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EXPLORING FOR COAL ON THE LAST FRONTIER

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Introduction

Alaska is one of the few places in the world today where the coal explorationist has an important role to play. The potential for large undiscovered coal deposits in Alaska is great. Although about 20 major coal fields have already been identified (Fig. 1), the extensive amount of cover and the fact that significant amounts of coal can occur in isolated basins, is consistent with exploration identification of other resources and reserves. Extensions to existing coal fields are being found almost every year, and entire new fields are likely to be discovered in the future. The State of Alaska has been interested in promoting coal development, and has provided millions of dollars over the past several years for coal exploration, coal-mine feasibility studies, and pre-development site investigations in many of Alaska's coal fields.

In addition, the State helped to complete the first deep-water coal-handling port facility at Seward, the southern terminus of the Alaska Railroad, in 1984. The Alaska legislature provided funds for the dredging of the harbor to accomodate large ships and authorized the construction of the facilities required for offloading coal from railcars into awaiting colliers. The State purchased the Alaska Railroad from the Federal government in early 1985. The railroad forms a major part of the essential infrastructure needed to transport Alaska coal to market, and its role is destined to increase in the future.

Because the payoff for State investment may not be immediately realized, some have questioned the soundness of such expenditures. However, over the long term, the State should reap huge benefits from such investments. In essence, it can be equated to placing funds in a State "energy bank." The more the State invests now, the larger the payoffs will be down-the-road.

History of Coal Exploration In Alaska

Alaska's coals have been explored and mined for over a century. English traders began exploring coal on the Kenai Peninsula in the late 1700's. Geologic expeditions to the Arctic Ocean around 1825 provided the first written reports of coal in Alaska. Russian engineers explored the coals of the Kenai and Alaska Peninsulas during the mid-1800's. U.S. Army and Navy exploration parties investigated Matanuska Valley coals in the early 1900's. The military was also heavily involved in exploring and producing coal to offset shortages in Alaska during World War II. Private industry has been engaged in large-scale coal-exploration drilling programs, engineering, environmental, and other premine studies in several areas of Alaska since the late 1960's. Most exploration has been associated with existent State, Federal, and Native coal-lease tracts, and has been centered in southcentral, interior, and northwest Alaska. In recent years, exploration activity has stepped up with the anticipated future need for additional coal supplies for Pacific Rim markets. Table 1 summarizes recent coal exploration activity in Alaska by field.

Role of Geology In Coal Exploration

Exploration by prospectors and geologists has led to the location of the major coal fields and other scattered occurrences in Alaska. Most coal explorationists today are geologists. Geology is playing an increasingly important role in coal exploration, mine planning, and development.

Geological evaluation of a mine property involves a number of methods (Fig. 2). Major categories for budgetary expenditures include rotary and core drilling, drill-hole location surveys, topographic and geologic mapping, geophysical logging, coal analyses, transportation, communication, subsistence, and documentation.

There are four general stages of exploration used to deter-

mine the development potential of a coal surface mine: 1) regional appraisal; 2) detailed reconnaissance; 3) detailed surface investigation of the lease tract; and 4) detailed three-dimensional physical sampling of the lease tract. The main activities and methods associated with each of these stages is outlined in table 2.

Geologists map and sample coal beds during field exploration projects (Figs. 3-7). Fly camps may be established at selected sites in order to facilitate effective assessment work (Fig. 8). Study of outcrops in remote areas is usually supported by helicopter (Figs. 9-12). Tracked vehicles are often used for transportation in tundra areas (Fig. 13). Bulk coal samples are excavated at small mine pits for combustion tests (Fig. 14). Drill rigs are used to obtain sample cuttings and core (Figs. 15-16).

Exploration vs. Development

Exploration is one of the keys to the future development of Alaska's vast coal resources. Continuing current exploration programs will help to insure wise land management decisions, prudent mine planning, and environmentally sound development of Alaska's coal resources in the future.

References

Bailly, P.A., 1972, Exploration methods and requirements, in Pfleider, E.P., ed., Surface mining: American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., New York, p. 19-42.

Loy, M.D., 1983, Selecting software for surface operations: Coal Mining and Processing, v. 20, no. 4, p. 89-91.

Merritt, R.D., 1986, Coal exploration, mine planning, and development: Noyes Publications, Park Ridge, New Jersey, 464 p.

Table 1. Summary of recent coal exploration activity in Alaska by field.

Coal Field	Exploration Activity
1. Beluga	1. Extensive exploration drilling, premine feasibility and environmental baseline studies---BELUGA COAL COMPANY and DIAMOND ALASKA COAL COMPANY.
2. Bering River	2. Exploration drilling, port and transportation feasibility studies---BERING DEVELOPMENT CORPORATION.
3. Cape Beaufort (Northern)	3. Pre-development drilling---HOWARD GREY & ASSOCIATES for the North Slope Borough.
4. Chicago Creek	4. Reconnaissance drilling, resource evaluation, and feasibility studies (ALASKA DGGS).
5. Chignik-Herendeen Bay	5. Geologic field exploration, continuing resource appraisal (ALASKA DGGS).
6. Jarvis Creek	6. Drilling for reserve definition, premine planning and engineering design studies---DELTA COAL COMPANY.
7. Matanuska	7. Drilling and mine feasibility studies---ROCKY MOUNTAIN ENERGY. Continuing feasibility of reopening Evan Jones underground mine---PLACER U.S. INC.
8. Nenana	8. Produced nearly 1.4 million short tons in 1985, about half for export to Korea, continuing reserve definition on State leases, Hosanna Creek field---USIBELLI COAL MINE, INC.
9. Yentna	9. Drilling and continuing reserve evaluation, preliminary mine design--MOBIL ALTERNATIVE ENERGY, INC.

