

DEPARTMENT OF THE INTERIOR  
U.S. GEOLOGICAL SURVEY

Haiti coal briquetting feasibility study ---  
Inventory of resource data and collection of samples

by

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A cooperative Coal Exploration Project with the Direction des Ressources Energetiques, Ministere des Mines et des Ressources Energetiques, Republique d'Haiti, under the auspices of the Agency for International Development

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

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HAITI COAL BRIQUETTING FEASIBILITY STUDY ---  
INVENTORY OF RESOURCE DATA AND COLLECTION OF SAMPLES

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U.S. Geological Survey

ABSTRACT

The purpose of the project was twofold:

- 1) to evaluate the available coal resource data of Haiti from which a program of activities might be identified that could lead to an assessment of the coal resources
- 2) to supervise the collecting, packing, and shipping of a 500-pound coal sample for analyses in the United States by the University of North Dakota Energy Research Center. A site in the Maissade/5<sup>e</sup> coal field was selected for sampling.

Analyses of the coal samples will focus on the possibility of converting the lignite into smokeless fuel briquettes. The Haitian population has relied on wood as the primary fuel. Deforestation has become a critical problem, and for this reason, a new source of energy would be desirable. Briquettes made from the lignite deposits could be that alternate energy source.

In 1976, a French firm (SOFREMINES-SOFRELEC) conducted a preliminary reconnaissance of the Maissade/5<sup>e</sup> coal field. In 1980 and 1982, the German Geologic Institute (Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) ) evaluated the same area and determined that it was not economically feasible to use Miocene lignite for electric power generation.

The following steps are recommended:

- 1) an accurate base map of the Maissade/5<sup>e</sup> coal field be made available that shows the location of the coal bed outcrops, their correlation, and altitude of the B coal bed.
- 2) a coal-exploratory drill program be designed. Several deep holes that penetrate the entire coal-bearing section of rocks are necessary to establish a stratigraphic framework from which we can determine the lateral extent of coal beds in the subsurface.

Interpretation of these data will lead to a more accurate assessment of the coal resources in the Maissade coal region.

## INTRODUCTION

### Purpose

At the request of the Agency for International Development (AID), the author traveled to Haiti to perform the following investigations with counterpart personnel from the Department of Mines and Energy Resources:

- 1) evaluate coal resource data available in Haiti from which a program of activities might be identified that could lead to an assessment of the coal resources.
- 2) supervise the collection, packing, and shipment of a sample of approximately 500 pounds of coal that will be analyzed in the United States for experimental research. The coal was sent to the University of North Dakota Energy Research Center for analysis and for testing the feasibility for its utilization as a smokeless fuel briquette.

Counterpart personnel and the schedule of activities during the visit are listed in Attachment 1.

Due to the time constraints, the two weeks in Haiti were spent strictly on the sampling of coal. Resource assessment of the coal will come at a later date, contingent upon recommendations stated in this report.

## Location

Haiti lies on the western third of the island of Hispanola, approximately 500 mi southeast of Miami (fig. 1). The most important Haitian coal resources are found in the Central Plateau (Maissade/5<sup>e</sup> and Savane-Haleine coal fields) near the town of Maissade, a short distance west of Hinche; the coal fields of Camp Perrin and L'Asile are on the southern peninsula, but their extent and coal quality are not well known (figs. 2a and 2b). The study area (Maissade/5<sup>e</sup>), on the Central Plateau, is approximately 140 km northeast of the capital, Port-Au-Prince (fig. 2b). This plateau is bordered to the southwest by the Montagnes Noires and to the northeast by the Massifs du Nord. From Port-Au-Prince to the Montagnes Noires the road is paved, but the rest of the distance is dirt road. North of the town of Maissade the road is rough and a 4WD vehicle is a must for crossing river beds, particularly during the rainy season. Flash floods are common and caution should be exercised while traversing the larger bodies of water. There were a few topographers working on the road north of Maissade and hopefully this will continue, for it will facilitate better access to the coal field.

