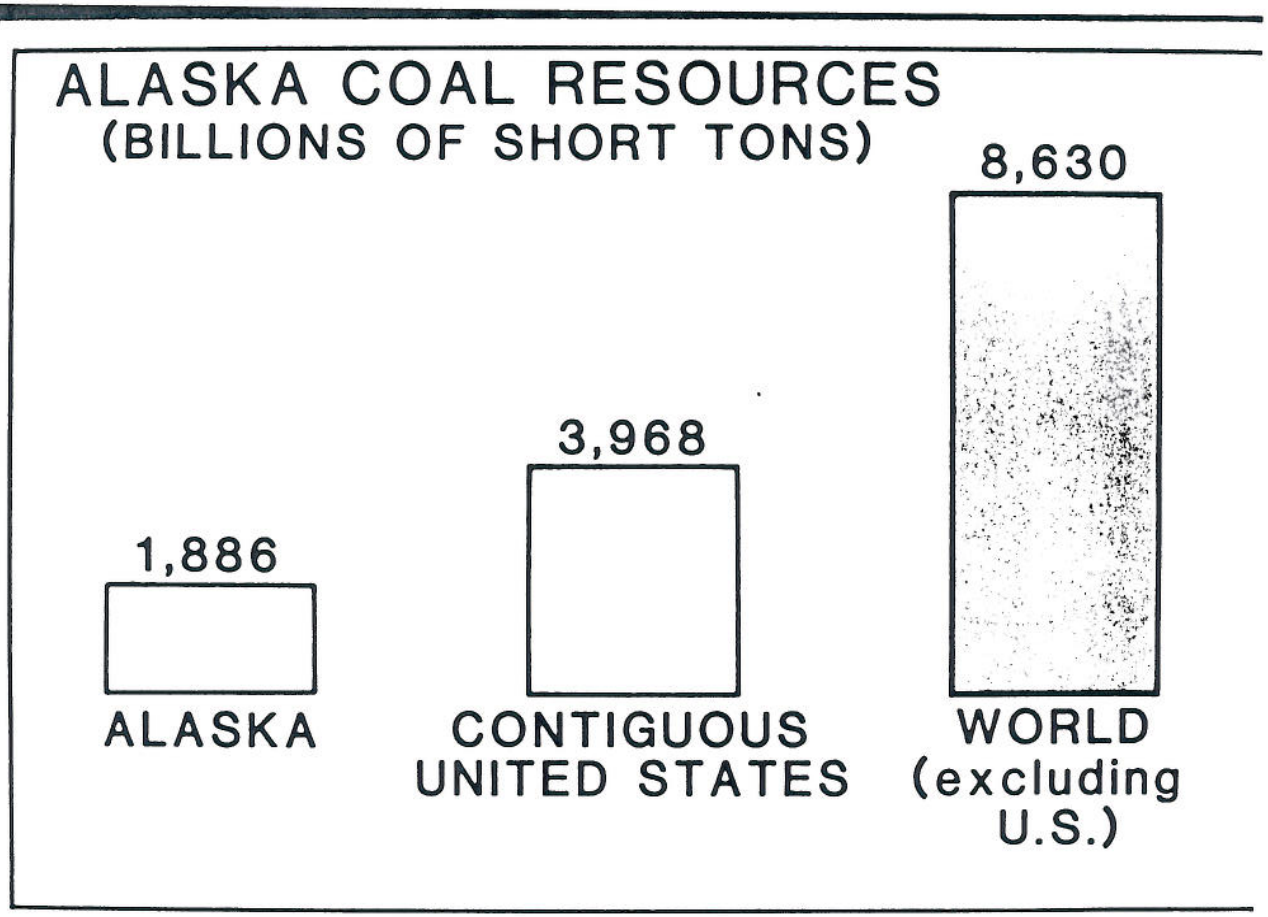


Figure 9. Bar graph comparing Alaska's identified coal resources with those of the contiguous United States and the world (from McGee and Emmel, 1979).

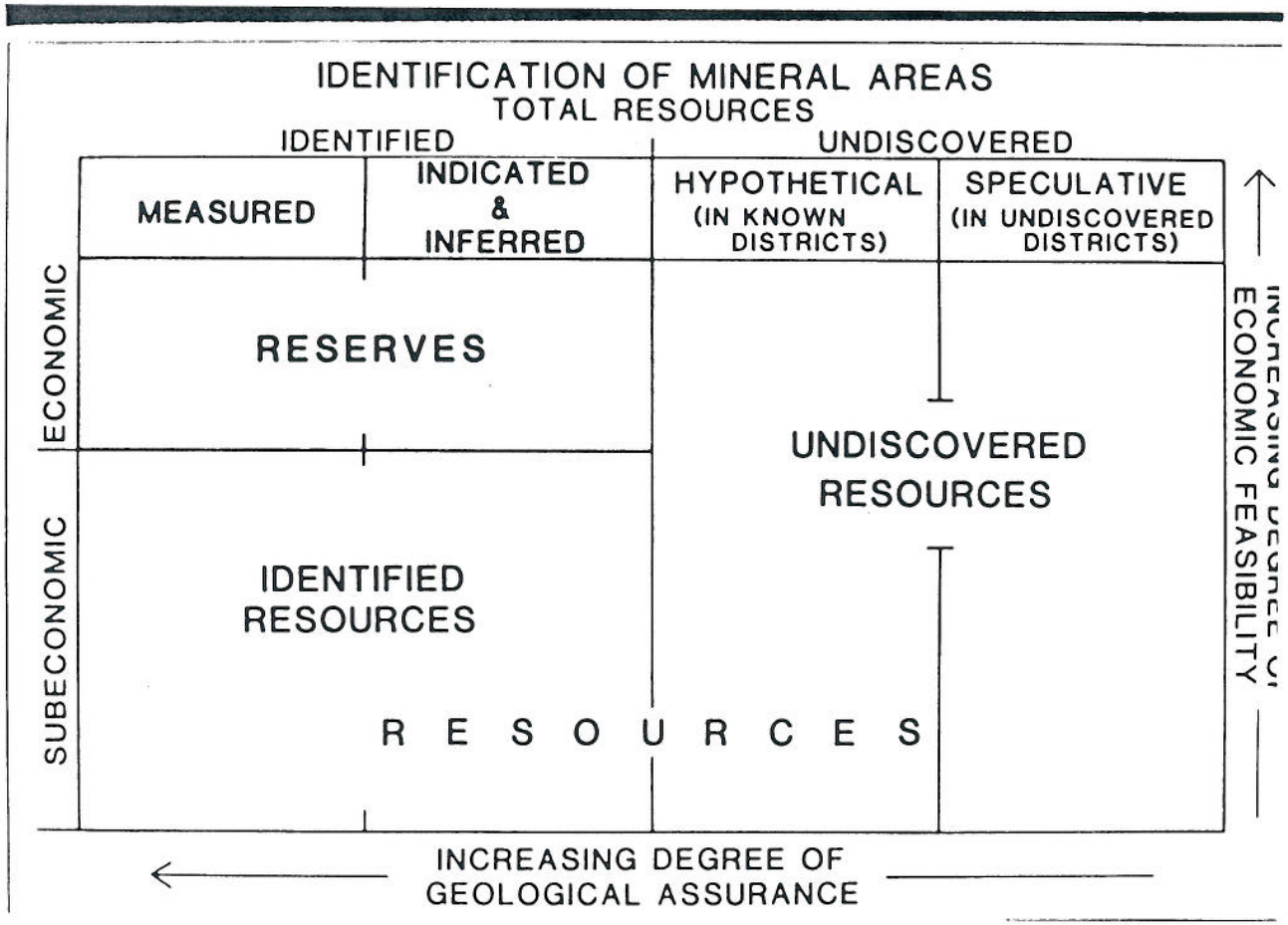


Figure 10. Coal classification system of the U.S. Bureau of Mines and U.S. Geological Survey (from U.S. Geological Survey, 1976).

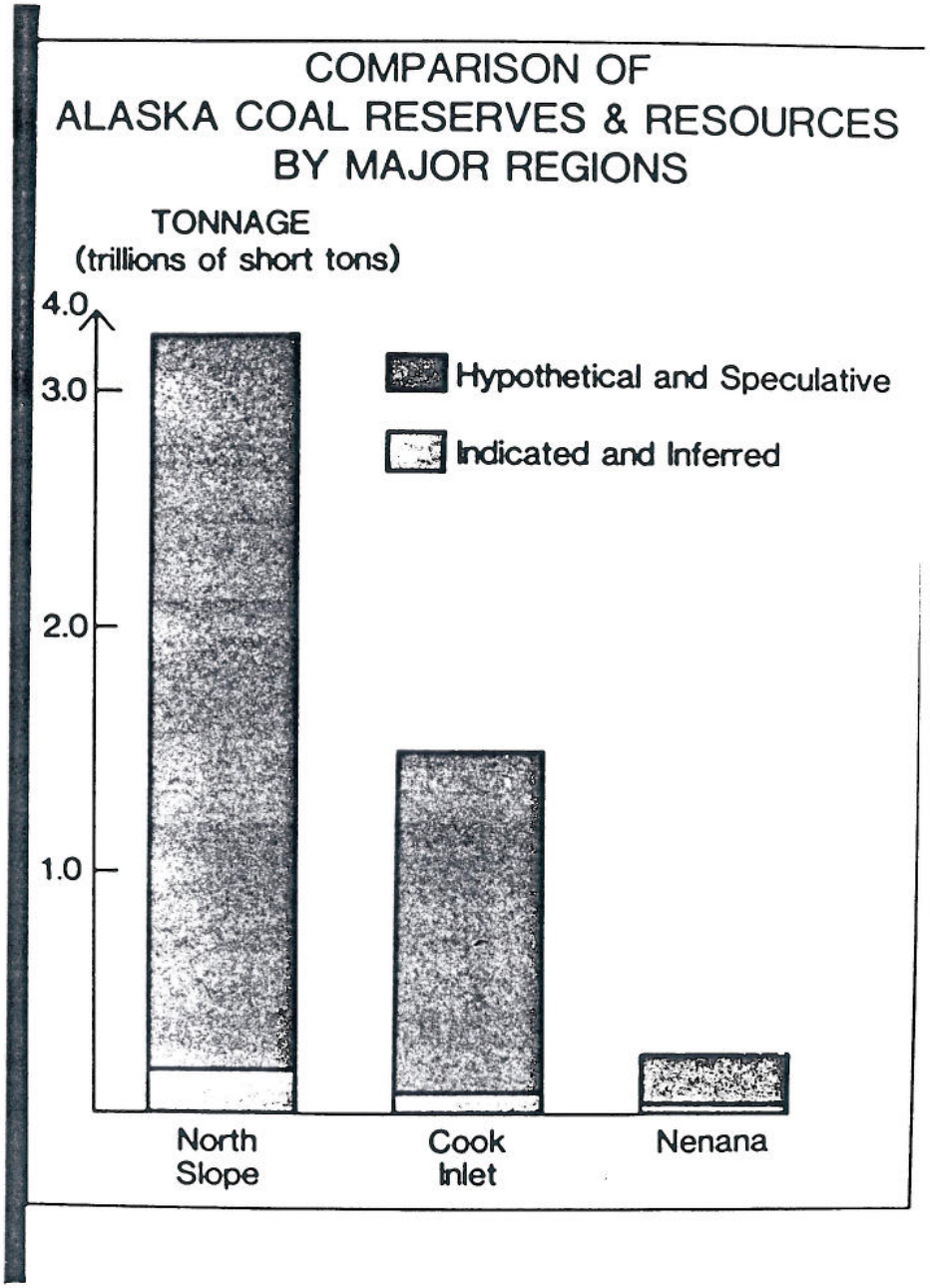


Figure 11. Comparison of coal resources for three major coal provinces of Alaska (from McGee and Emmel, 1979).

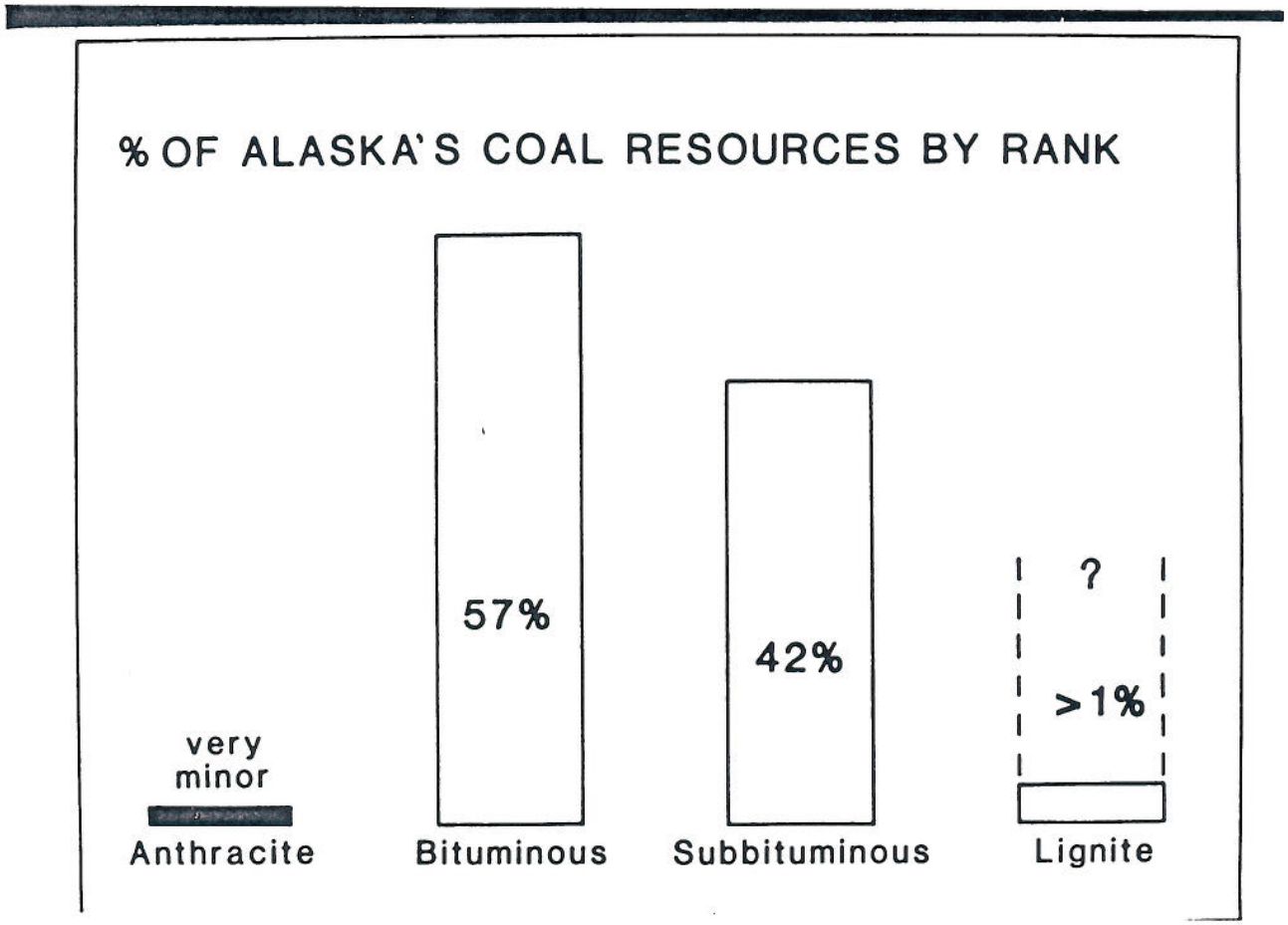


Figure 12. Alaska coal resources by rank (from McGee and Emmel, 1979).

Figure 13. Location, extent of deposits, and general rank of Northern Alaska Coal Fields (adapted from Conwell, 1977).

Group of rocks as shown in the correlation diagram of figure 14. The isopach map (fig. 15), prepared by Jim Callahan, shows that the group attains its greatest thickness, approximately 11,000 ft, in the southwestern portion of the province near Cape Lisburne. Callahan and Martin (1981) have developed a deltaic sedimentation model (fig. 16) to illustrate the depositional environments of the facies of the Corwin and Kukpowruk Formations, which compose the Nanushuk Group on the Arctic Coastal Plain and in the foothills of the western North Slope.

Major coal resources are found within the Naval Petroleum Reserve Alaska (NPRA), which in energy terms is a misnomer, as well as both west and east of it. At Elusive Creek (fig. 17) in the western NPRA, a 14-ft coal bed (fig. 18) crops outs in the cutbank shown. Approximately 20 mi upstream along the Kukpowruk River (fig. 19), on the inside of the meander loop at center, a 20-ft seam (fig. 20) is exposed. These two seams are typical of the numerous 15- to 40-ft coals characteristic of the group. The coal resources of this large province are summarized in figure 21 comparing the estimates of various individuals. Identified resources range up to 150 billion short tons, while hypothetical and speculative resources range upward to 4 trillion short tons.

