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Western Arctic Coal Study Proposal (1986)

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ALASKA DIVISION OF MINING AND GEOLOGY

PROJECT PROPOSAL

Title:

Coal and Overburden Characterization of Selected Stratigraphic
Sections In Nanushuk Group Rocks of Western Arctic Alaska:
Prediction of Geologic Constraints To Mine Development, And
Application To Depositional Modeling, Mine Planning, And
Reclamation Potential

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Purpose

To select and sample in detail several stratigraphic sections containing multiple coal seams in Nanushuk Group rocks of western Arctic Alaska; to systematically perform a suite of geochemical and physical analyses to determine the main coal and overburden rock types; to relate the types of coals and overburden to their specific and diagnostic position in the deltaic depositional system (that is, lower, transitional, or upper delta plain environments); and to determine those factors a) influencing mine planning and minability, b) allowing the prediction of geologic constraints to mine development, and c) bearing on post-mining reclamation potential.

Project Location

Northern Alaska coal fields with priority given to sites in the western Arctic. Specific sites may be selected at Corwin Bluff, Cape Beaufort, or other areas on or near the Chukchi Sea, including the Utukok, Kokolik, and Kukpowruk Rivers.

Statement of Problem

The Northern Alaska fields constitute one of the largest coal reserves in the world (Tailleur and Brosge, 1976). The resource base is definitely not a limiting factor to future development, but mining in permafrost, reclamation, and transportation will likely pose formidable challenges to coal mine development in the region (Merritt, 1986).

Geologic study over the past decade has resulted in the development of a deltaic sedimentation model (Ahlbrandt and others, 1979; Stricker and Roehler, 1981; and Callahan and Martin, 1981) for the coal-bearing Cretaceous Nanushuk Group rocks and led to a greater understanding of coal character and ultimate development potential for the different facies. A very tentative interpretation is that coals of intermediate thickness and continuity in the transition zone between upper and lower delta plain deposits have the best future commercial potential. Thicker coal beds of the upper-delta-plain deposits preliminarily appear to exhibit poor lateral continuity, and coal beds of the lower-delta-plain environment seem to be relatively higher in sulfur and generally too thin to mine.

Detailed and systematic study of coal and overburden characteristics at sites representative of these specific depositional situations has not been done. This study will determine diagnostic types of coal and overburden as a function of their position in this river-dominated paleodepositional system. Once these types have been established, a demonstrational model can be developed to explain factors influencing mine planning, development, and post-mining considerations.

Objectives/Policies

Alaska contains large quantities of coal, perhaps as much as one-half of the United States resource base. Much of this resource is concentrated in the Northern Alaska coal fields. The quality of geologic information on this resource has eclipsed the reconnaissance stage, and currently more detailed study at specific locations (as proposed here) will better serve to stimulate future coal development in the region.

Because of the large resource base, State and Federal agencies, Native villages and regional corporations, industry, and Pacific-rim coal consumers are very interested in assessing the coal resources of the Northern Alaska fields, especially in areas of the western Arctic lying on or near coastal access of the Chukchi Sea. Assuming that transportational and other mine-related constraints can be bridged, mines can be developed in the region to supply high quality bituminous coal for export and in-State use. There has long been an interest by Native organizations in developing the coal resources to provide heat and power in remote Northern Alaska villages.

The State Department of Natural Resources will need detailed studies to help manage future coal leases and to regulate mine development in the region. Subsurface exploration by drilling, coring, and geophysical logging has been intense over the past several years in the Cape Beaufort and Deadfall Syncline areas of the western Arctic. The study proposed here will supplement information provided by these efforts and provide new, detailed, and systematically-derived coal and overburden characterization data at several sites (at least 3) in the region. This data will be applied directly to constructing demonstrational models that can be used to predict geologic constraints to development, minability, and reclamation potential.

Development of Northern Alaska mines will provide new sources for high quality bituminous coal on the Pacific rim,

create new mining and reclamation technologies, demonstrate that Arctic coal mining is feasible in Alaska, and provide new avenues for employment in the region.

Interest Groups Affected

State and Federal government agencies; Alaska Native Villages and Regional Corporations; the North Slope Borough; industry; shipping (barging) and other contractors; Pacific-rim coal consumers; Alaska residents.

Project Description

This is a two-year project that will ultimately produce a set of summary sheets showing the detailed stratigraphy at several selected coal-bearing sections in the Nanushuk Group of western Arctic Alaska. Each sheet will be representative of geologic strata diagnostic of specific positions in the deltaic depositional system (that is, lower, transitional, and upper delta plain environments). Coal and overburden rock types characteristic of these environments will be demonstrated. Stratigraphic sections will be chosen which contain multiple coal seams. Each sheet will contain detailed and site-specific data derived from coal and overburden characterization research that will bear on quality, quantity, minability, marketing, and environmental aspects.

This will require the selection of sites in the western Arctic based on previous geologic studies and depositional modeling. Among the specific sites that may be selected are Corwin Bluff, Barabara Syncline, Ninuluk Bluff, Killik Bend, Kokolik Warp Anticline, Coke Basin, and/or South Limb Snowbank Anticline (Ahlbrandt and others, 1979). It is expected that three sites at a minimum will be selected that are representative of certain diagnostic positions in the river-dominated depositional system. It will require detailed study, description, and sampling at those sites selected. A surficial geologic map will be developed for the area in the immediate vicinity of diagnostic stratigraphic sections. Analytical tests on the coal and overburden samples will be conducted either in-house or at consultant laboratories specializing in certain analyses. It is expected that field operations will require helicopter transport to, from, and between the sites selected. The project will require the assistance of 2-3 geologists and a geochemistry technician. It will also likely require one RSA contract and one professional services contract.

Specific Types of Analyses To Be Conducted

1. Total sulfur and sulfur forms on coal and overburden
2. Illite/kaolinite ratios
3. Munsell color values
4. Grain size analysis---particle size and texture
5. Fossil types---body, plant
6. Trace element analysis on whole coal (elements of environmental concern)
7. Trace element analysis (elements of environmental concern) and major oxide analysis on overburden
8. Suite of overburden characterization analyses---including acid and neutralization potentials, potential acidity, paste pH, base saturation, cation exchange capacity, ammonium acetate extractable cations, extractable nutrients, lime percentage, organic matter, bulk density, exchangeable sodium percentage, sodium adsorption ratio, saturation extract cations, saturation percentage, and electrical conductivity
9. Coal petrology and vitrinite reflectance
10. Selected proximate and ultimate analyses of coal

Products

Three or more summary sheets describing the geology, coal resources, and mine-related considerations at each selected demonstrational site; a surficial geology map (inset on each sheet or separate) of each site; a summary report analyzing practical applications of and conclusions drawn from the detailed coal and overburden characterization data presented on the sheets.

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