Table 2. Main activities and methods used during the four stages of exploration previous to a decision that a profitable coal surface mine can be opened. At the end of each stage all results are integrated and the area of interest redefined. Modified from Bailly, 1972.

STAGE	PHASE	ACTIVITIES AND METHODS
#1	Regional appraisal	O---Geologic compilation for "marketing" area*
#2	Detailed reconnaissance	F---Field check of sections containing coal seams* F---Reconnaissance drilling for stratigraphy and coal thickness F---Chemical and calorific check of outcrops or drill samples
#3	Detailed surface investigation of target area	F---Detailed helicopter-borne or ground survey F---Detailed mapping of outcrops
#4	Detailed three-dimensional physical sampling of target area	F---Drilling and logging* L---Mineralogical, chemical analyses and physical tests on samples, cores, and cuttings* F---Down-hole geophysical surveys L---Amenability tests on coal quality O---Reserves computations* O---Preliminary valuation F---Investigation of water problems and water availability for plants* F---Investigation of suitability of ground for plant, tailings, dump and town sites F---Shaft sinking, tunneling, or trenching to obtain bulk samples L---Coal bulk tests

LEGEND: F= field investigation; L= laboratory tests; O= office study; * = activity or method that is judged indispensable.

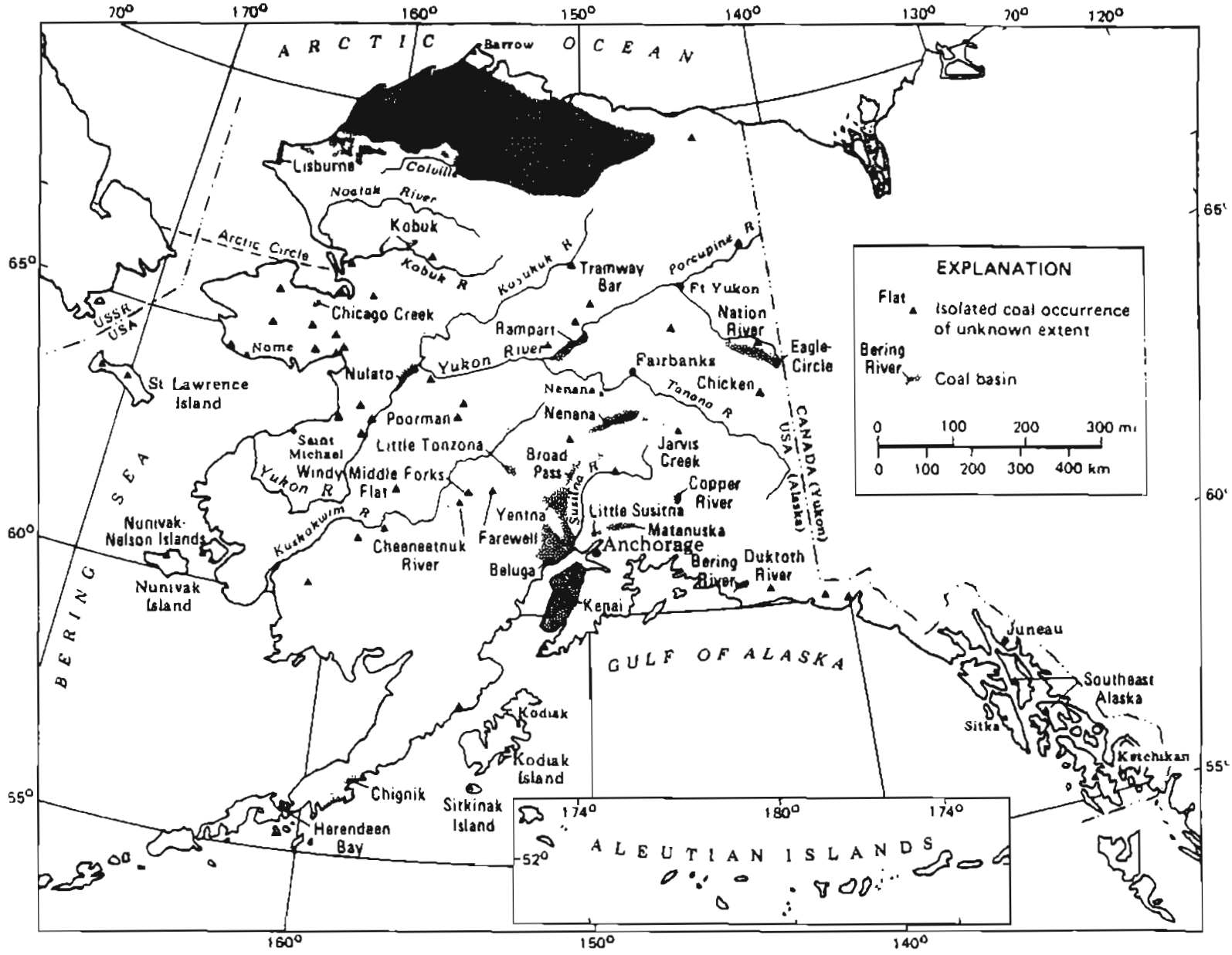


Figure 1. Map showing the general location of Alaska's coal resources.