The Cook Inlet-Susitna Lowland coal province encompasses the second largest coal resource base in Alaska. It is composed of several major basins or fields (fig. 22). These include the Beluga, Yentna, Little Susitna, Matanuska, Broad Pass, and Kenai coal fields, as well as the deposits offshore in Cook Inlet.

The coals of the Beluga and Yentna fields of the Susitna Lowland occur within three formations of the Tertiary Kenai Group (fig. 23). Most of the major minable seams, over 20-ft thick, of the Kenai Group are restricted to the Tyonek Formation, while relatively thin lignite and subbituminous coal beds occur in the Beluga and Sterling Formations.

The Capps Field occupies a localized coal deposit 7 to 8 mi^2 in which two major beds, the Capps and Waterfall seams of 55- and 25-ft maximum thicknesses (respectively) occur (Patsch, 1976). The

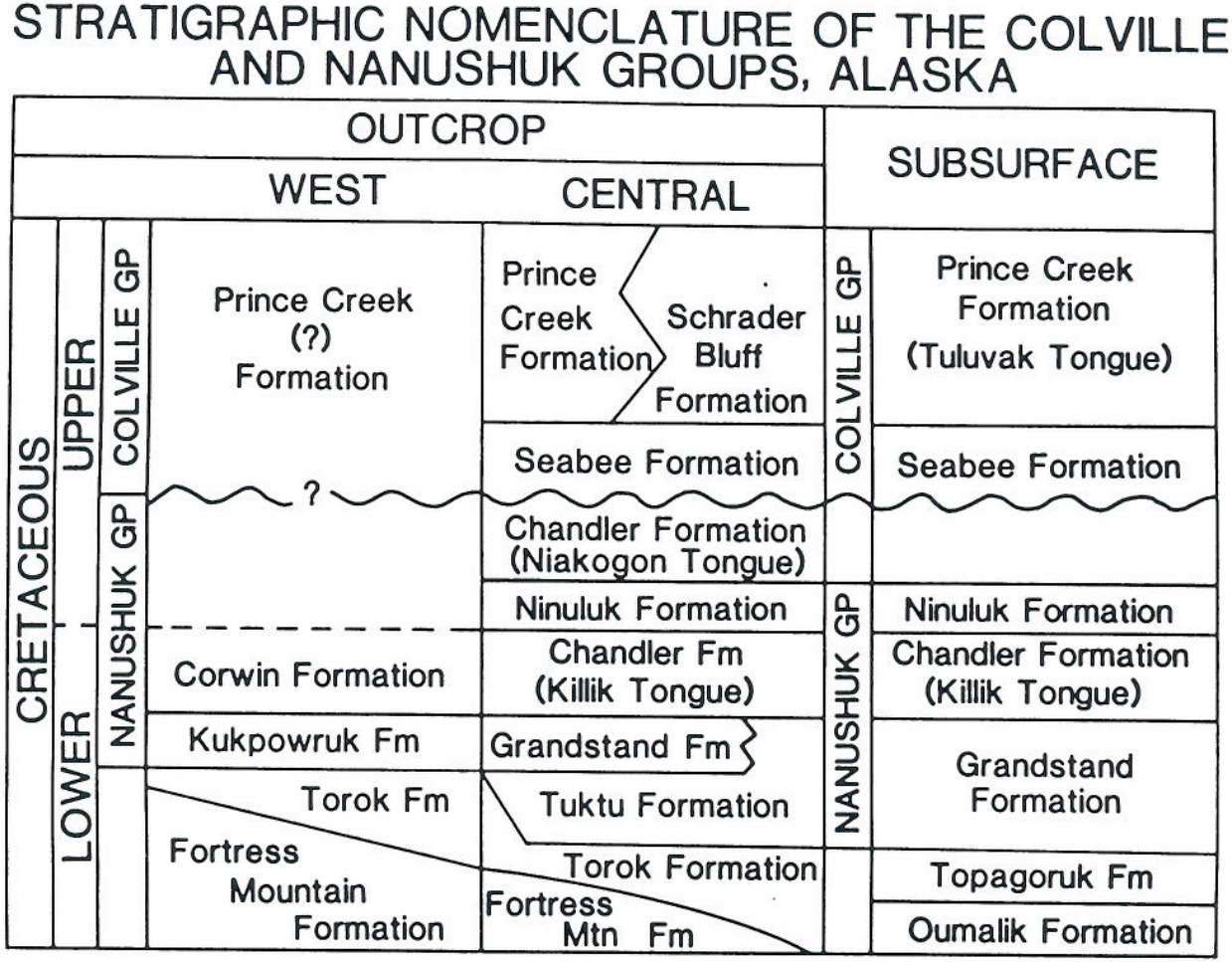
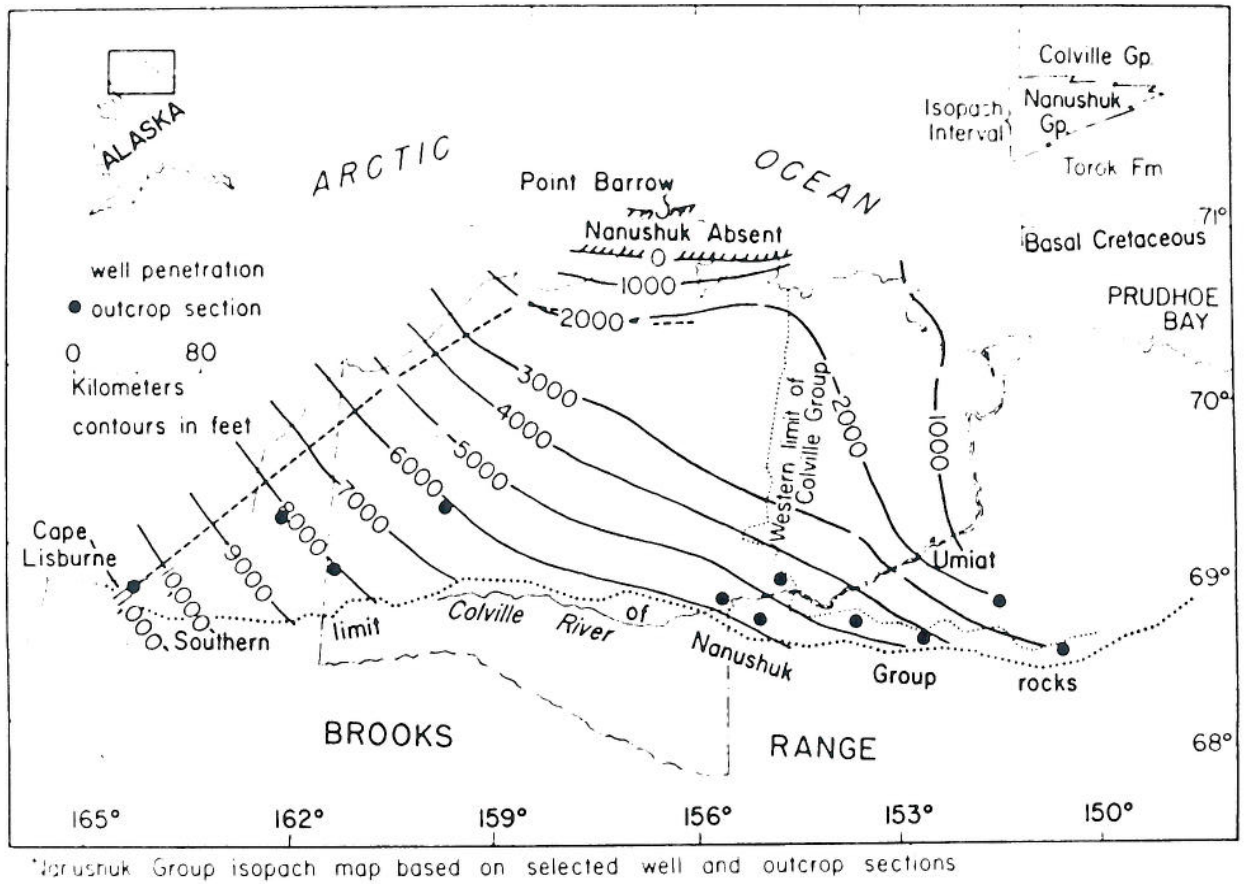
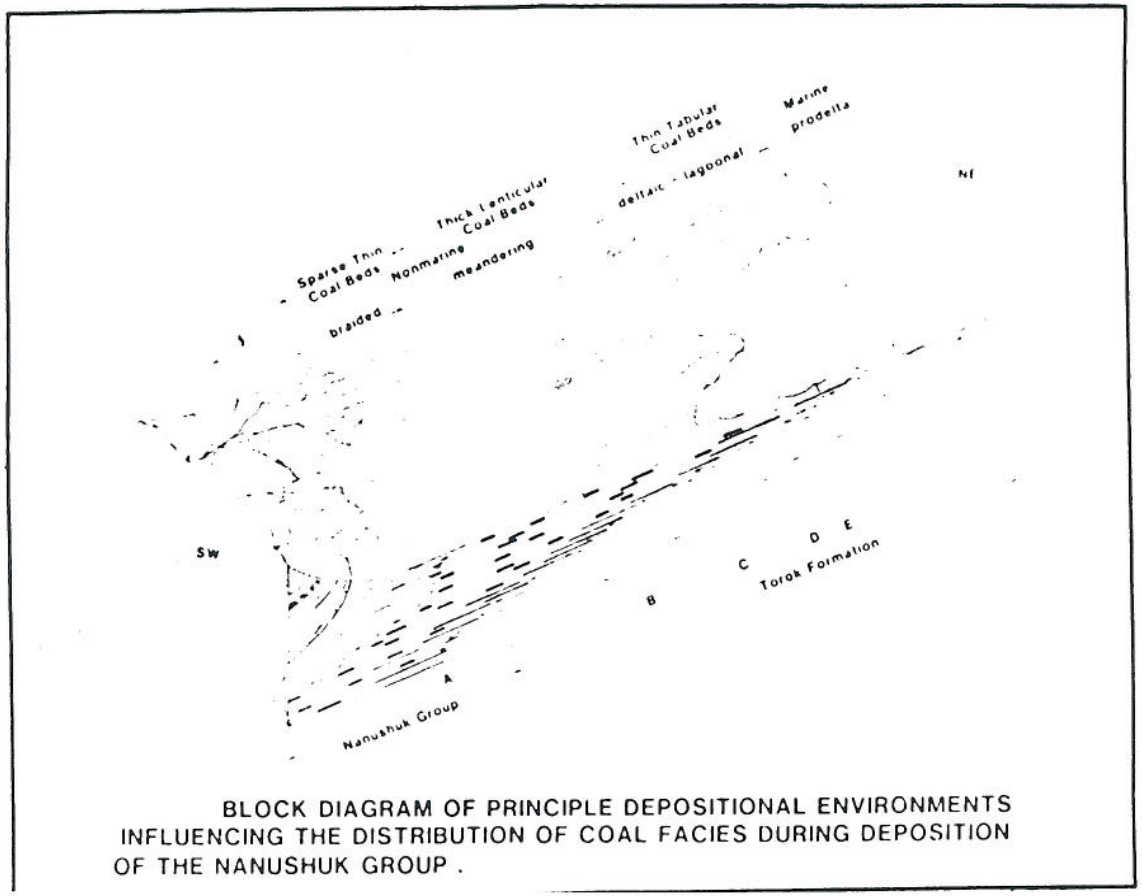


Figure 14. General correlation diagram with stratigraphic nomenclature for the Colville and coal-bearing Nanushuk Groups (from Ahlbrandt and others, 1979).



Nanushuk Group isopach map based on selected well and outcrop sections

Figure 15. Nanushuk Group isopach map (courtesy J. Callahan).



BLOCK DIAGRAM OF PRINCIPLE DEPOSITIONAL ENVIRONMENTS INFLUENCING THE DISTRIBUTION OF COAL FACIES DURING DEPOSITION OF THE NANUSHUK GROUP .

Figure 16. Deltaic sedimentation model for Corwin and Kukpowruk formations (from Callahan and Martin, 1981).

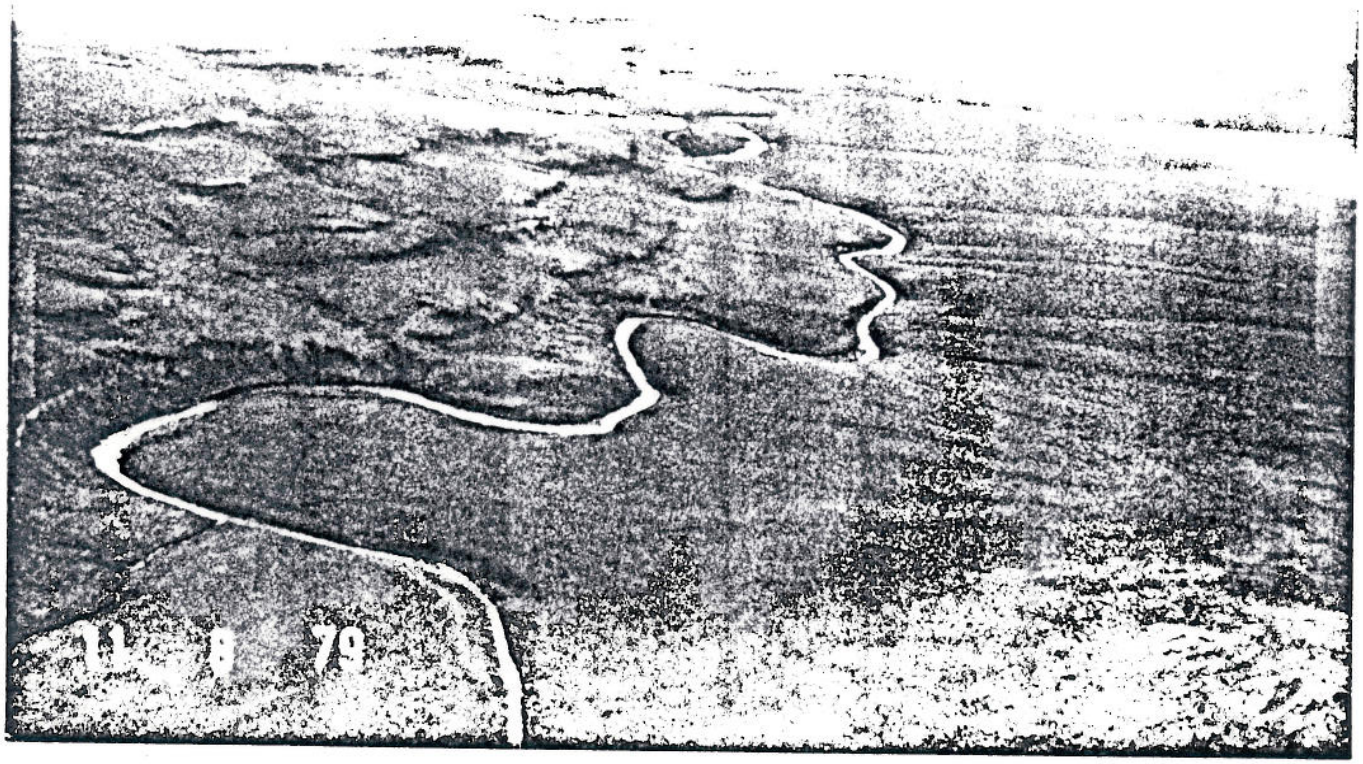


Figure 17. General physiography of Elusive Creek area, western N.P.R.A. (courtesy J. Callahan).

Figure 18. Coal bed cropping out at Elusive Creek site (courtesy J. Callahan).

Figure 19. General physiography of Kukpowruk River area (courtesy J. Callahan).

Figure 20. Coal seam cropping out at Kukpowruk River site (courtesy D. McGee).