The town of Maissade has a dense urban population; the population in the surrounding country side maintains a consistent rural density. The typical local farmer raises chickens and goats, and has a few plots of land where he grows sugar cane and corn. Soil erosion is a constant problem because of deforestation. To date the population has relied on wood as the primary fuel; a new source of energy, such as briquetted coal, would be desirable to avoid further problems with deforestation.

## Previous Work

The presence of lignite has been recognized in Haiti since the early 1900's. Reports by W. Woodring (1924), J. Butterling (1960) and L. Duplan (1978) are only a few which describe Miocene lignite in Haiti. In 1976, Maissade/5<sup>e</sup> was explored by a French firm, SOFREMINE-SOFRELEC. This was followed in 1980 and 1982 with a study by the German Geologic Institute, Bundesanstalt fur Geowissenschaften und Rohstoffe (BGR). The French and German reports are on file with the Government of Haiti. The Germans conducted a limited drilling program of 39 holes. The average hole depth was 35 m and a total of 1,009 m was drilled. Some core samples of coal were recovered (81.28 m) as part of this program; core recovery of the coal beds averaged about 84 percent.

The German investigations established a very good base for study of the Maissade/5<sup>e</sup> coal field, even though they concluded that to use Miocene lignite for electric power generation in the near future was not economically feasible. Now, the Agency for International Development (AID) is assisting the Government of Haiti (GOH) in a study to determine the feasibility of converting the lignite into carbonized smokeless fuel briquettes.