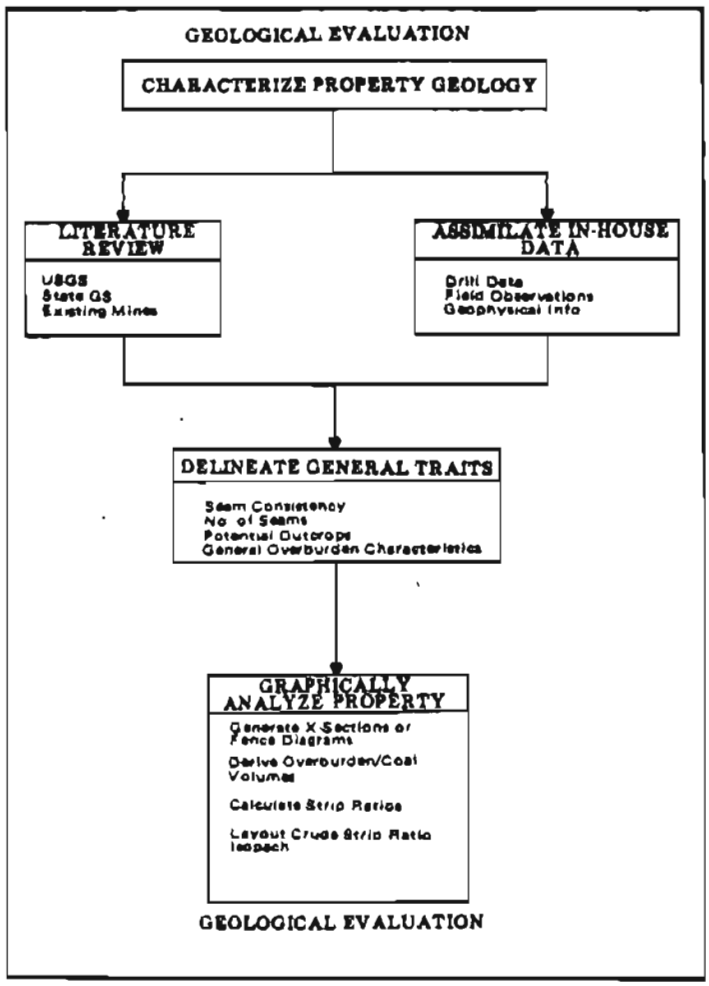


Figure 2. General flow chart illustrating the major methods involved in the geological evaluation of a mine property. Modified from Loy, 1983.

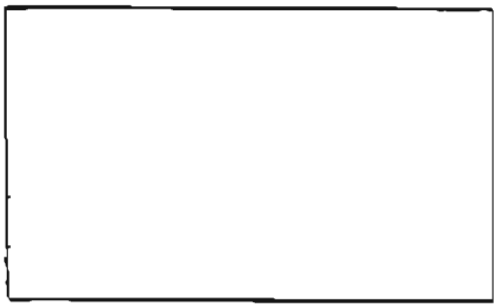


Figure 3. Geologist taking a channel sample of a coal bed on Saturday Creek, northern Beluga field (1981 photo).

Figure 4. Geologist mapping the location of a coal bed in the Nenana basin, interior Alaska (1982 photo).

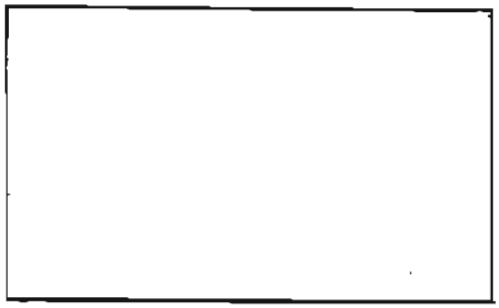


Figure 5. Geologist working on one of several coal seams in the Wood River field, Nenana basin (1982 photo).

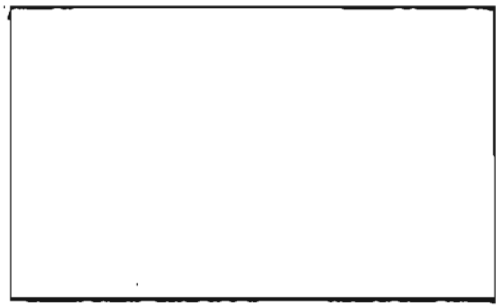


Figure 6. Geologist studying a coal bed in the southern Tatlanika Creek field, Nenana basin (1982 photo).

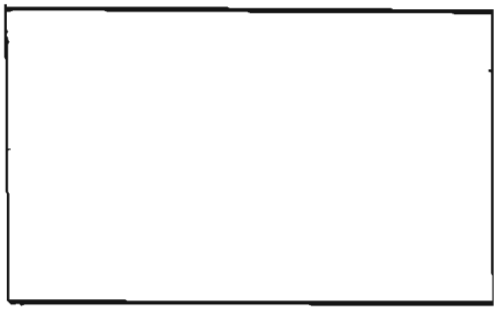


Figure 7. Geologist resting on a coal bed at about 3400-ft elevation of Jumbo Dome, a volcanic intrusive center located in the Hosanna Ceeek field, Nenana basin (1982 photo).