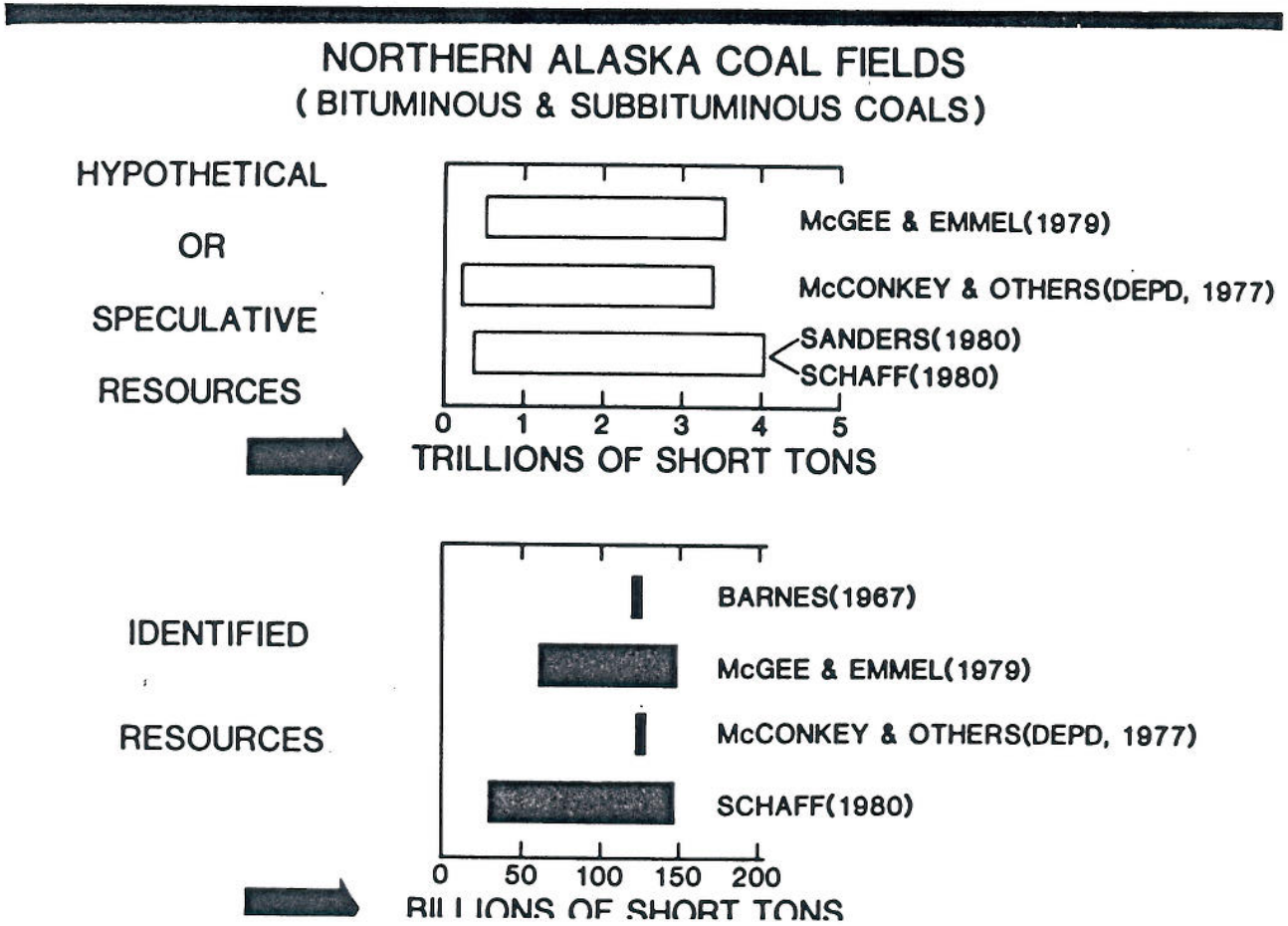


Figure 21. Summary of the coal resources of the Northern Alaska Coal Fields.

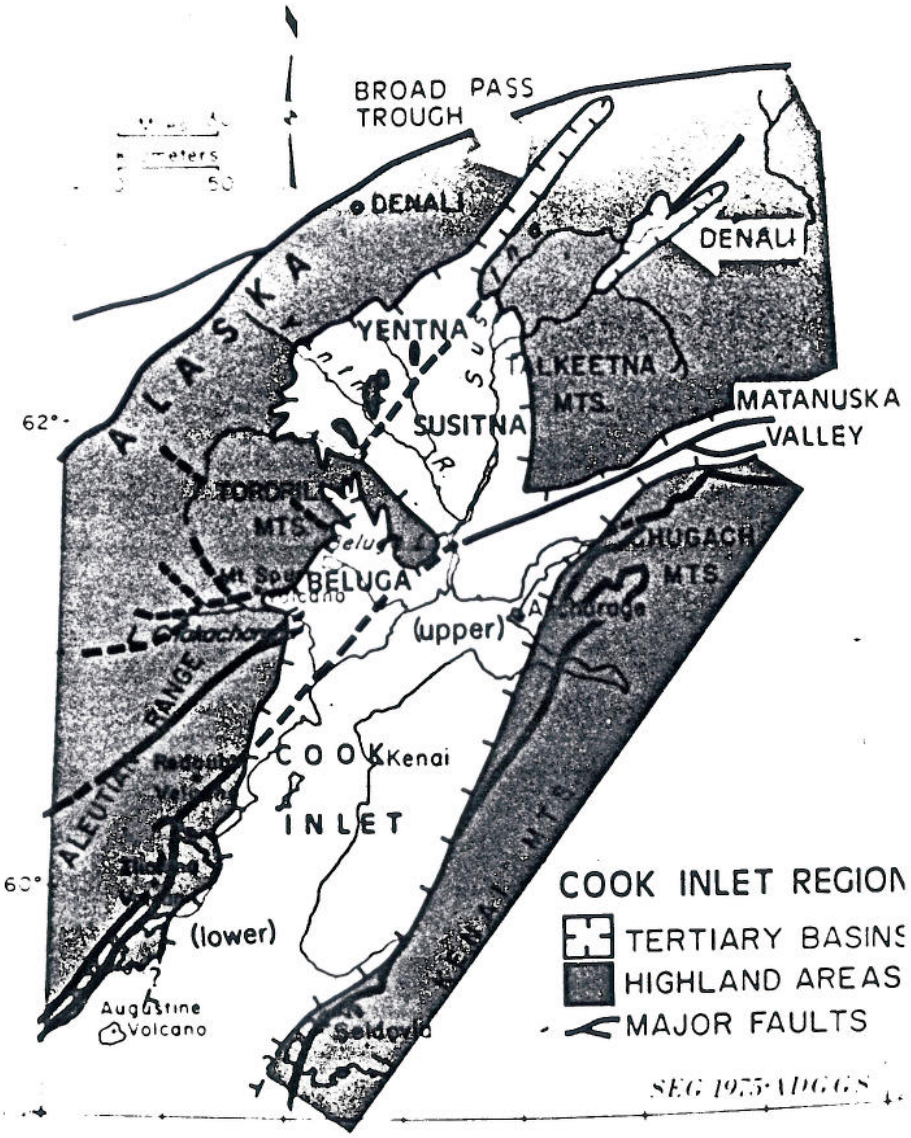


Figure 22. Major basins of the Cook Inlet-Susitna Lowland region (from Hackett, 1977).

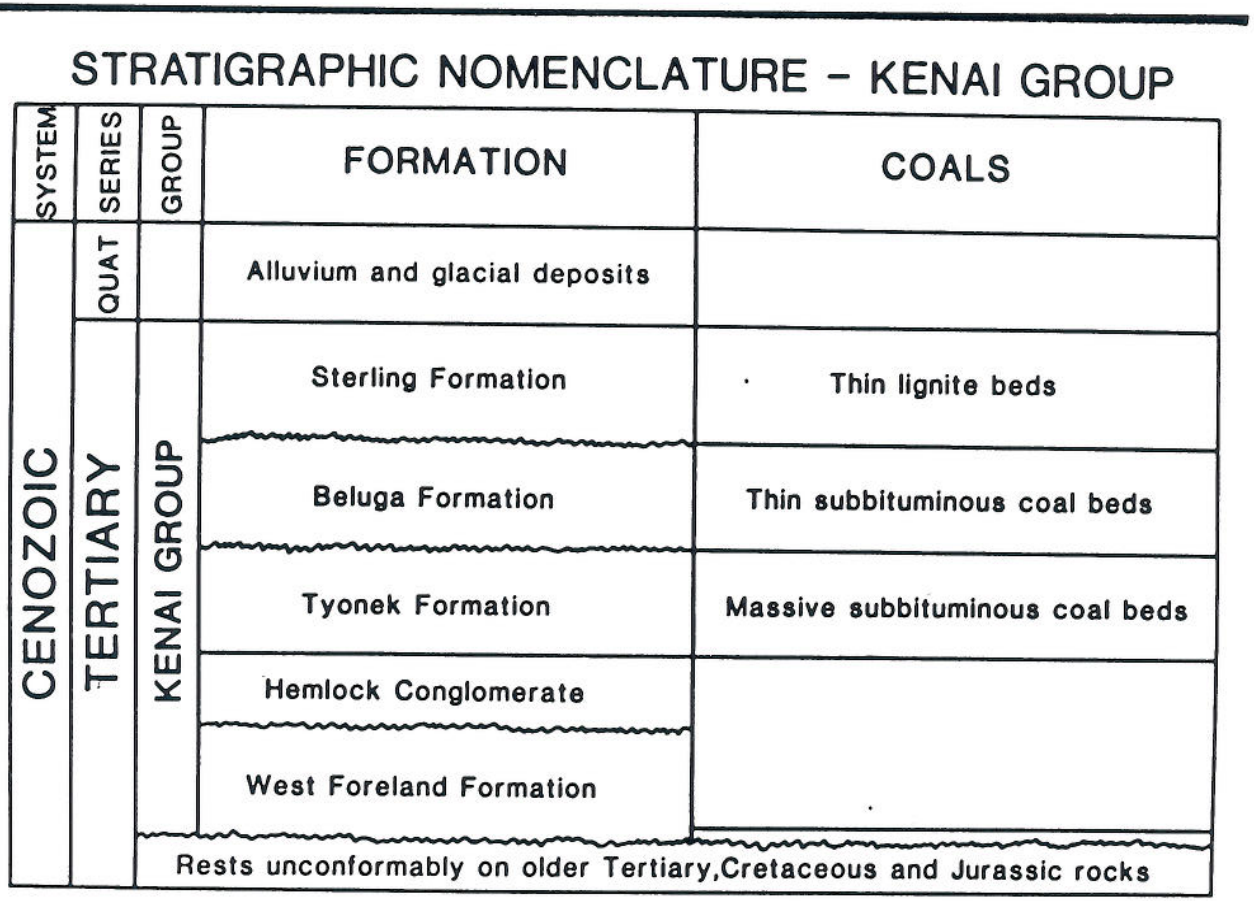


Figure 23. General correlation and nomenclature for Tertiary Kenai Group (adapted from Calderwood and Fackler, 1972).

coal bed shown in figure 24 is the Capps seam, despite the waterfall. Needless to say, this has resulted in some confusion over the years. The Chuitna Bed (fig. 25) of Barnes (1966) or the Brown Seam (as now known) crops out along the Chuitna River. It averages 28-ft thick and is underlain by five other minable seams---the Yellow, Green, Blue, Orange, and Red seams (Ramsey, 1981). Along the western side of the Susitna Lowland, an 8-ft bed crops out along Saturday Creek (fig. 26), and four of the six coal beds (ranging up to 7-ft thick) cropping out at Fairview Mountain are shown in figure 27. Coal occurrences in the Fairview Mountain region were first described by Capps (1913). Figure 28 summarizes the coal resources of the Beluga and Yentna fields. Identified resources range up to 10 billion short tons, while hypothetical and speculative resources range up to over 30 billion short tons.

Coals also underlie much of the Kenai Peninsula (fig. 29). Along the western coast of the Kenai Peninsula, 37 reported coal beds of the Sterling Formation of the Kenai Group are exposed. Several of these beds can be observed on the north side of Kachemak Bay (fig. 30) near Homer. Identified resources of the Kenai Field (fig. 31) are approximately 300 million short tons. Hypothetical and speculative resources to 2,000-ft depth are around 100 billion short tons, while to 10,000-ft depth, they range up to around 1.5 trillion short tons.

The distribution of coal-bearing rocks of the upper Cook Inlet region and Matanuska Valley are shown in figure 32. The Chickaloon Formation of the Matanuska Field contains at least 30 separate coal beds in the upper half of the 3,000-ft thick unit (Conwell and others, 1982). Two districts of this field are Wishbone Hill and Anthracite Ridge. The coals in the Wishbone Hill area occur in the Jonesville, Premier, Eska, and Burning Bed groups, as shown in the cross section of figure 33. Locally, coals of this field have been upgraded to anthracite due to the complex folding, faulting, and igneous intrusives. The site of the Evan Jones Mine near Palmer is shown in figure 34. Over 100 million tons of coal have been identified for the Matanuska Field (fig. 35), and hypothetical and speculative re-

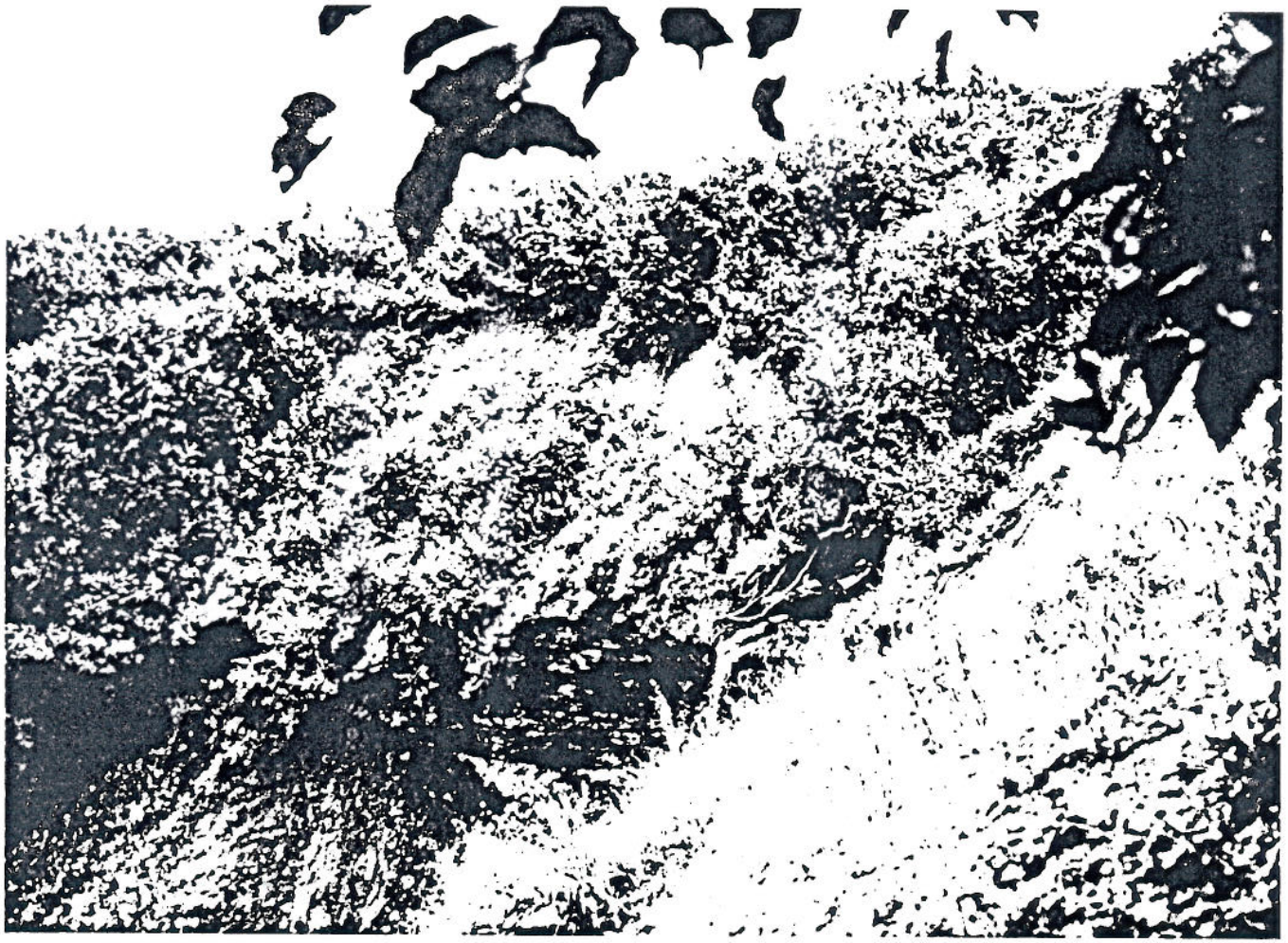


Figure 24. Capps Seam, Capps Coal Field, western Susitna Lowland.

Figure 25. Chuitna Bed or Brown Seam, Chuitna River, Susitna Lowland.

Figure 26. Saturday Creek coal-bearing outcrop, western Susitna Lowland.

Figure 27. Fairview Mountain coal-bearing section, northwest Susitna Lowland.