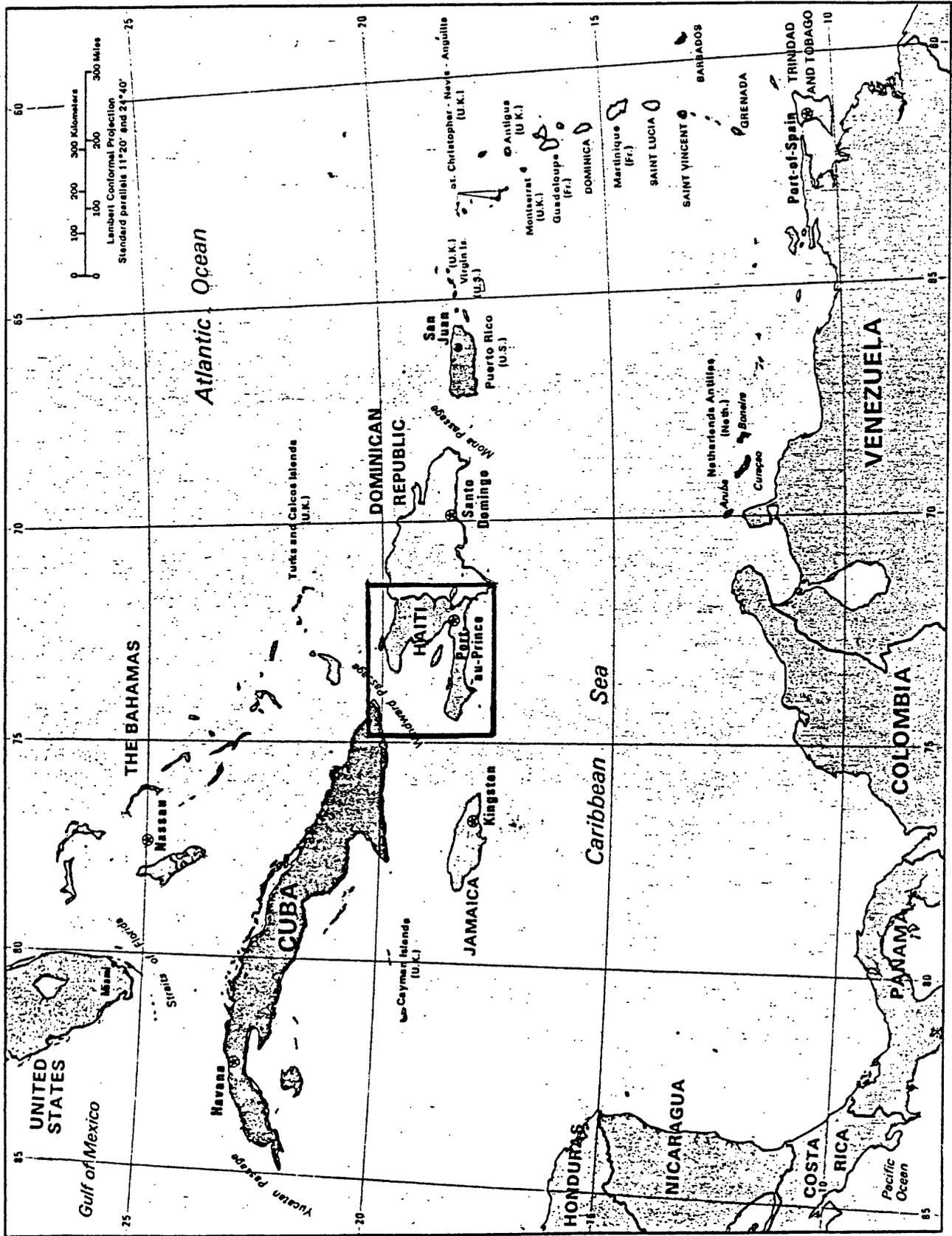


Figure 1: Location map.