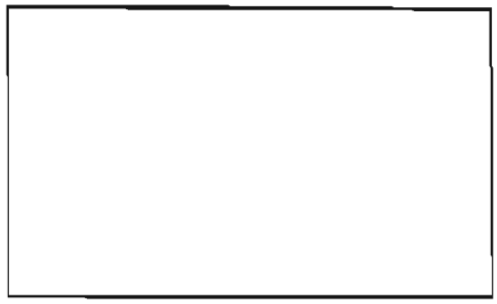


Figure 8. Small geologic field camp located on Emma Creek, western Nenana coal basin (1982 photo).

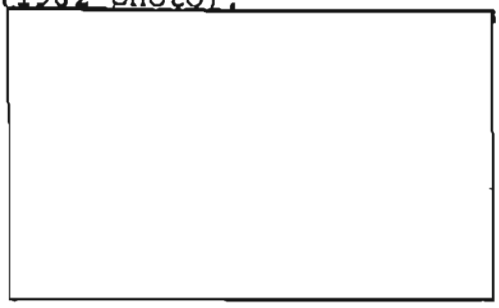


Figure 9. Geologic field crew working on coal-bearing section at Staniukovich Mountain, Herendeen Bay field, Alaska Peninsula (1984 photo).

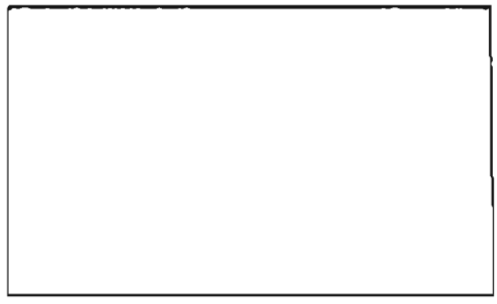


Figure 10. Outcrop view of the coal-bearing rocks of the Wood River field, Nenana basin (1983 photo).

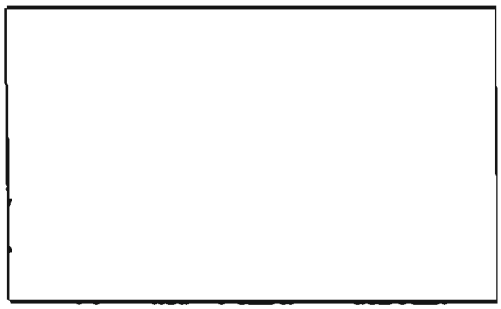


Figure 11. Exploring coal-bearing rocks on Hicks Creek at eastern edge of Matanuska field (1983 photo).

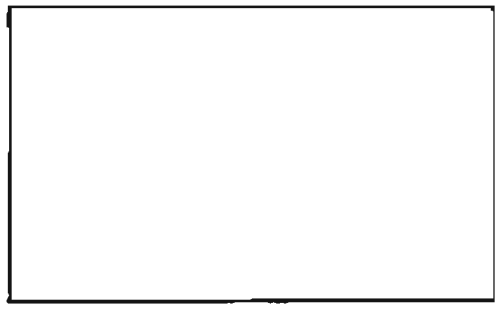


Figure 12. Geologic field reconnaissance at Mine Harbor, Herendeen Bay coal field (1984 photo).

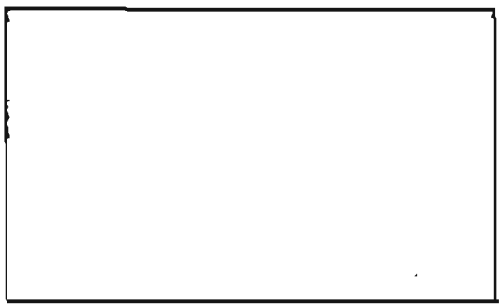


Figure 13. Nodwell tracked vehicle commonly used in fragile tundra area exploration programs (1983 photo).

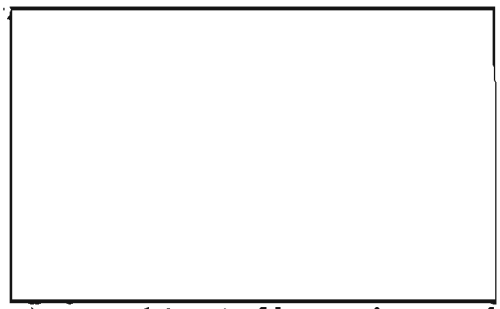


Figure 14. Bulk-coal sampling pit in the Beluga coal field, south-central Alaska (1983 photo).

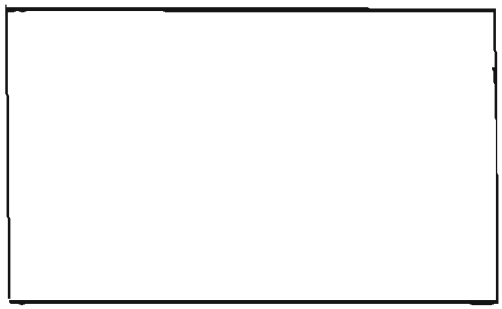


Figure 15. Truck-mounted drilling rig and ancillary equipment at remote coal-exploration site showing special cyclone sample retrieval system for drill cuttings (1983 photo, Matanuska field).