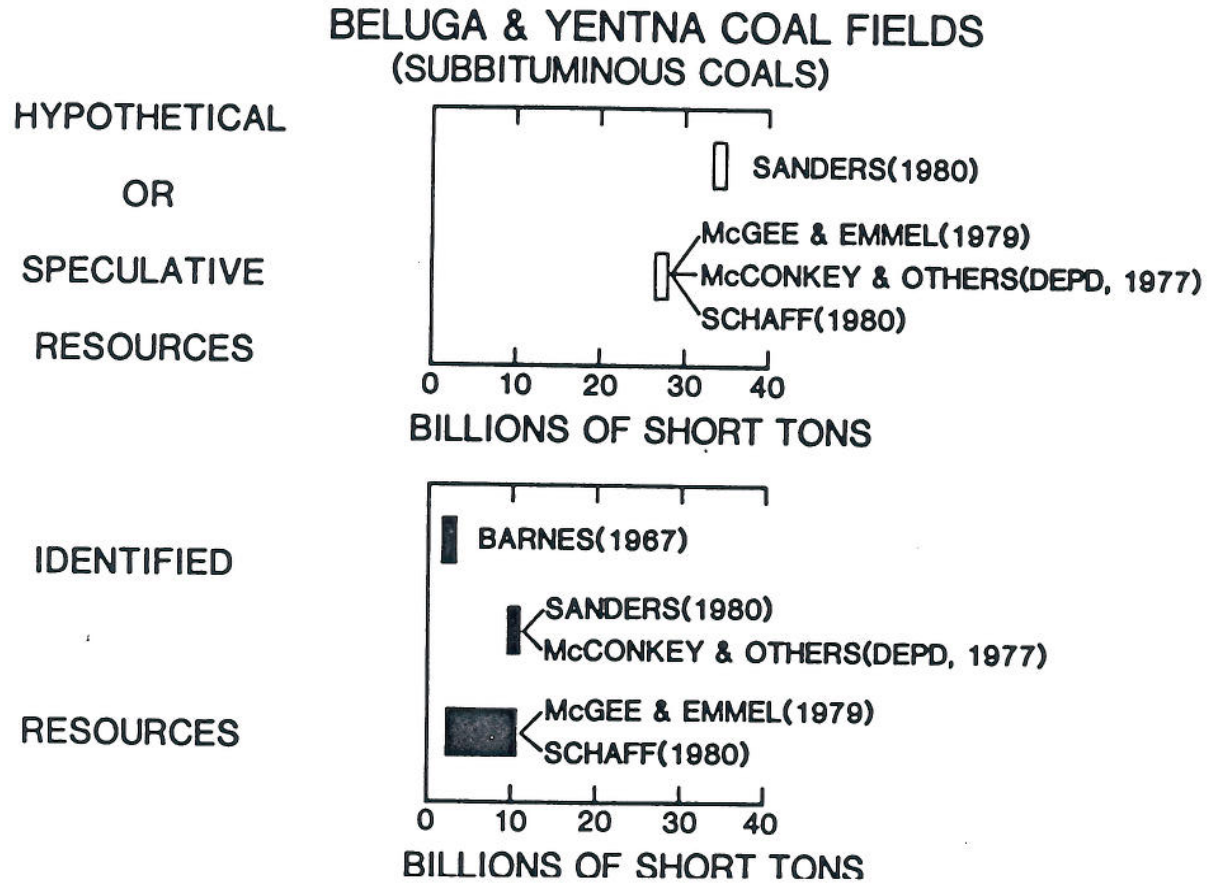


Figure 28. Summary of the coal resources of the Beluga and Yentna Fields.

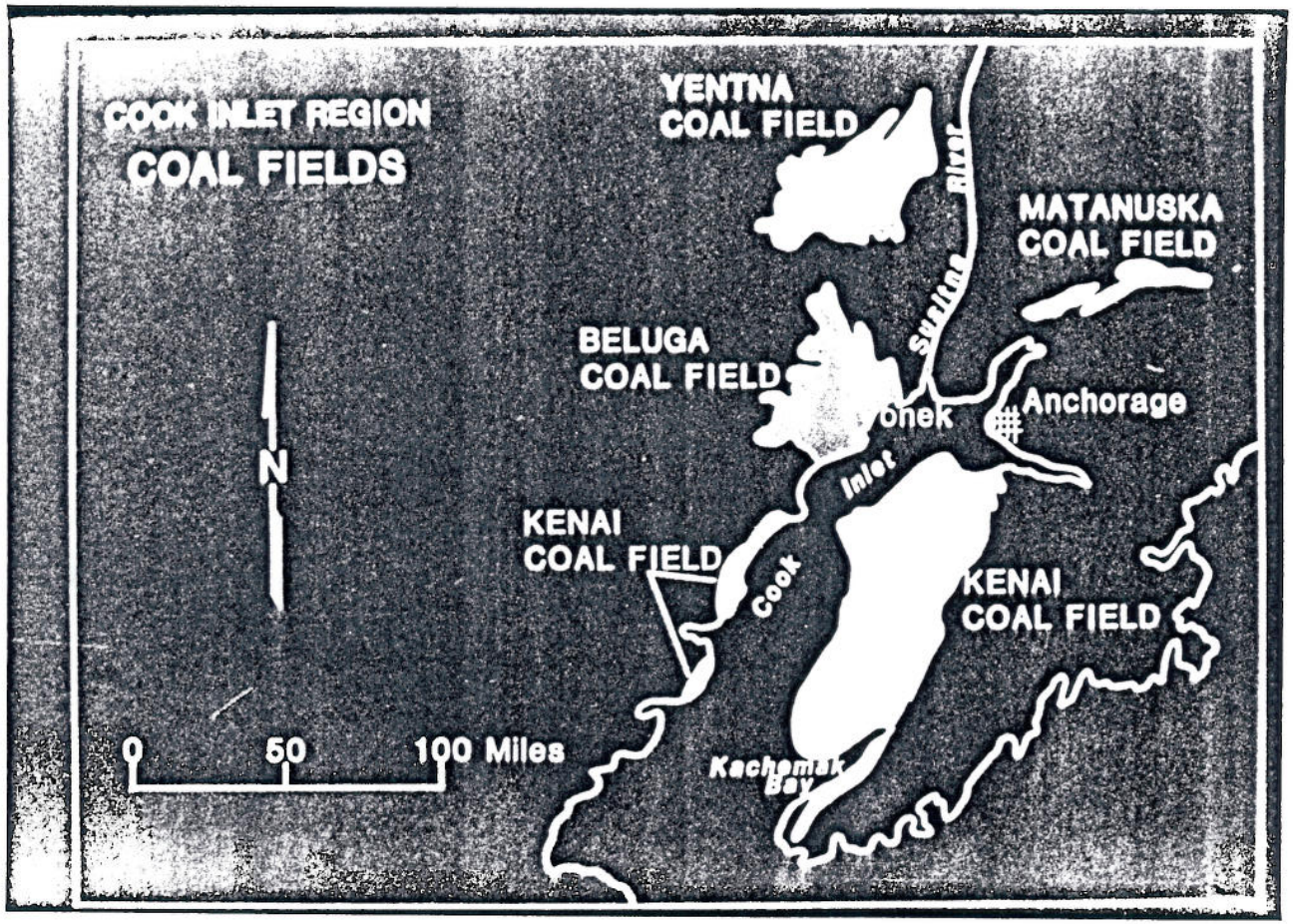


Figure 29. Location of Kenai Peninsula and other major coal-bearing areas of the Cook Inlet-Susitna Lowland region (adapted from Conwell, 1977).

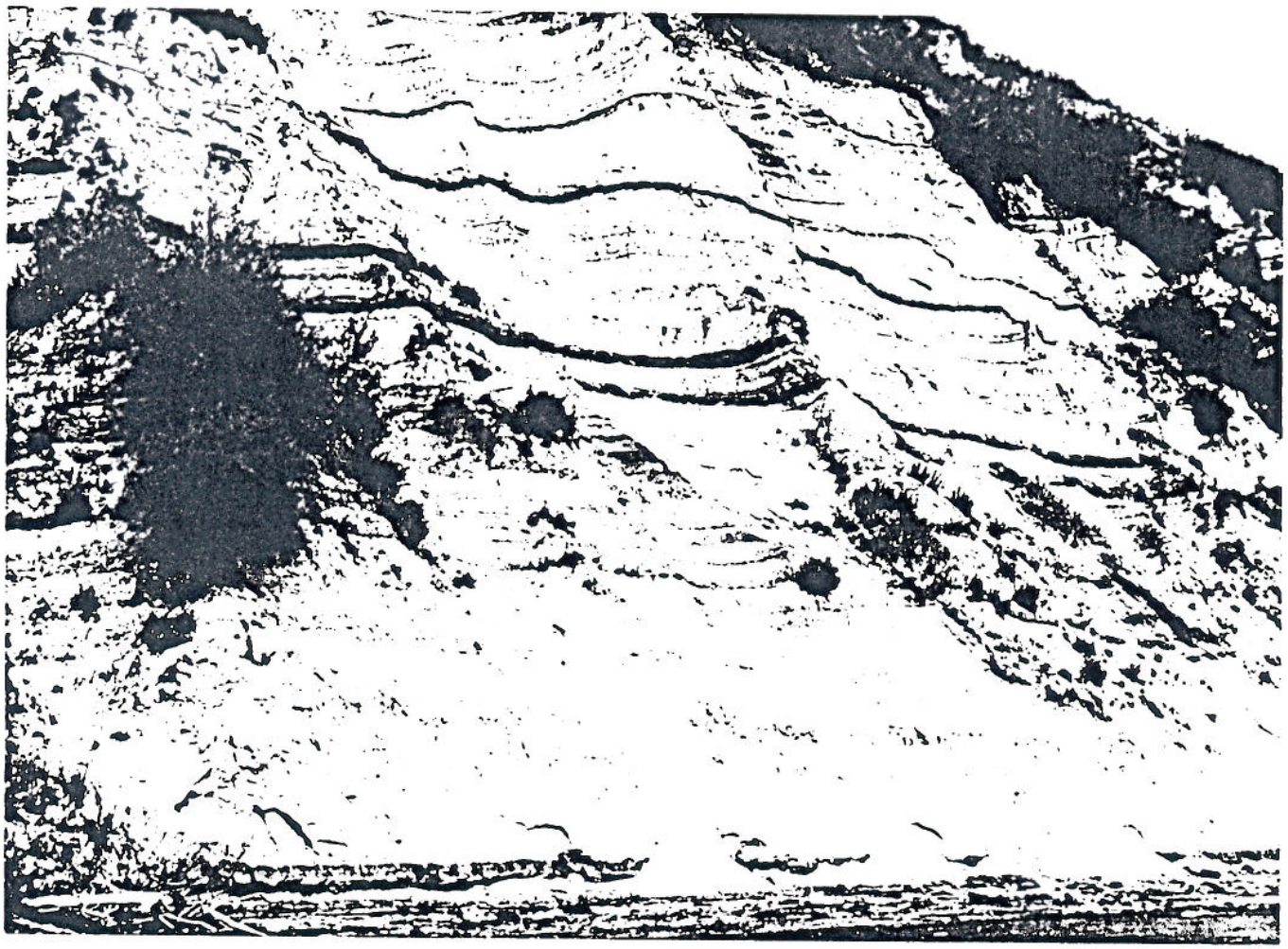


Figure 30. Coal-bearing section at Kachemak Bay near Homer (courtesy D. McGee).

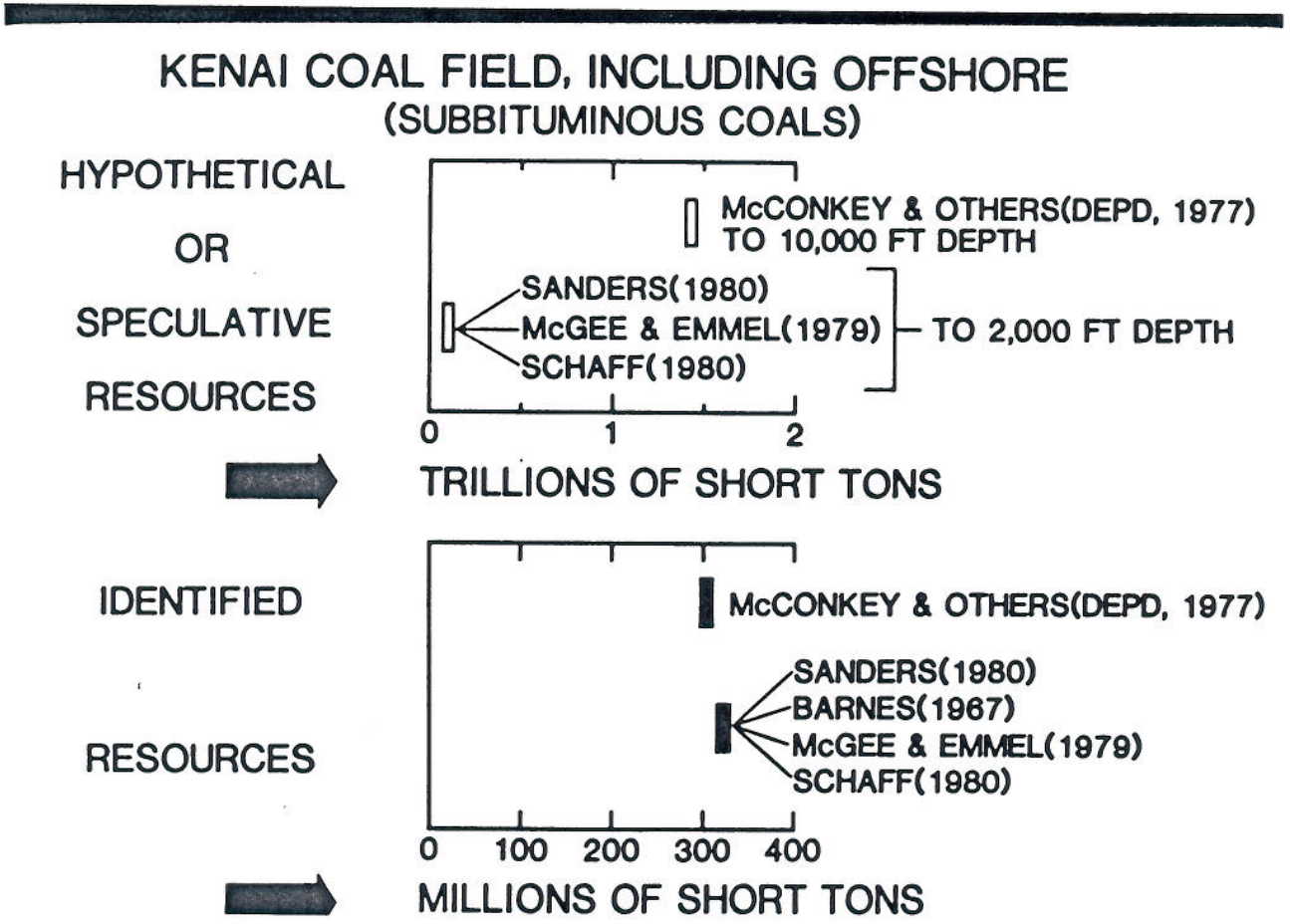


Figure 31. Summary of the coal resources of the Kenai Field.

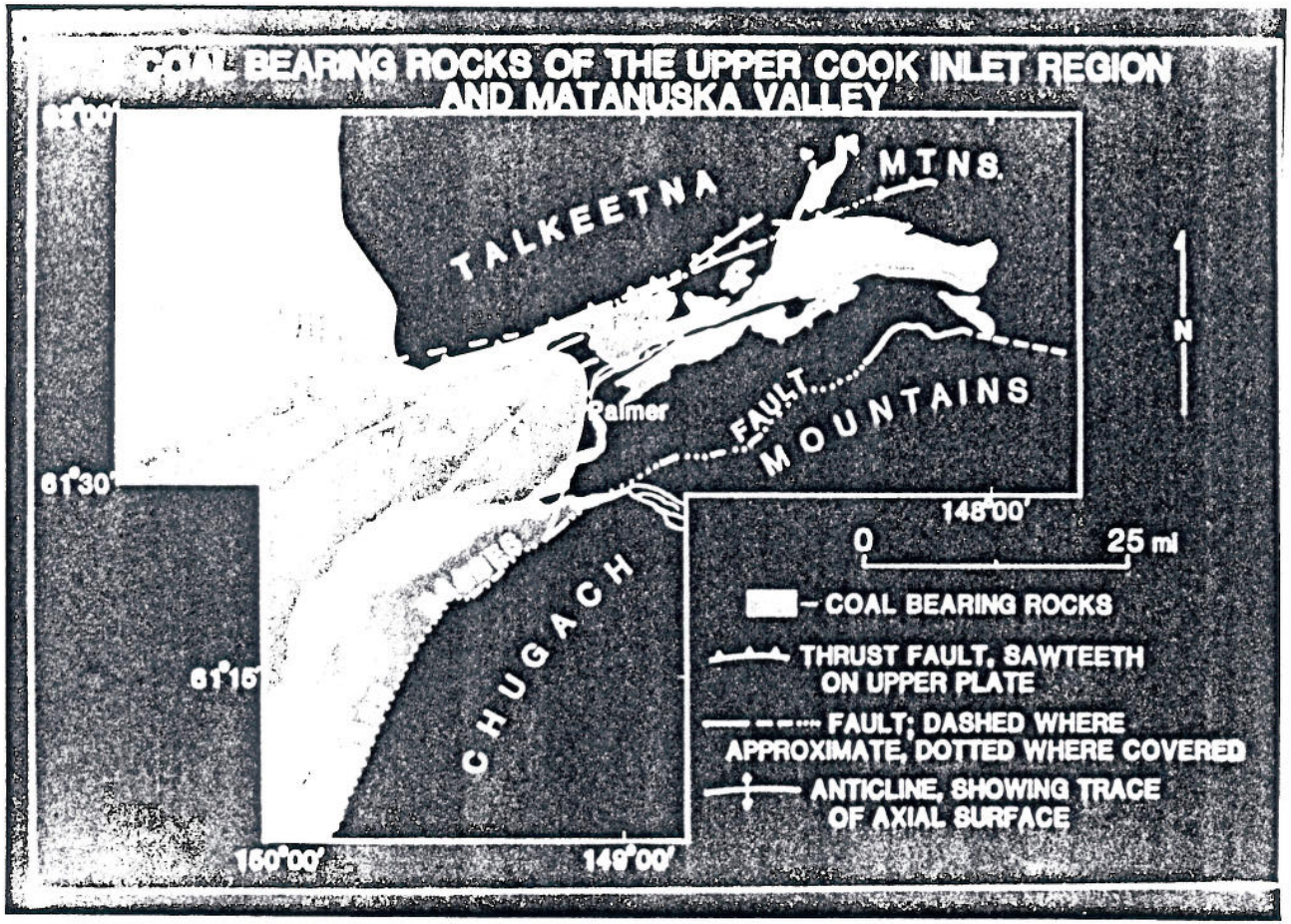


Figure 32. General distribution of coal-bearing rocks of the upper Cook Inlet region and Matanuska Valley (adapted from Conwell and others, 1982).