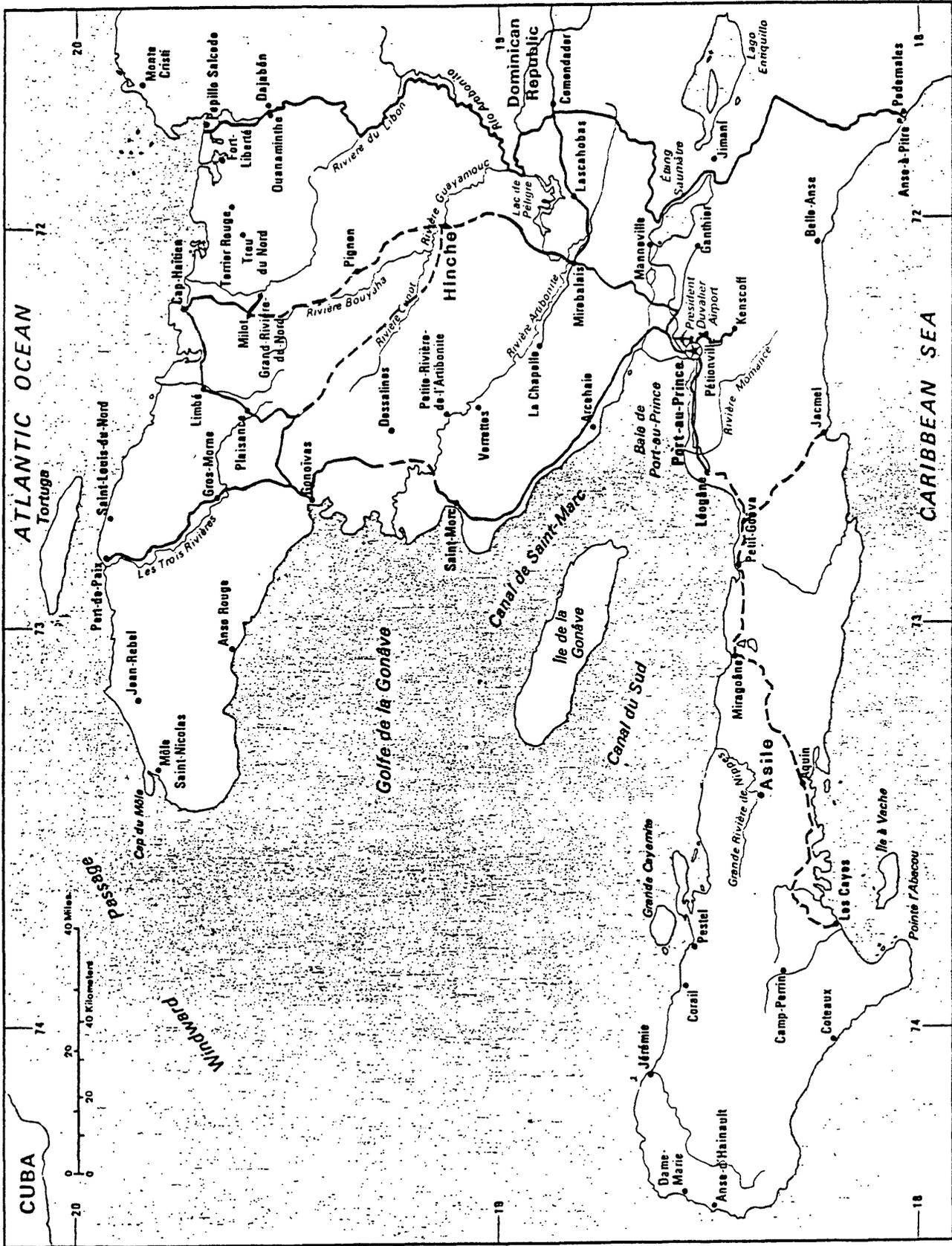


Figure 2a: Index map of Haiti.

Lambert Conformal Projection  
 Standard parallels 17°20' and 22°40'  
 Scale 1:1,500,000