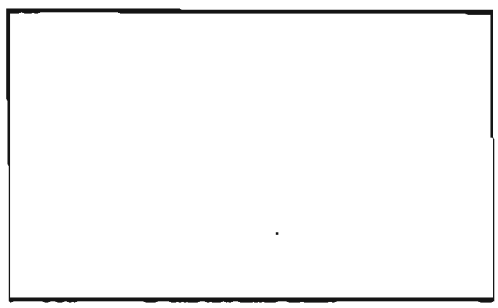
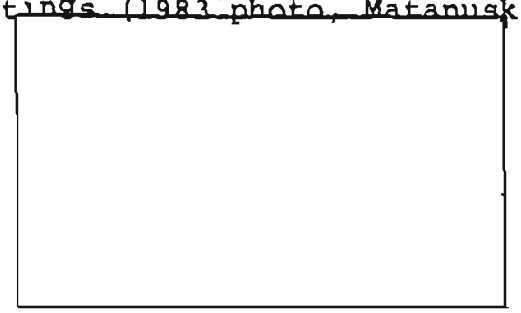
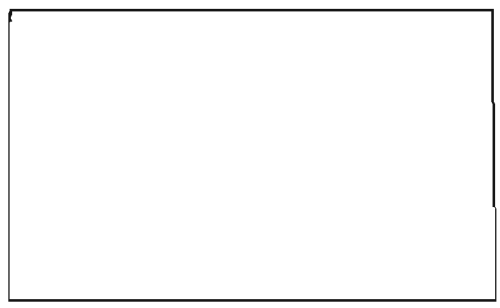


Figure 16. Core barrels holding continuous sections of rock core penetrated in a drill hole in the Matanuska coal field (1983 photo).





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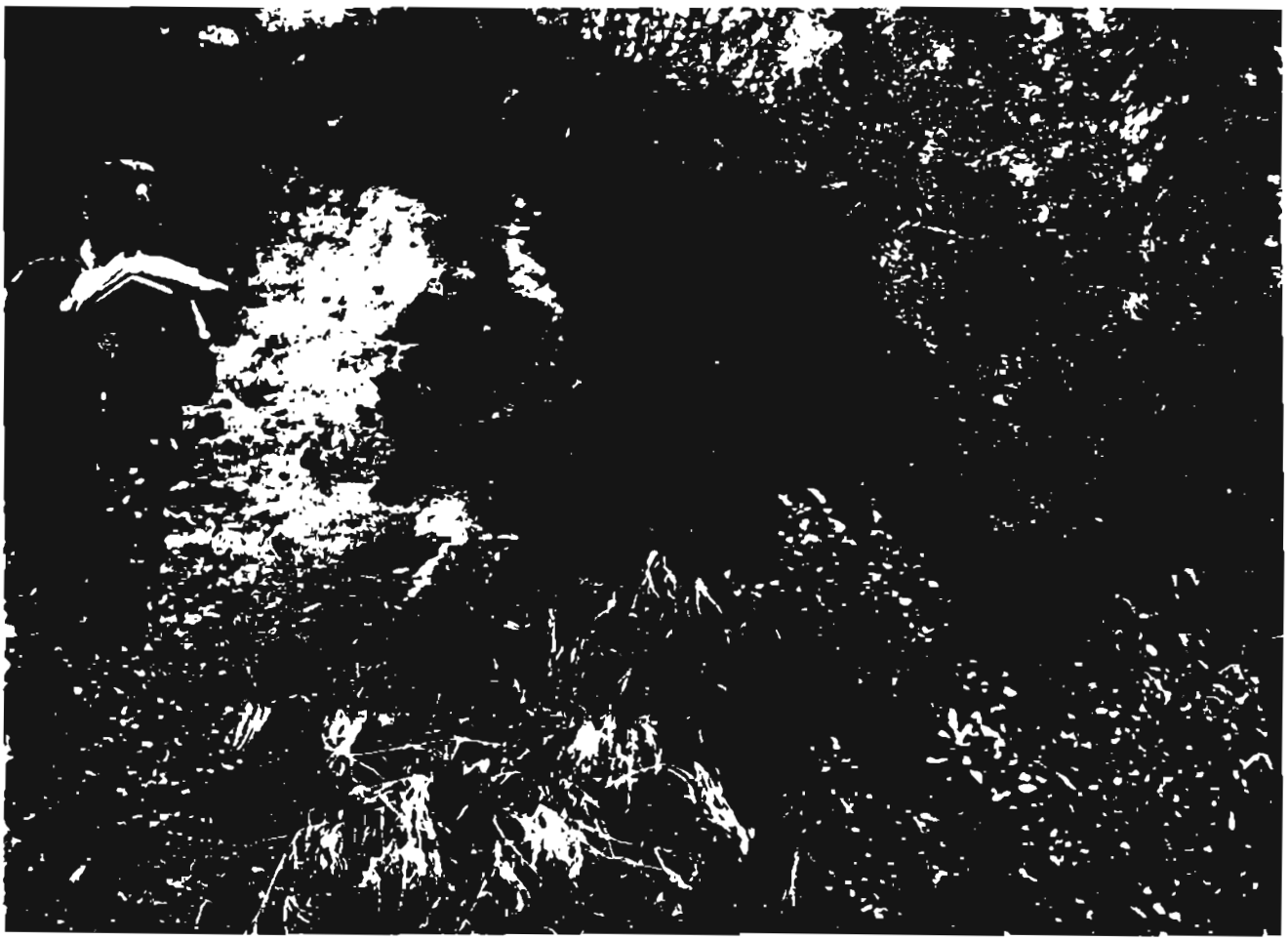