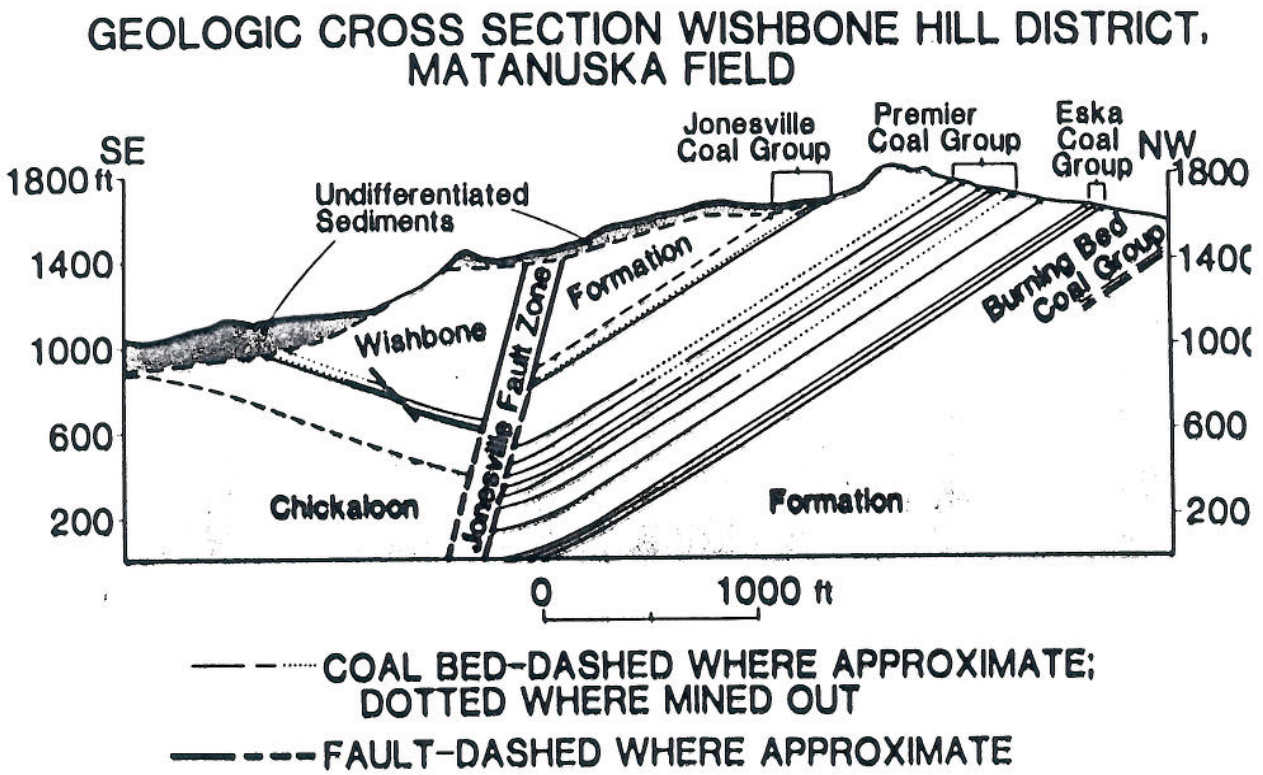


Figure 33. Coal-bearing groups of the Wishbone Hill district (from Barnes and Payne, 1956).

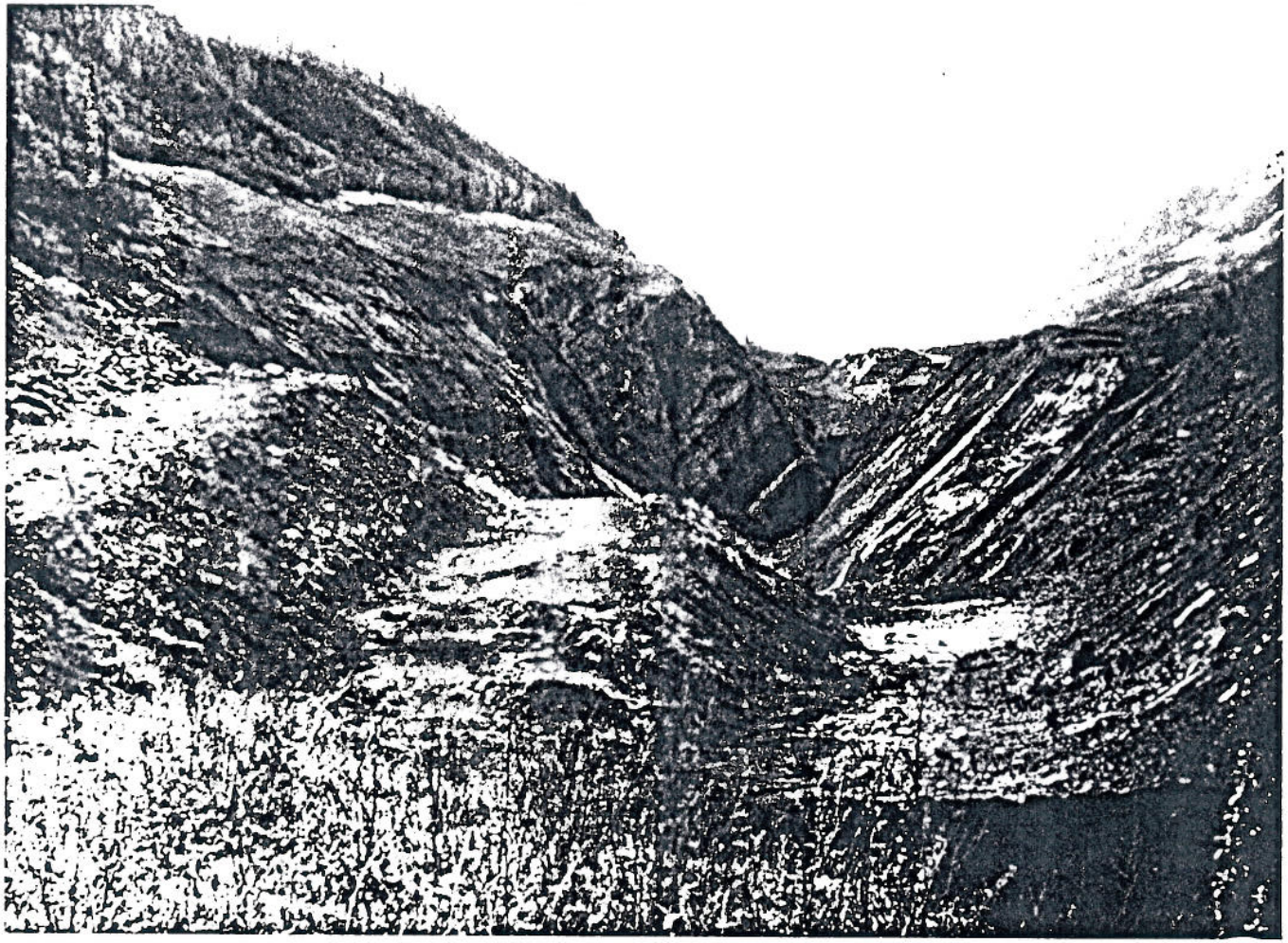


Figure 34. Site of the Evan Jones Mine near Palmer (courtesy D. McGee).

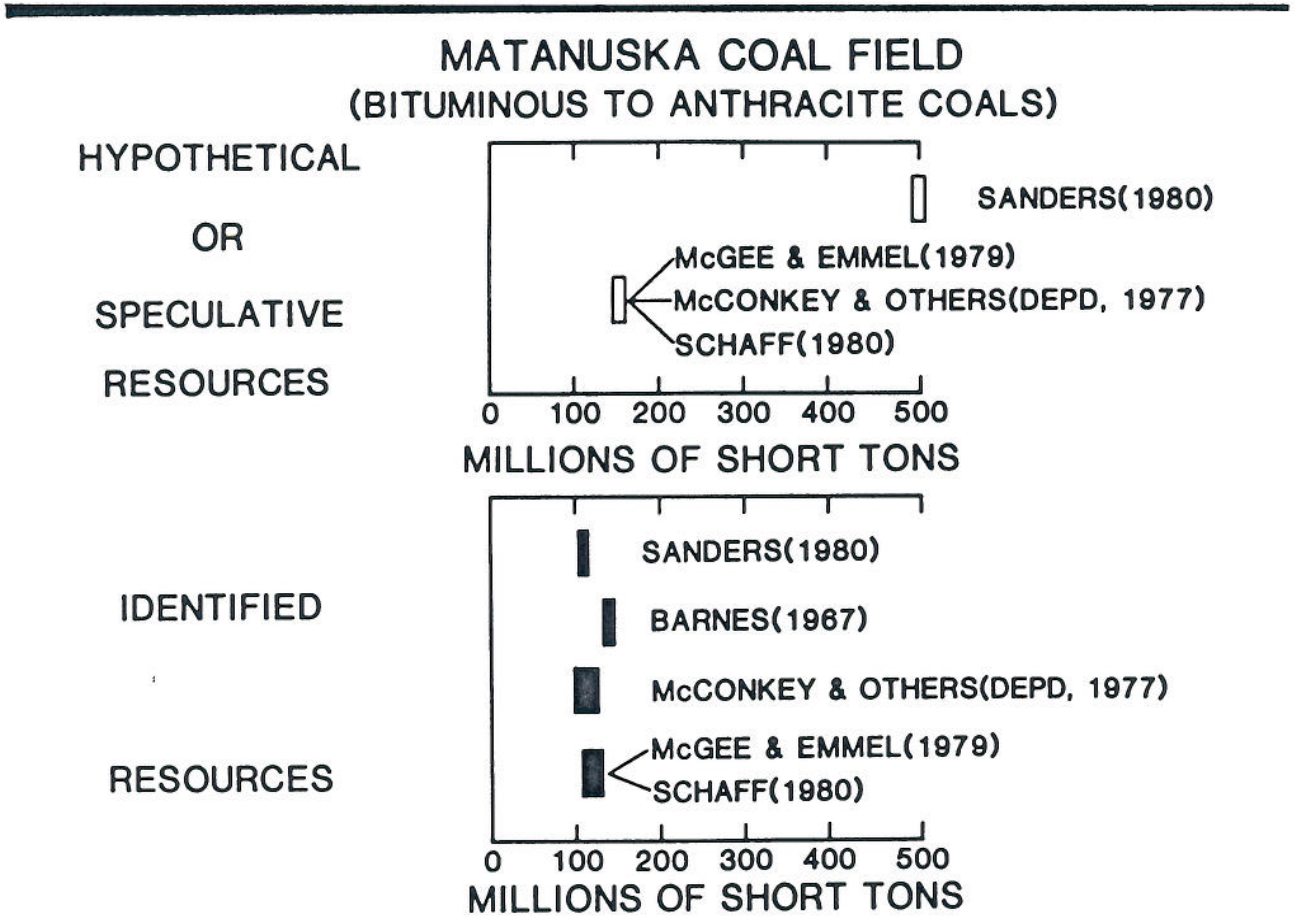


Figure 35. Summary of the coal resources of the Matanuska Field.

source estimates range up to 500 million short tons.

The Nenana Coal Trend forms the third largest coal resource base in Alaska. The major coal-bearing areas of the Nenana Field (fig. 36) include Healy Creek, Lignite Creek (now producing), Rex Creek, Tatlanika Creek, Mystic Creek, Wood River, and Jarvis Creek (not shown). The Jarvis Creek Field, east of the Delta River, is essentially at the easternmost extent of the trend, but its western margin continually shifts farther and farther west. Deposits are also found along the Little Tonzona River and even farther west near Farewell---at Windy and Middle Forks of the Kuskokwim River and at Cheeneetnuk River.

A generalized section of the coal-bearing group of the Nenana Field (fig. 37) shows the thick coal beds (up to 60 ft) of the Suntrana Formation, which contains the bulk of the coal resources of this region. Major coal deposits occur to the south and west of Jumbo Dome (fig. 38), particularly along the Marguerite Creek drainage basin and upper Lignite Creek region. One of the numerous outcropping seams in the upper Lignite Creek area is shown in figure 39. At least 16 significantly thick coal seams with an aggregate thickness over 100 ft are exposed along Coal Creek (fig. 40) on the northeast side of Mystic Mountain in the Wood River Coal Basin. Figure 41 shows a close-up view of several of the seams at this site. Identified resources of the Nenana Field (fig. 42) range to 7 billion short tons, and upward to 10 billion short tons of hypothetical and speculative resources; the latter estimate includes the deposits of the Little Tonzona River.

The distribution of the coal deposits of the Bering River Coal Field (fig. 43) is delineated by the outcrop extent of the Kushtaka Formation. A general rank-upgrading trend occurs from west to east. Coals on the west are medium volatile bituminous; these grade eastward into low volatile bituminous, anthracite, and to meta-anthracite (Sanders, 1976; personal communication, 1983). The structure of the coal-bearing formation is complex, with the coals occurring in pod- or lense-shaped thickenings; they are discontinuous laterally, either pinching out or truncated by faults. The approximately 28-ft thick Queen Vein is shown

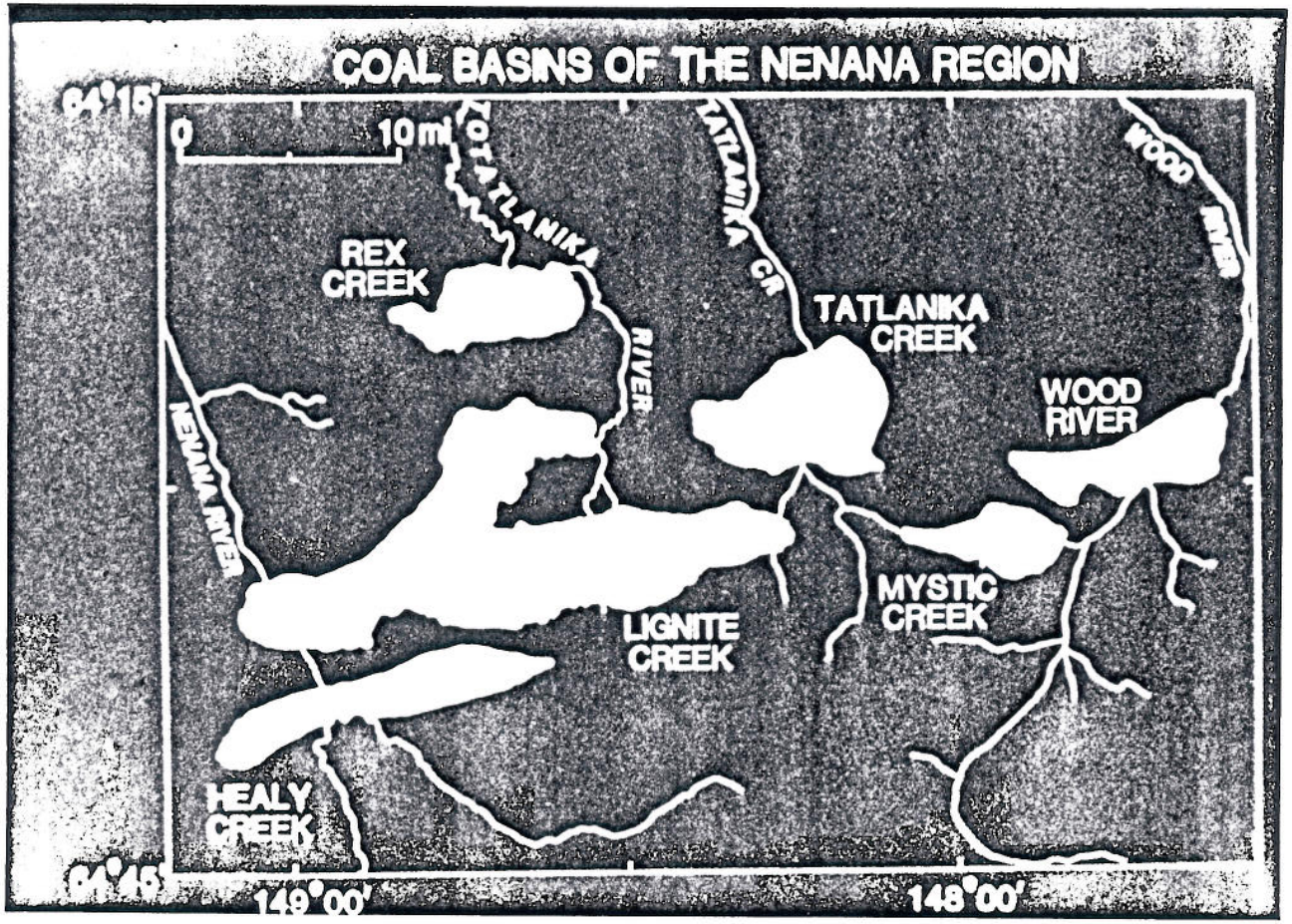


Figure 36. Major coal-bearing areas of the Nenana Field (adapted from Wahrhaftig and others, 1969).