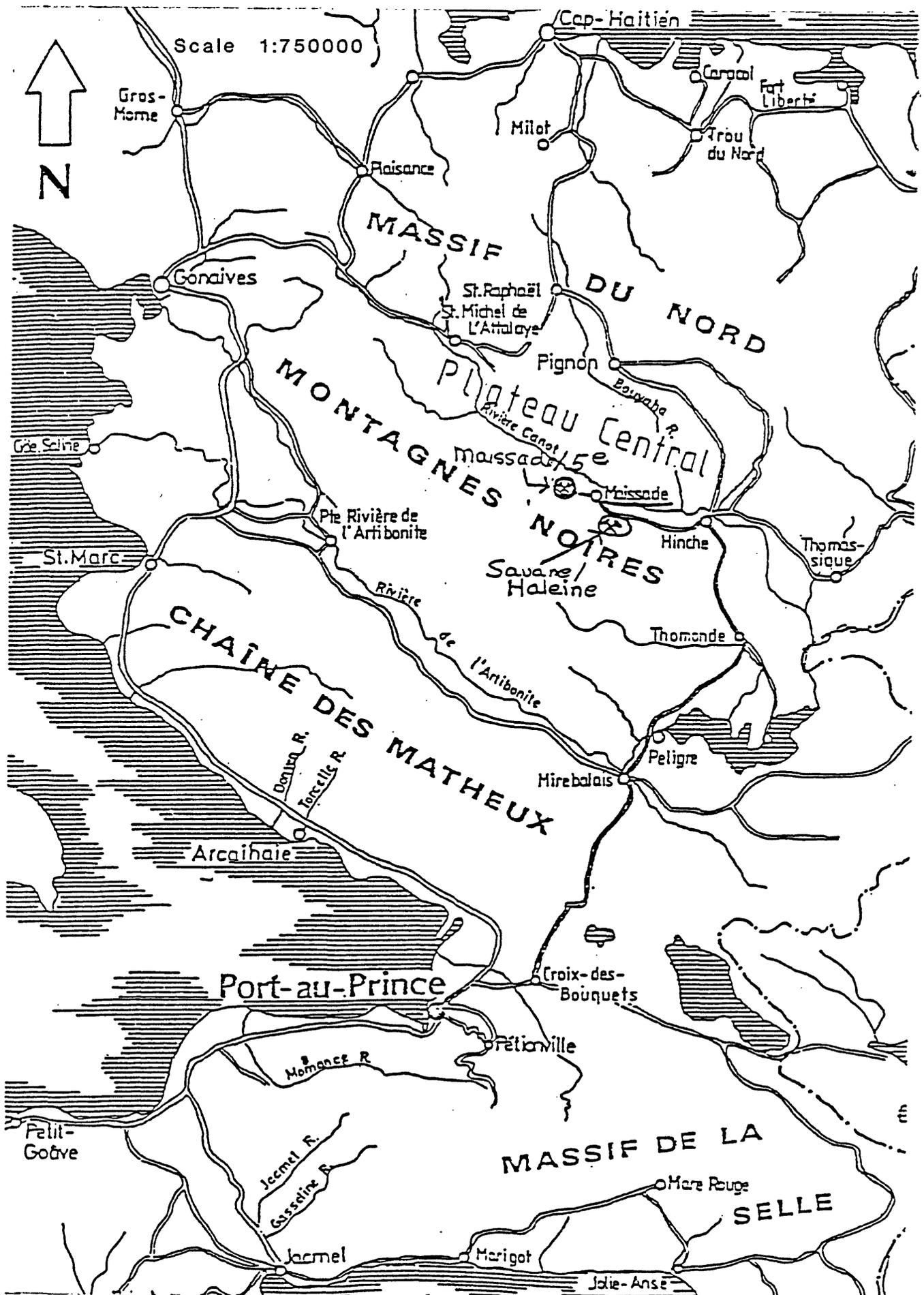


Figure 2b: Location of Maissade/5e and Savane/Haleine coal fields.

## Geology

The Central Plateau, a syncline trending about 135° NW, is bordered on the north by the Massif du Nord and on the south by the Montagnes Noires. These two mountain chains reach 1,600-1,700 m in altitude. The altitude of the plateau averages 280 m.

The syncline contains two coal fields, Maissade/5<sup>e</sup> and Savane-Haleine (fig. 2b). More is known about the Maissade/5<sup>e</sup> coal field because the German report examined it in considerable detail. Betonius Pierre (GOH/DMER) has worked extensively on the Savane-Haleine area, but the geology of the Maissade/5<sup>e</sup> area makes coal beds there more conducive to exploration and mining. The low angle of dip in the Maissade/5<sup>e</sup> area (2-5° southeast) allows easier assessment of the resources at this time. In contrast, towards the edges of the basin, near Savane-Haleine, the dips increase to as much as 30°.

Figure 3 shows positions of coal zones and beds in a generalized measured section for the coal fields and an expanded lithologic column of the B coal bed at the site sampled. The B coal bed is underlain, with a sharp contact, by a gray fossiliferous shale. Two or three small stringers (less than 2.5 cm thick) of gray fossiliferous shale exist within the B coal bed. The fossils are juvenile gastropods. The top of the B coal bed is in sharp contact with an overlying 0.8 ft thick (0.28 m) sandstone ledge that in turn is overlain by the B<sub>0</sub> coal bed (approx. 0.7 m). The B<sub>0</sub> bed will not be included in the resource estimates because it is not a continuous unit in the area and is known to pinch out within 50 m of the sample site. Another gray shale unit, which is also fossiliferous, overlies the B<sub>0</sub> bed.