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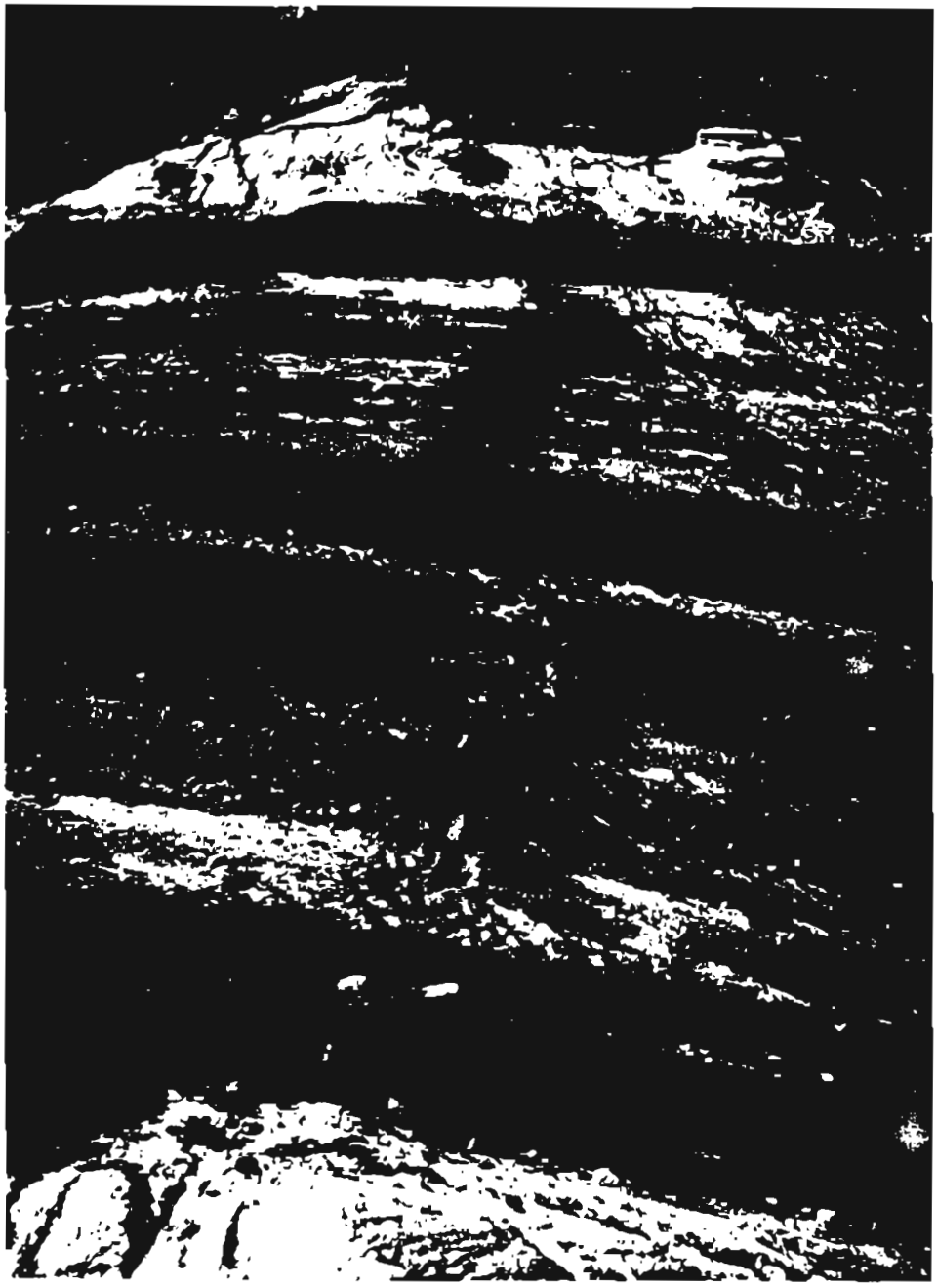