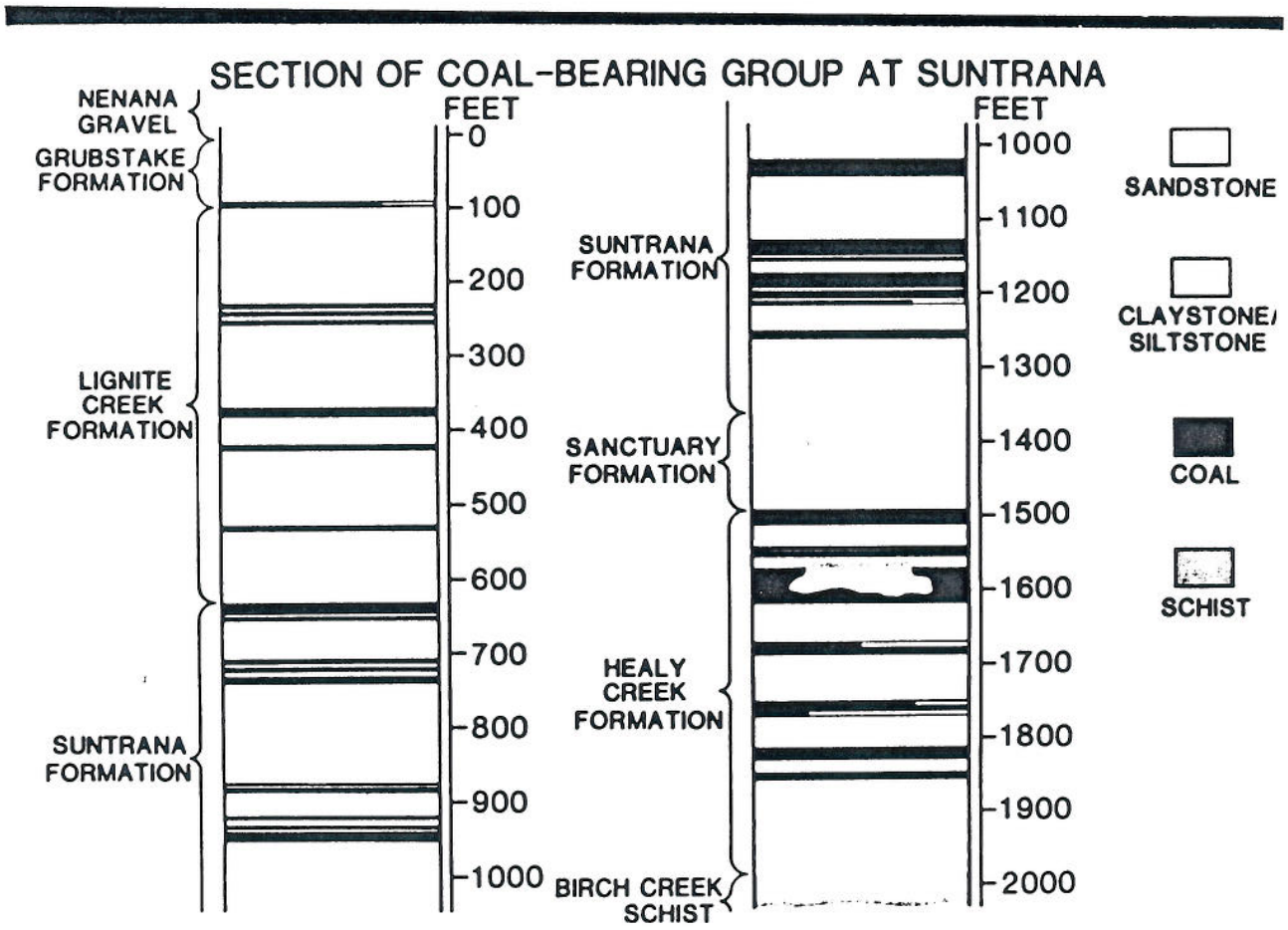


Figure 37. Highly generalized section of the coal-bearing group of the Nenana Field (adapted from Wahrhaftig and others, 1969).

Figure 38. Coal deposits of the Jumbo Dome region, Lignite Creek basin.

Figure 39. Outcrop view of coal seam in upper Lignite Creek region.

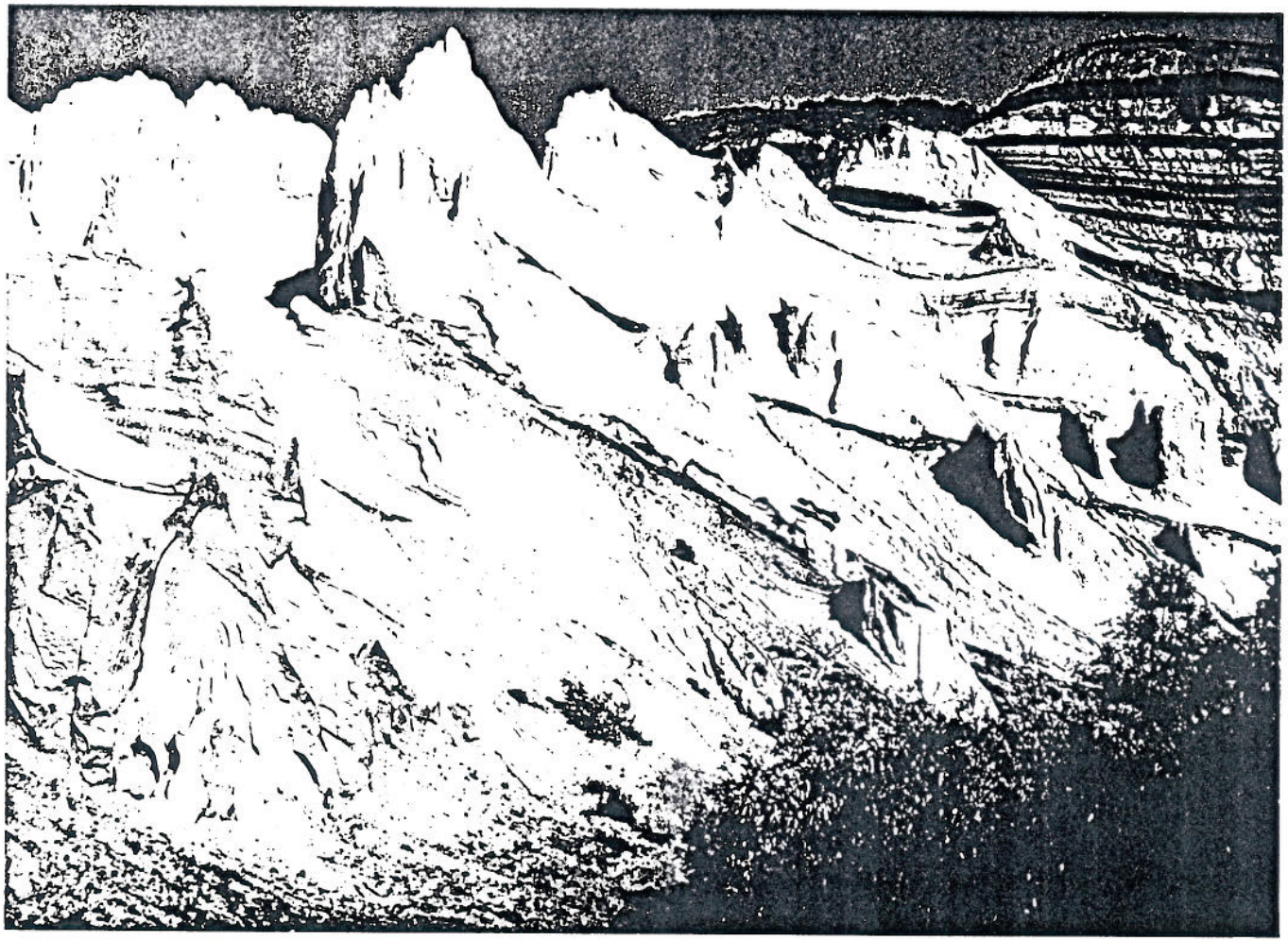


Figure 40. Coal-bearing section along Coal Creek, northeast side of Mystic Mountain, Wood River Coal Basin.

Figure 41. Coal seams at Coal Creek site, Wood River Coal Basin.

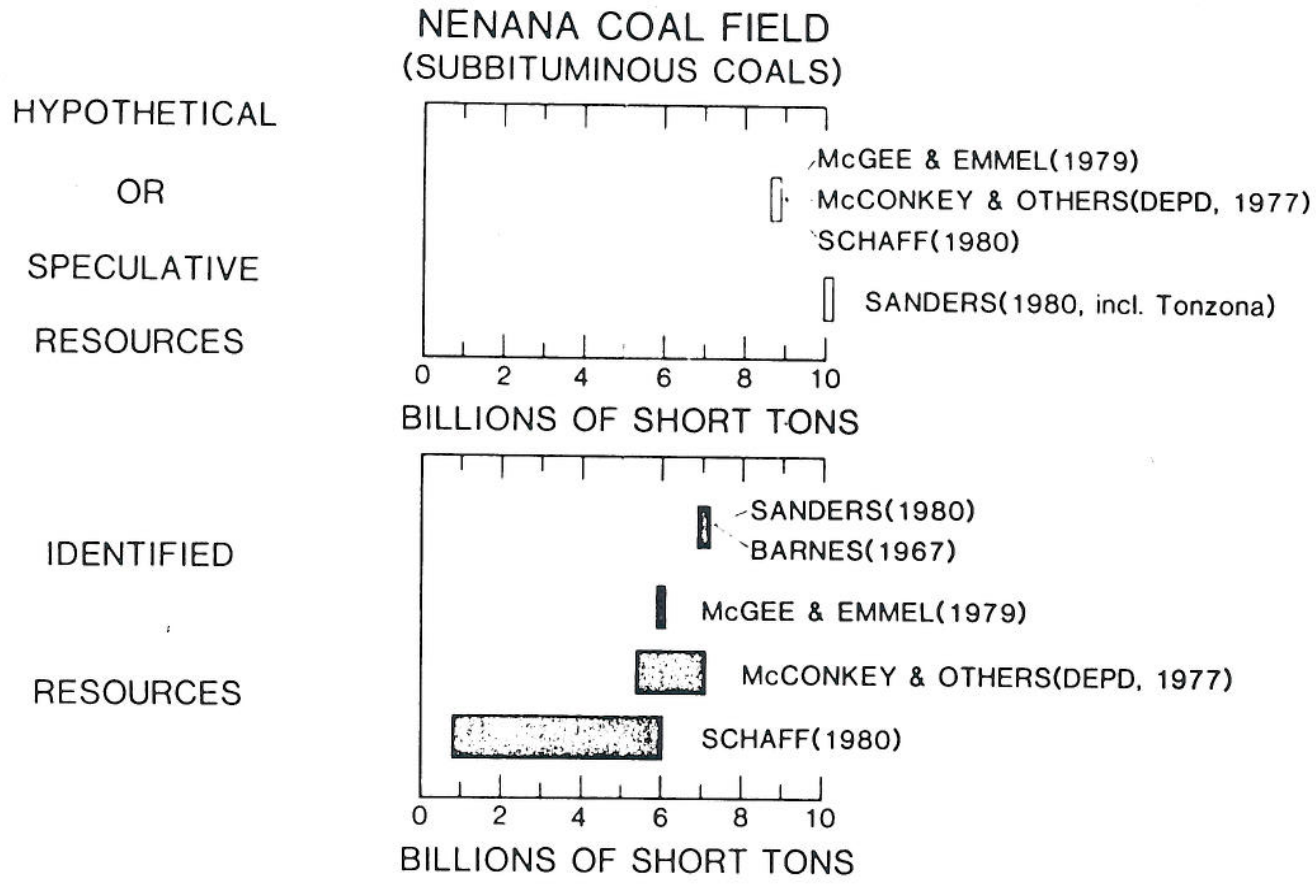


Figure 42. Summary of the coal resources of the Nenana Field.

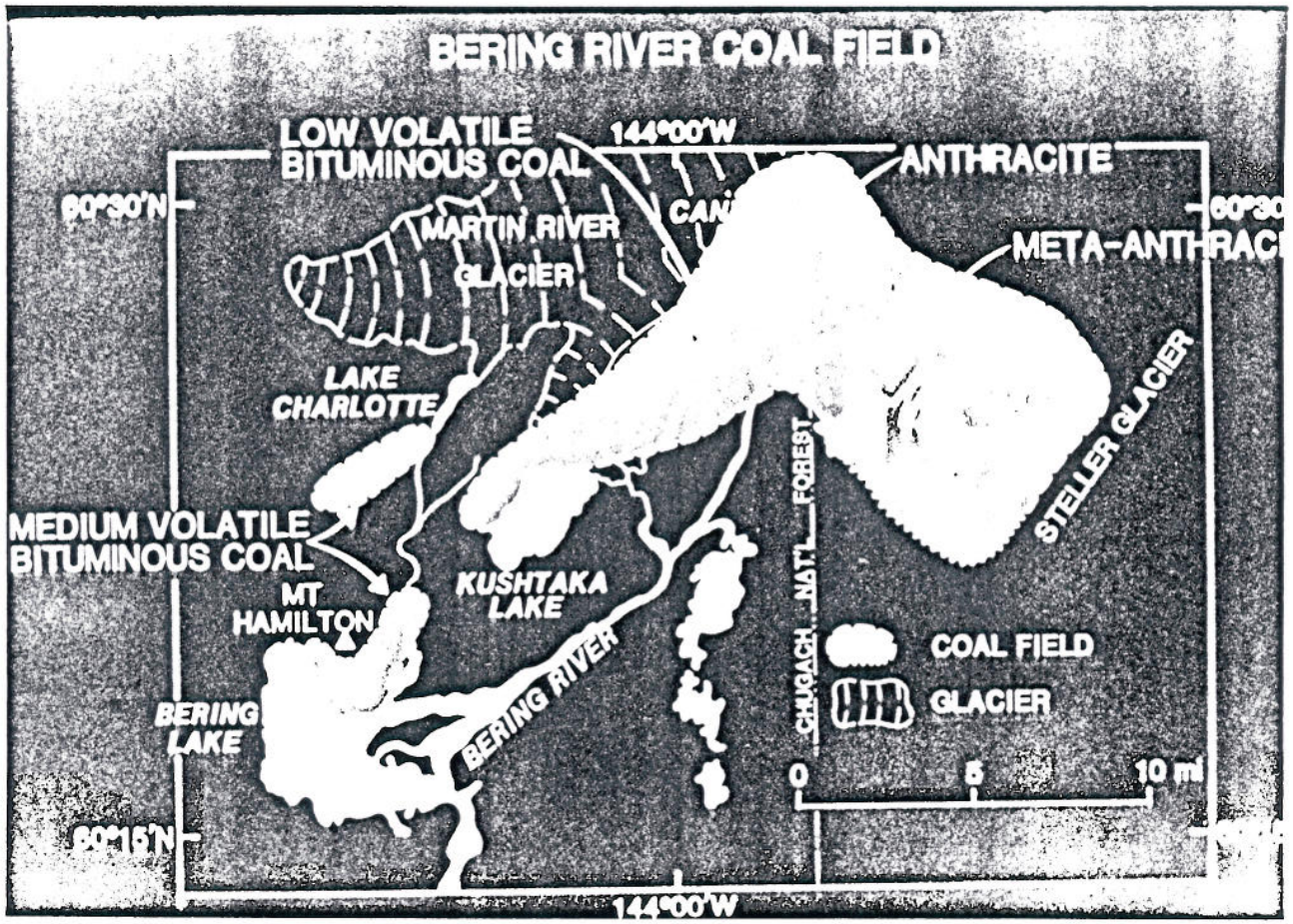


Figure 43. General distribution of coal-bearing rocks of the Bering River Coal Field and eastward rank-upgrading trend (Sanders, 1976; personal communication, 1983).

in figure 44 and the complex folding at Carbon Mountain in figure 45. Hypothetical and speculative resources (fig. 46) range up to over 3.5 billion short tons.

Two relatively unchartered coal occurrences are Chignik Bay and Herendeen Bay on the Alaska Peninsula. The coal-bearing rocks of the Chignik Formation are shown on the general distribution map of figure 47. The Cretaceous bituminous and subbituminous coals of the Coal Valley Member of the Chignik Formation are typically less than 7-ft thick. Figure 48 shows an outcrop view of one bed at Chignik Bay. At Herendeen Bay (fig. 49), up to 17 beds crop out but most are less than 2-ft thick. Minor and thin coal seams are also found on Unga Island. Figure 50 shows a coal-bearing section of the Chignik Formation at Mine Harbor, Herendeen Bay. Identified resources for Chignik and Herendeen Bay coal fields (fig. 51) range up to 200 million short tons, while hypothetical and speculative resources range from less than 1 to over 3 billion short tons.

Various other coal occurrences throughout the state and their estimated hypothetical and speculative resources are summarized in figure 52----including Eagle-Circle, Nation River, Yukon River, Rampart, Jarvis Creek, and Broad Pass. Total identified Alaska coal resoures (all ranks) range up to 160 billion short tons (fig. 53), while hypothetical and speculative resources range up to 5 or 5.5 trillion short tons. This vast resource base possibly makes up 48 percent of the United States total coal resources, and 22 percent of the world resources of coal.

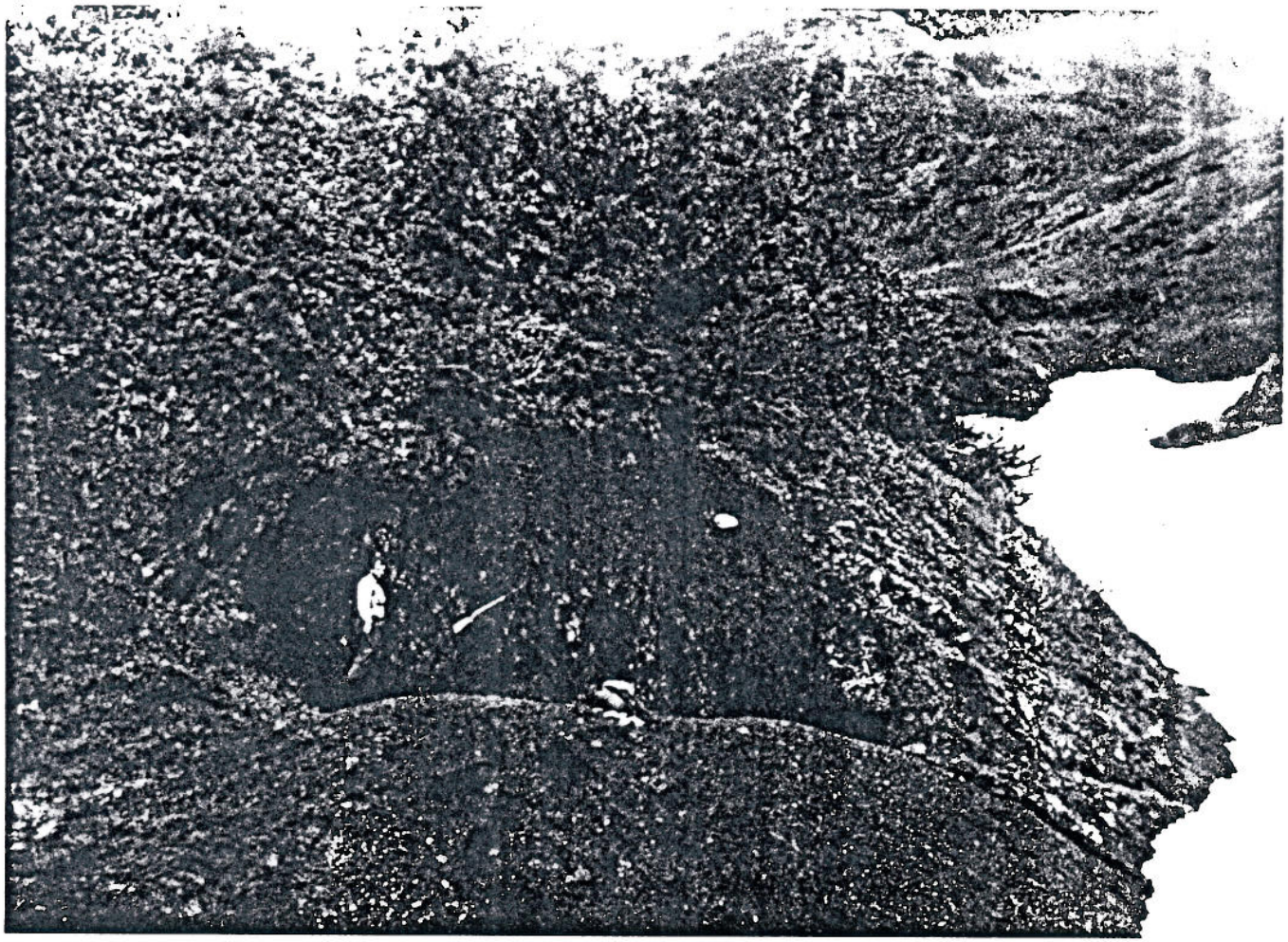


Figure 44. Queen Vein of the Bering River Coal Field (courtesy R. Sanders).

Figure 45. Complex folding in Kushtaka Formation at Carbon Mountain (courtesy R. Sanders).

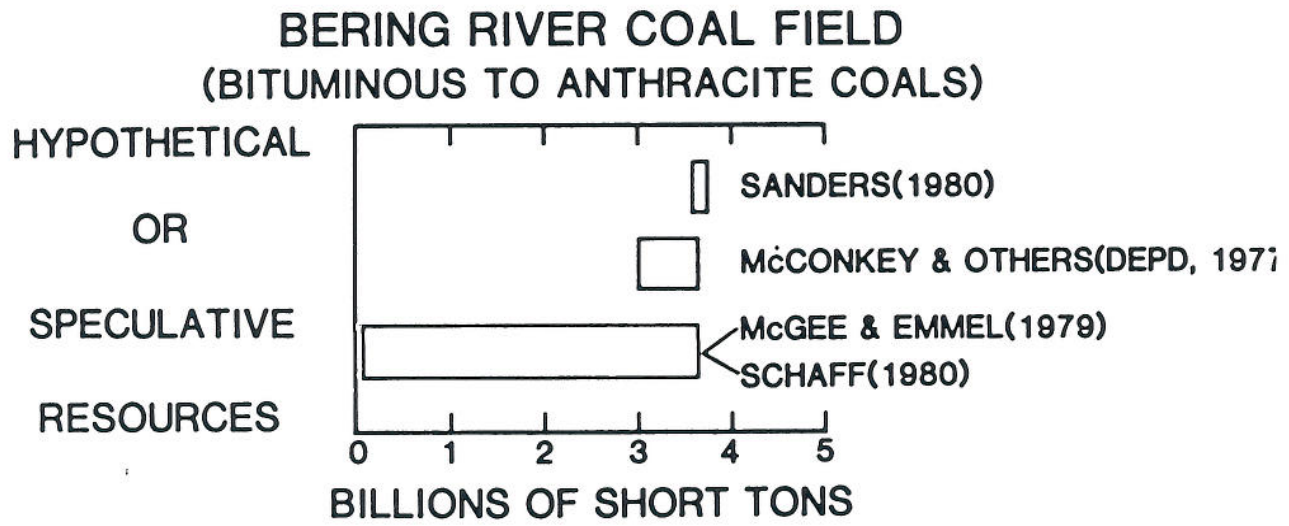


Figure 46. Summary of the coal resources of the Bering River Field.

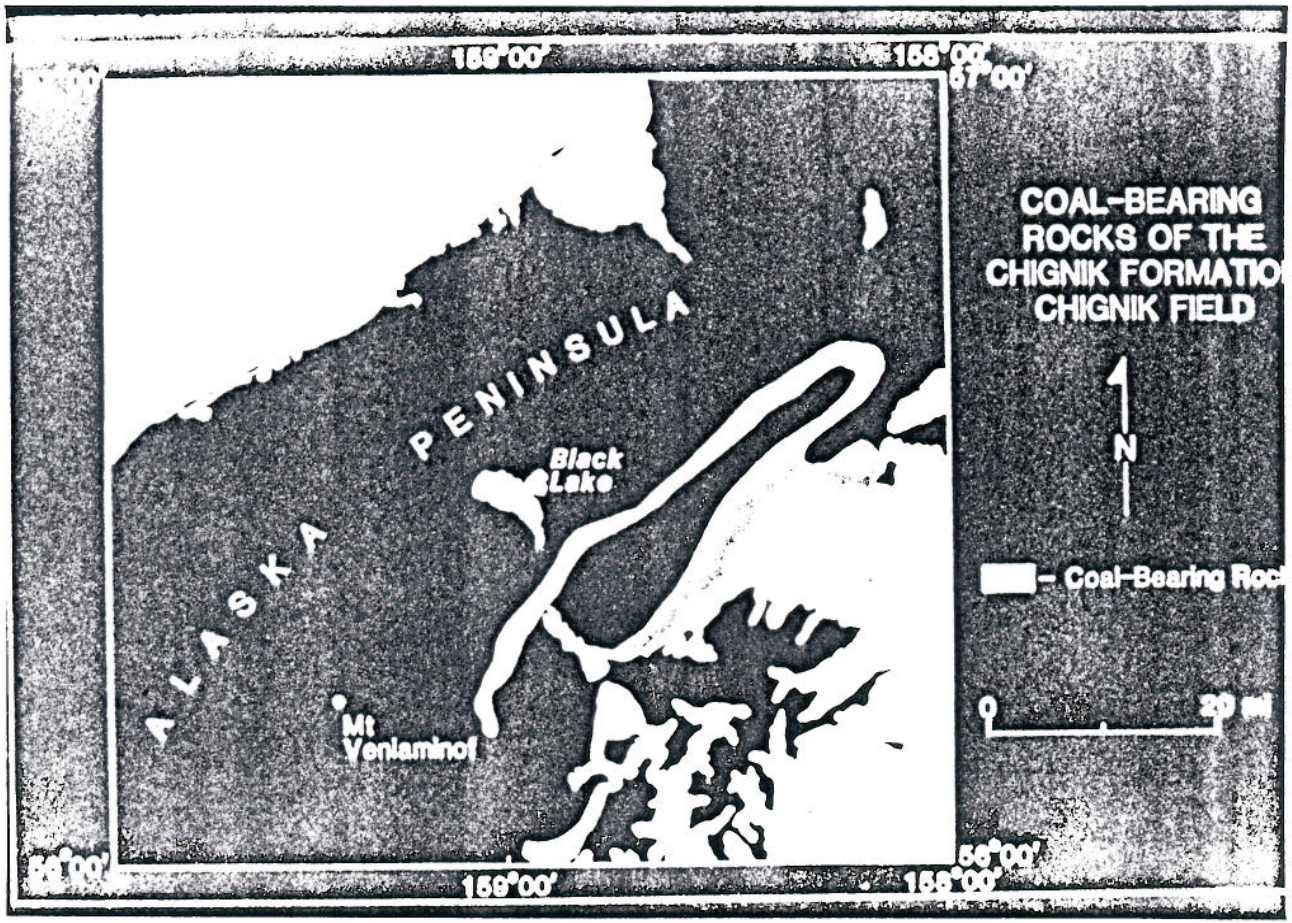


Figure 47. General distribution of coal-bearing rocks of the Chignik Formation, Chignik Coal Field, Alaska Peninsula.

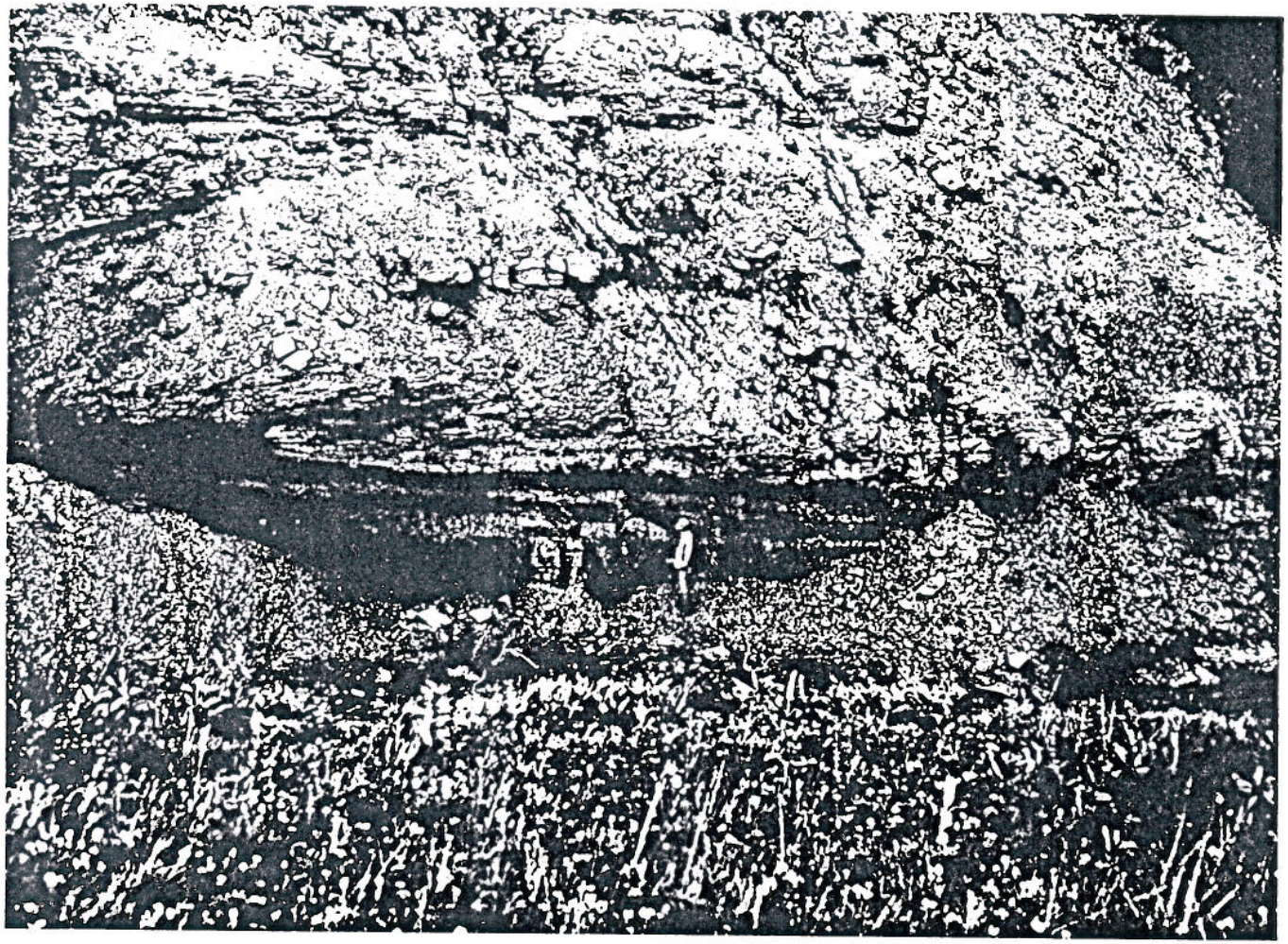


Figure 48. Coal seam of the Coal Valley Member of the Chignik Formation, Chignik Bay (courtesy D. McGee).