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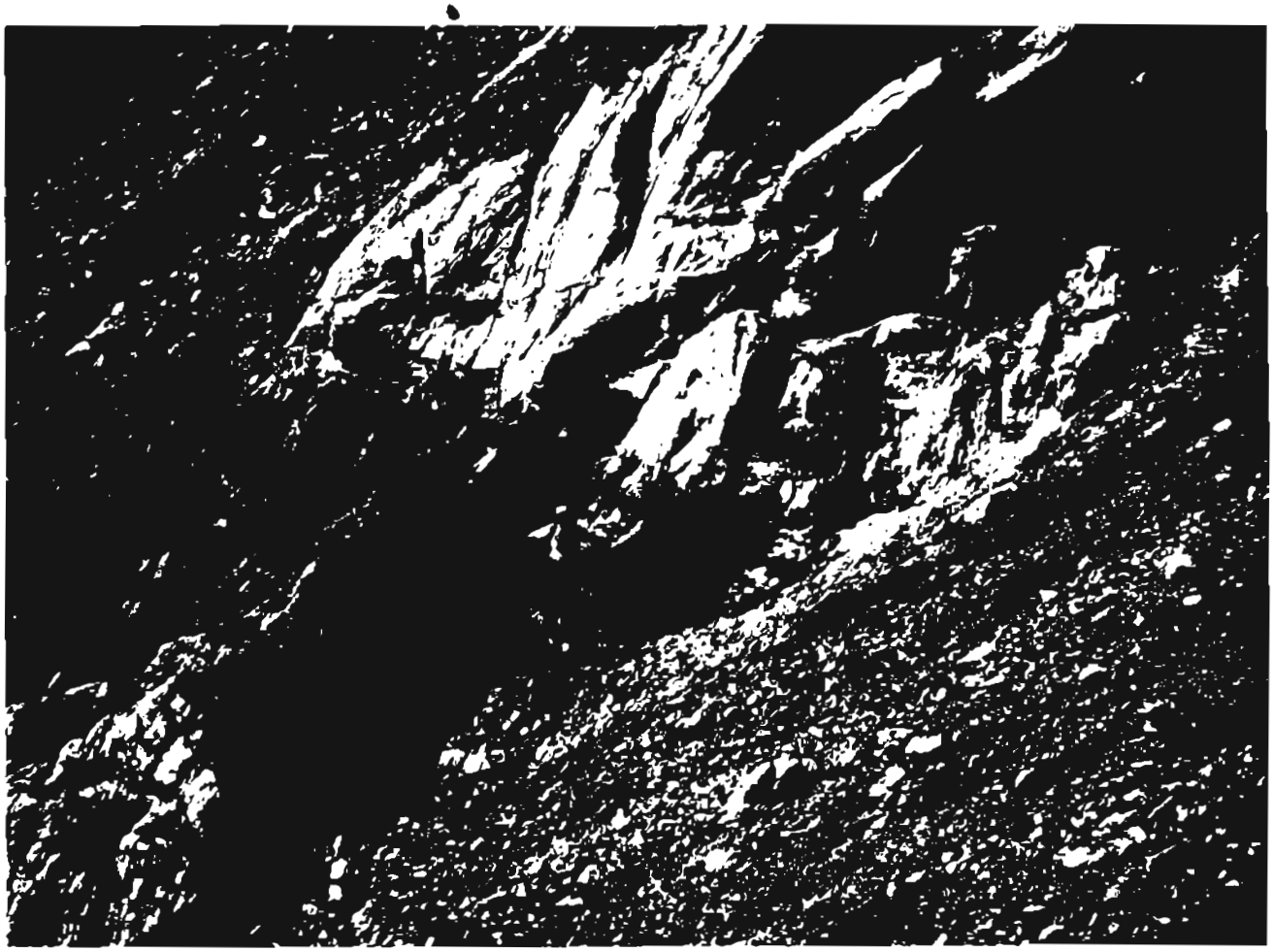

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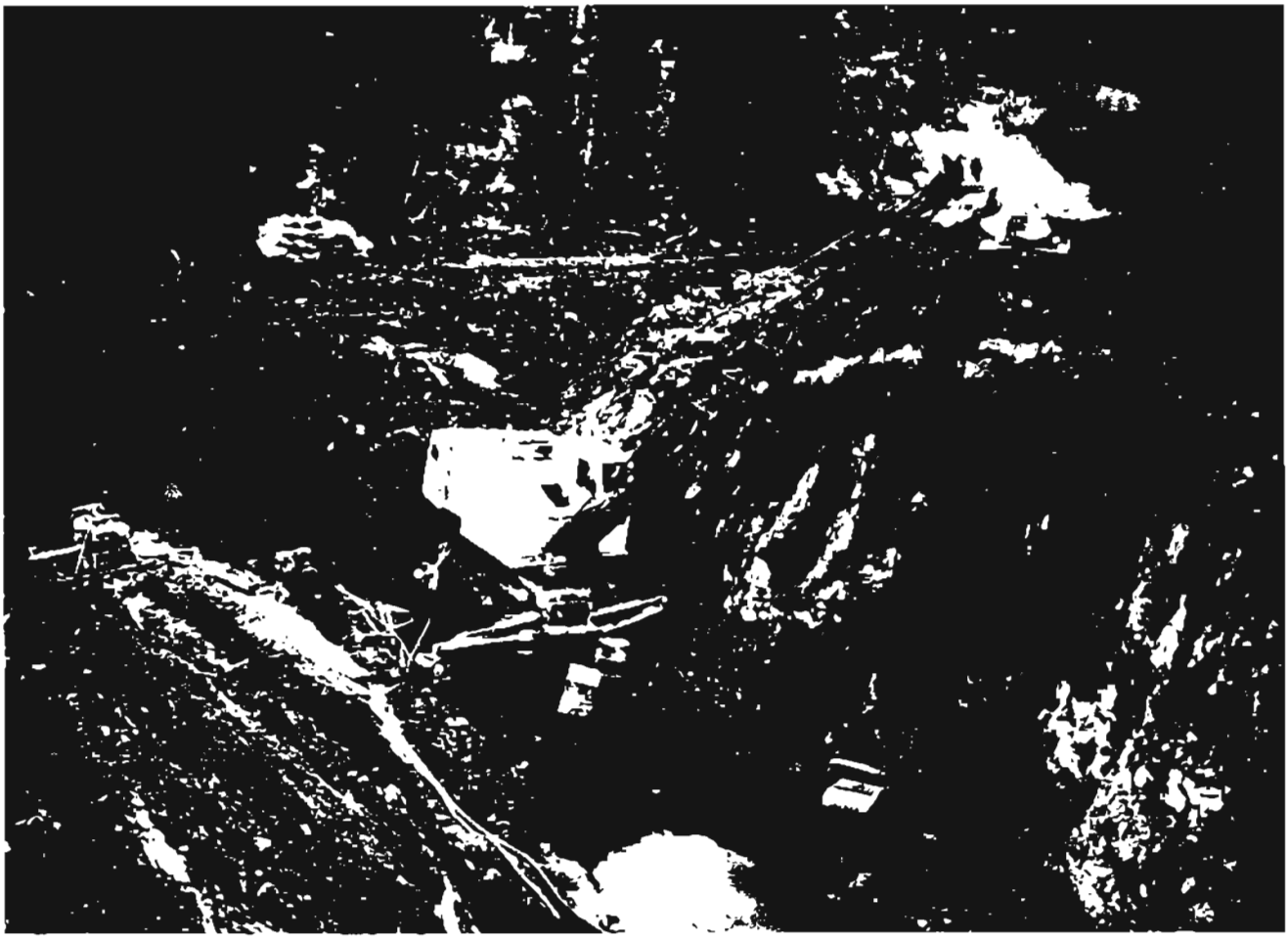