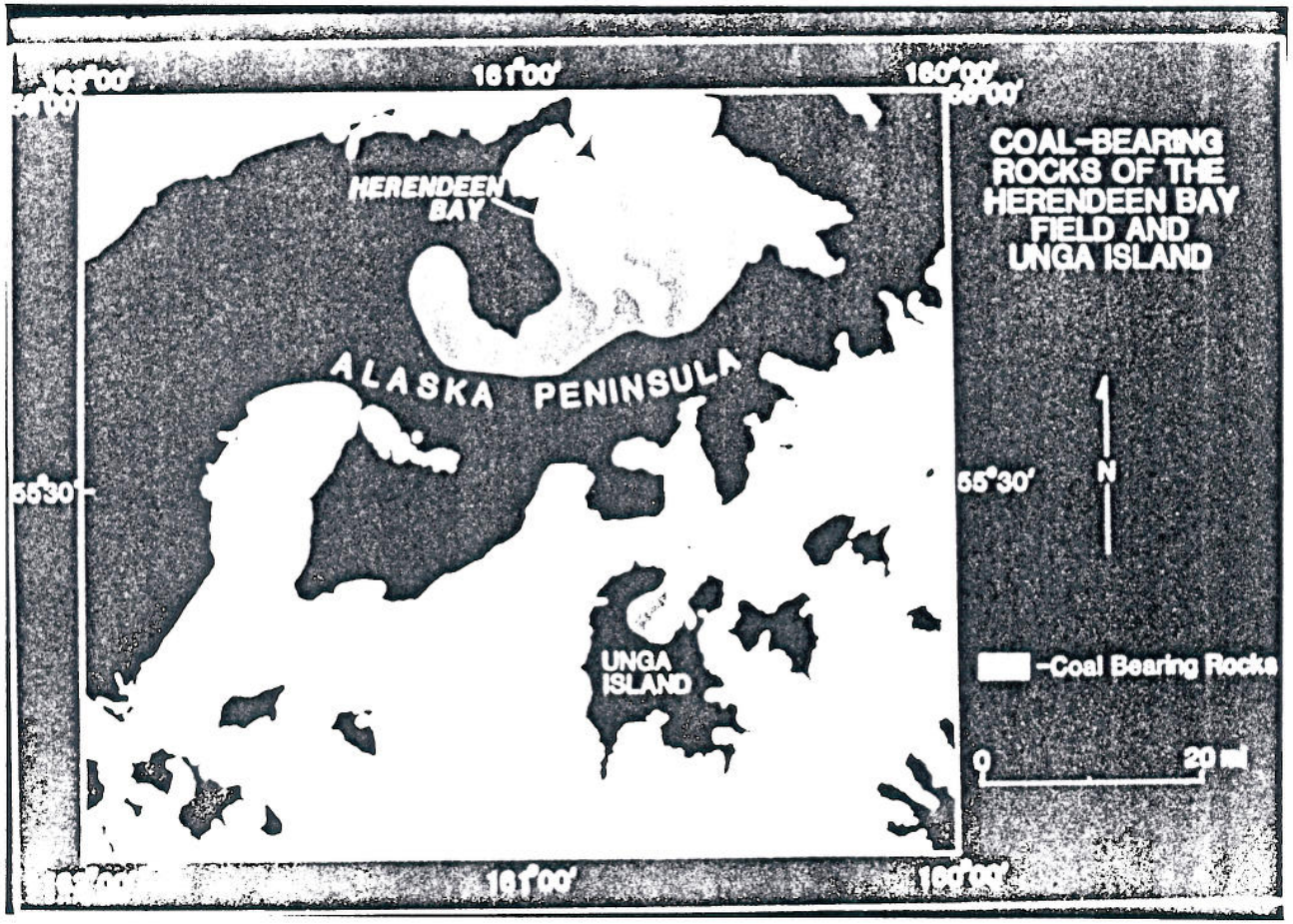


Figure 49. General distribution of coal-bearing rocks at Herendeen Bay and Unga Island, Alaska Peninsula.

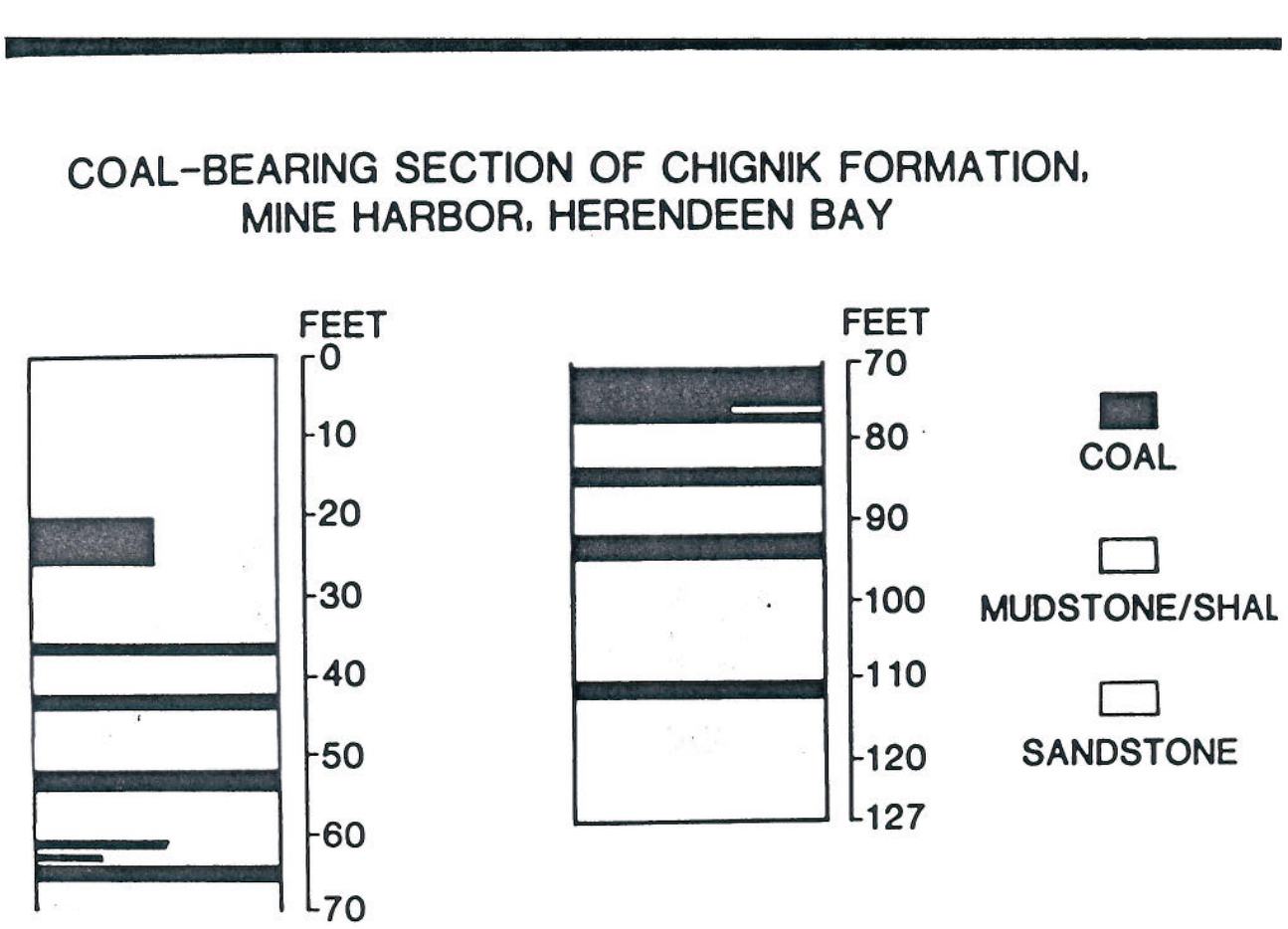


Figure 50. Highly generalized coal-bearing section of the Chignik Formation at Mine Harbor, Herendeen Bay (adapted from Conwell and Triplehorn, 1978).

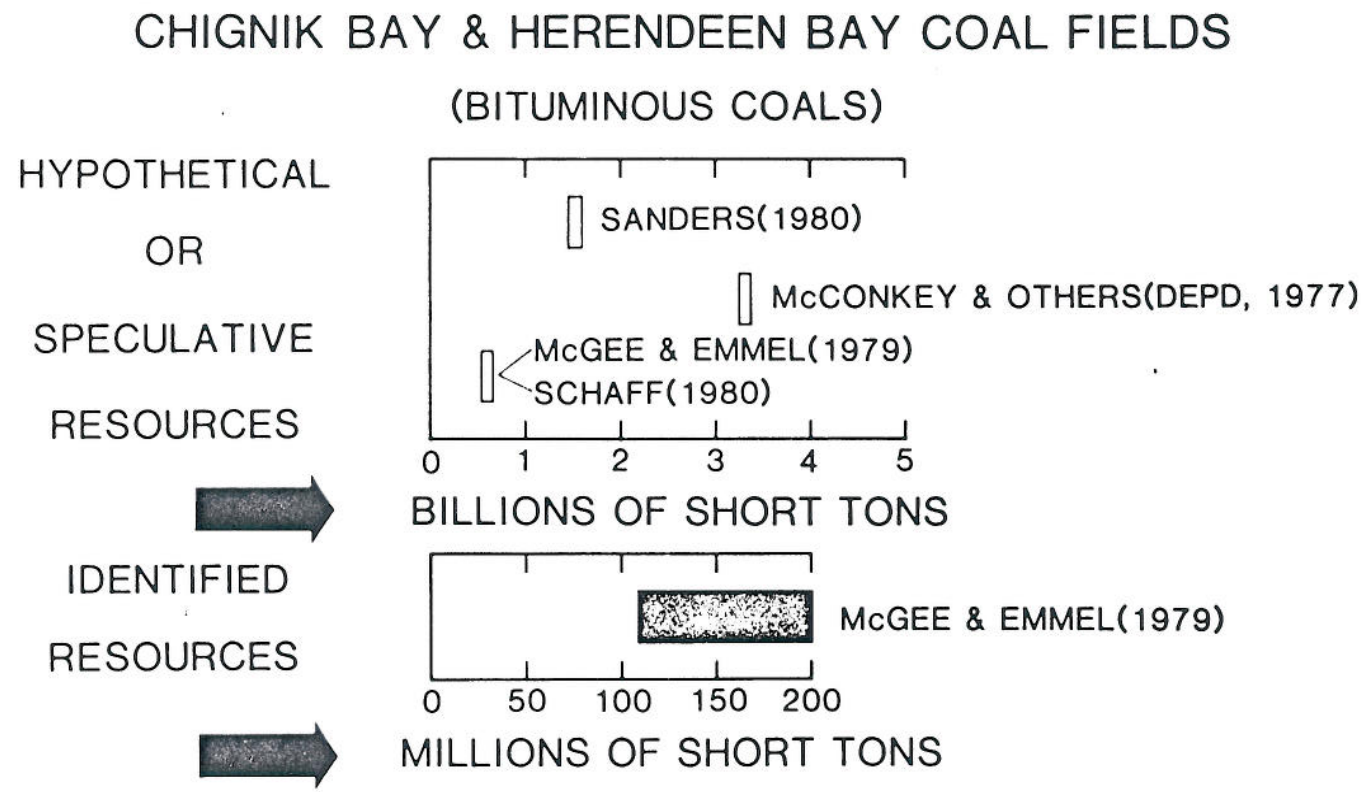


Figure 51. Summary of the coal resources of the Chignik and Herendeen Bay coal fields.

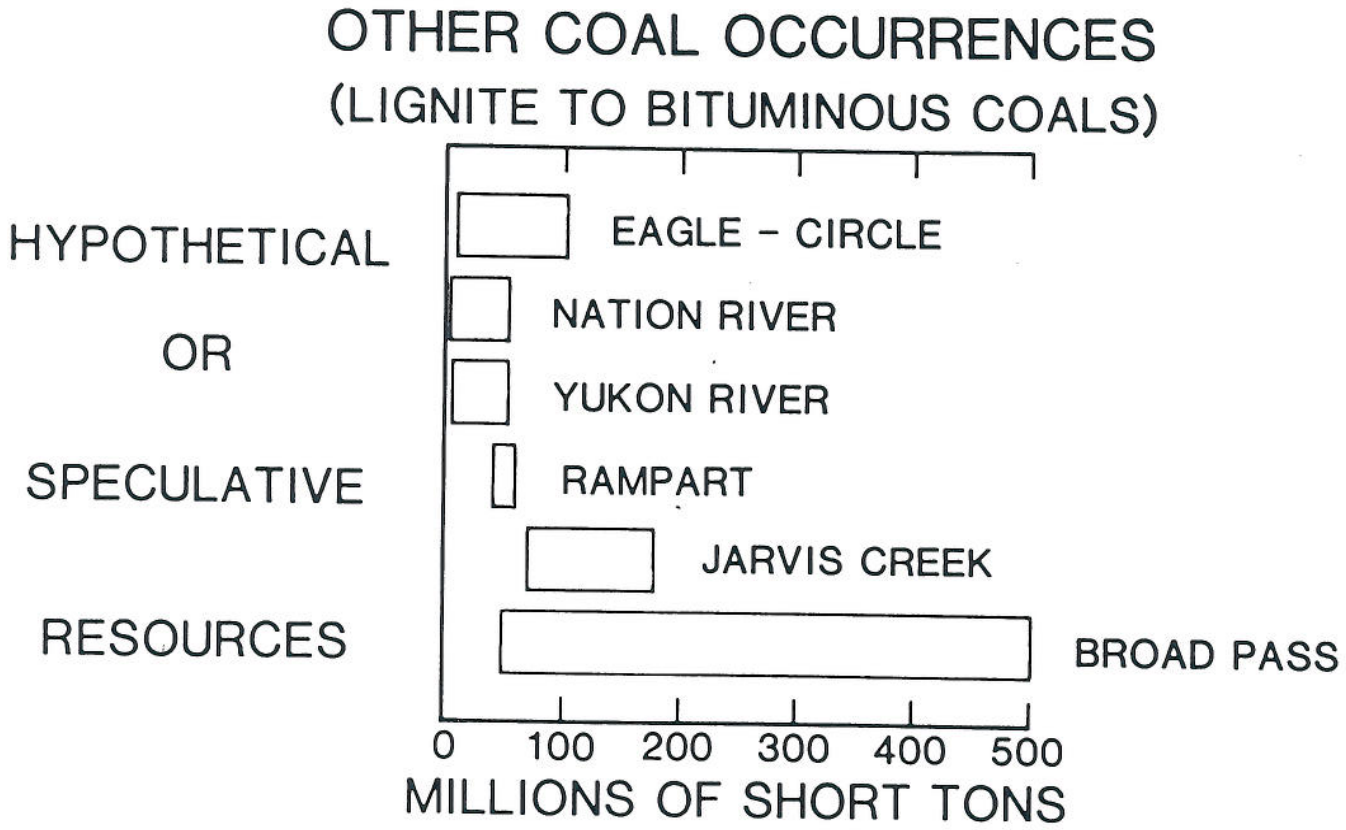


Figure 52. Summary of the coal resources for other occurrences in Alaska.

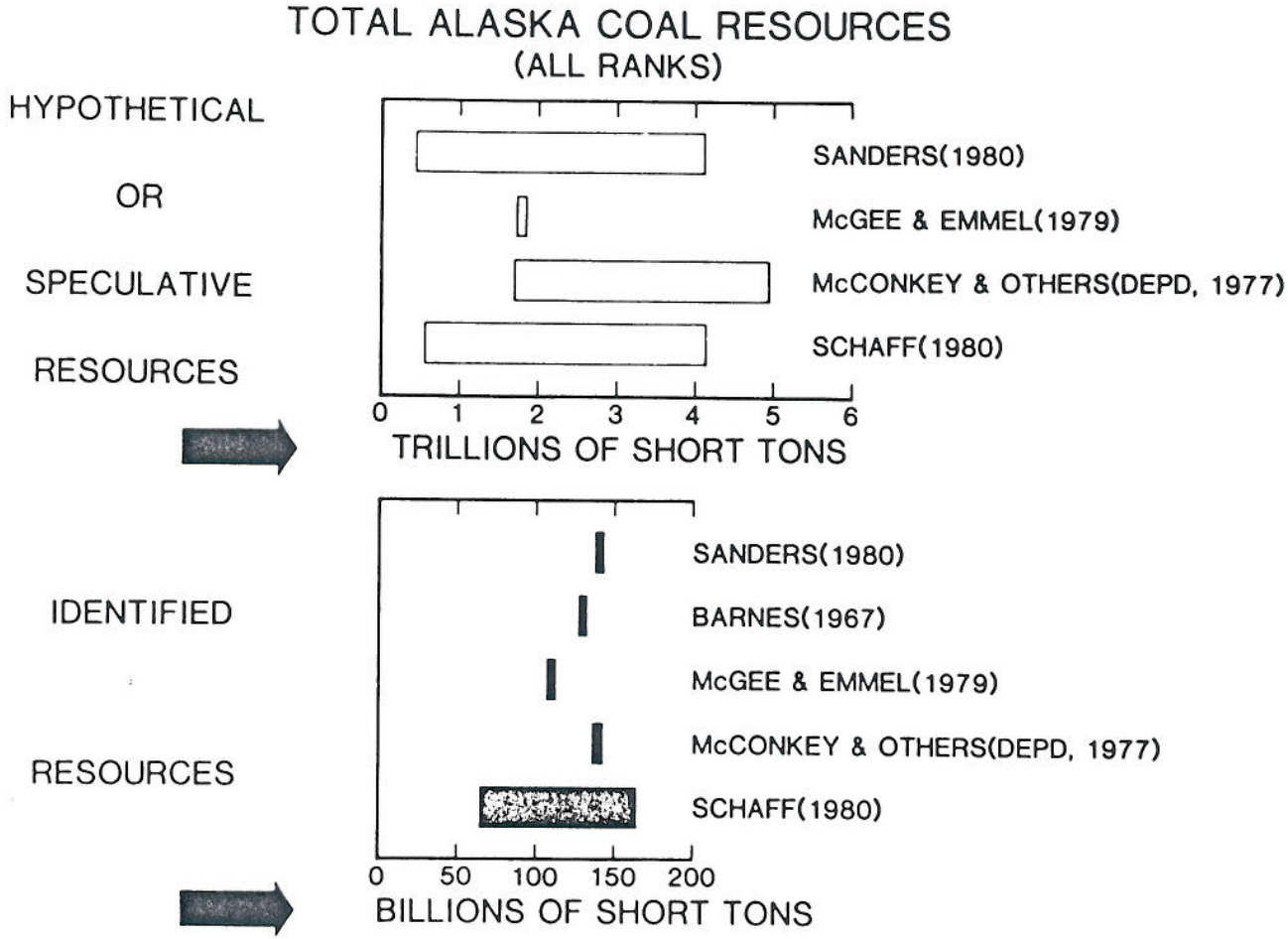


Figure 53. Summary of the total Alaska coal resources.

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