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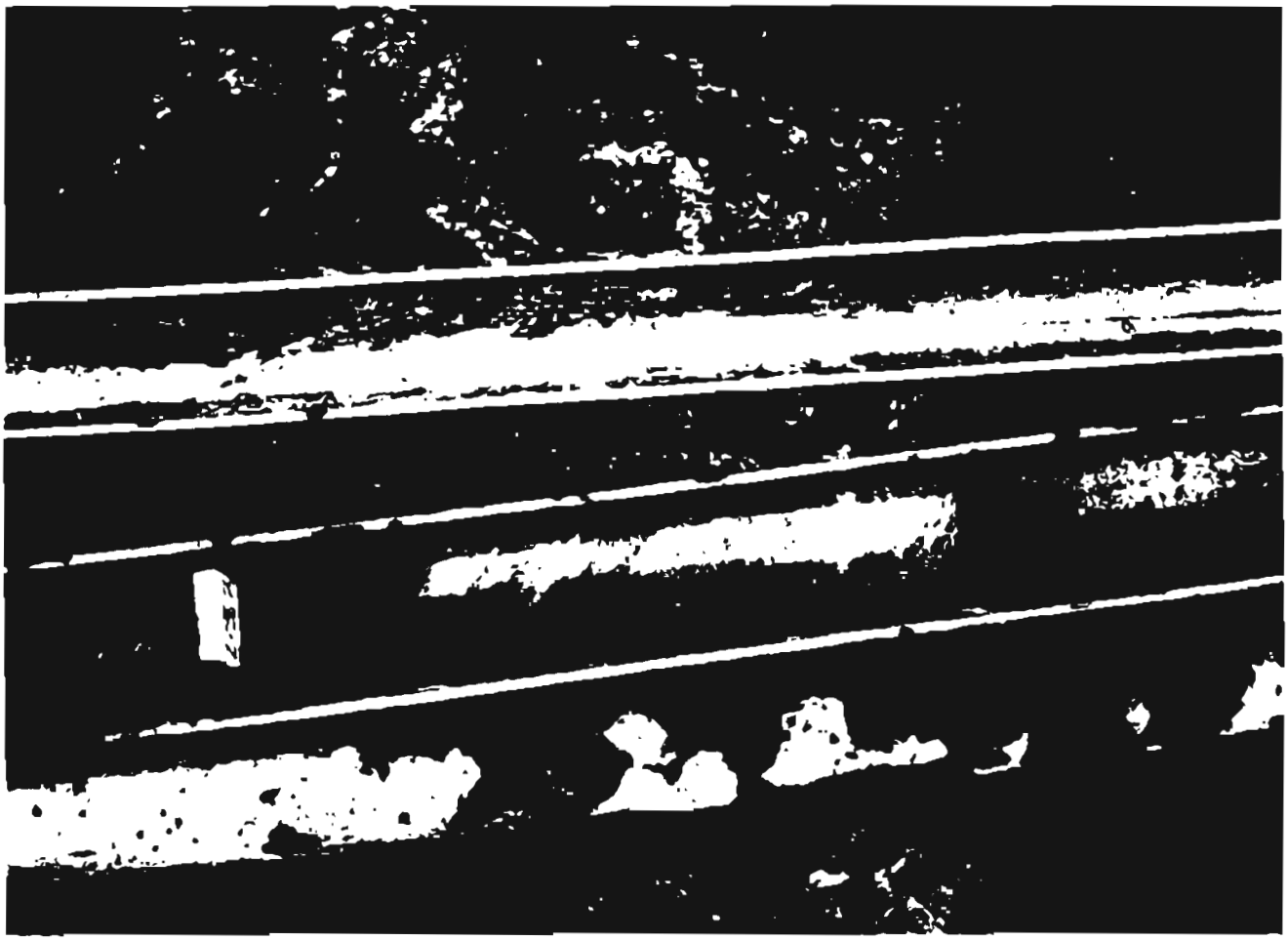

Figure 16