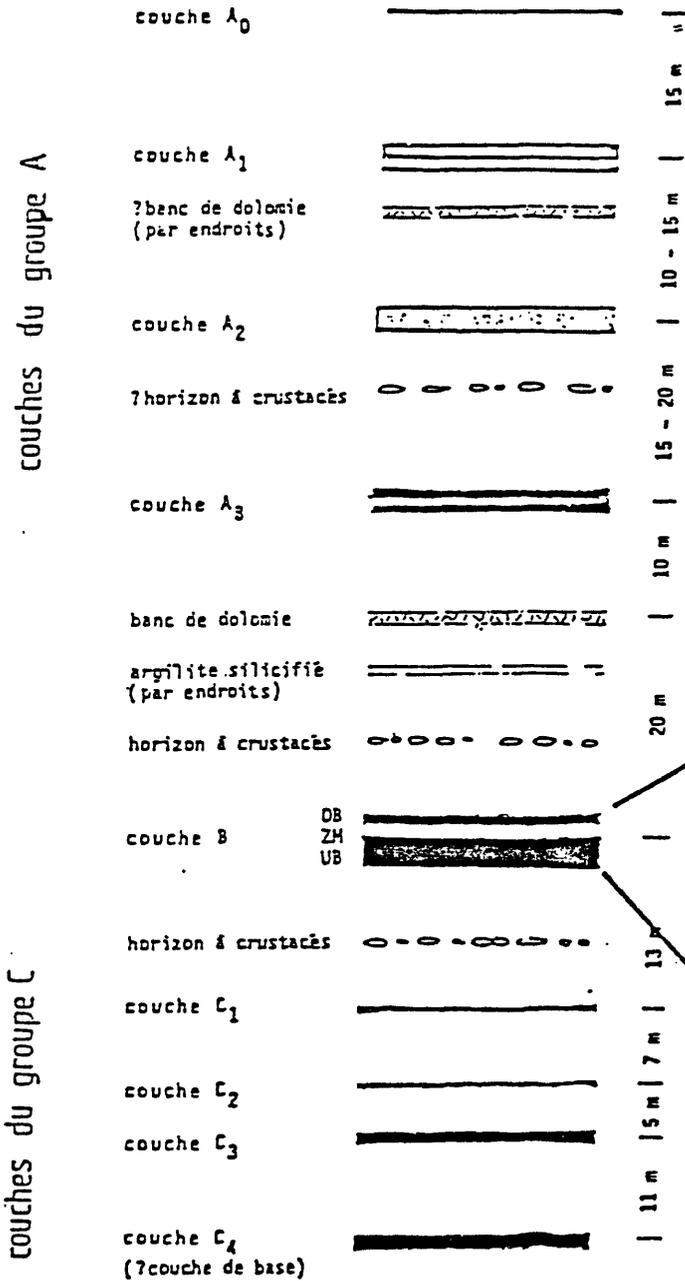
## FIELD TECHNIQUES

Field work in the Maissade/5<sup>e</sup> area consisted of visiting all the known outcrop exposures of the B coal bed. Site TT 74C (designation in the German report) was selected by mutual agreement between myself and Betonius Pierre because it was the most representative of the lithologic section and was easily accessible.

A bulldozer removed as much as 2 ft (0.6 m) of weathered outcrop from the sampling location. The outcrop was quite resistant, so removal of the weathered material took most of one day. Workers continued to dig at the outcrop once the bulldozer could no longer remove the coal. The coal was sampled the next day when a point was reached where we felt confident that the freshness of the sample would give representative coal analyses. All coal was double bagged, labeled, and placed inside two 55-gallon drum containers, each container had an air tight lid.

# LITHOLOGIC COLUMN

## MAISSADE/5<sup>e</sup> COAL FIELD



# LITHOLOGIC COLUMN TT 74C

Sample locality

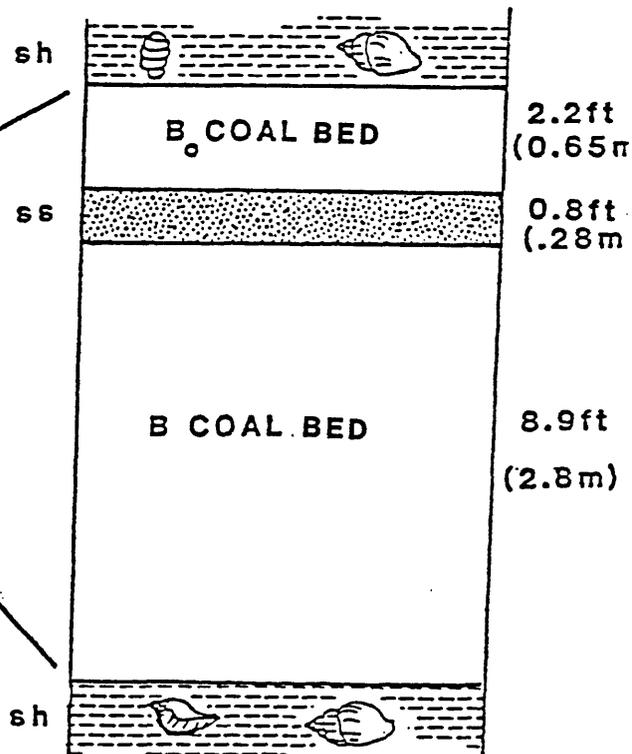


Figure 3. Schematic Measured Section with Expanded Lithologic Column at Sample Site (modified from German report)

The coal samples were sent by air freight to the University of North Dakota Energy Research Center, in Grand Forks. Until the results of analyses are known, it will be very difficult to assess the future of the project. Without the development of the actual lignite briquette, any distribution logistics and potential production forecasts will be invalid.

## RECOMMENDATIONS

### Project Activities

Because the main purpose of this project is to eventually develop substitute fuels for the Haitian fuelwoods and charcoal, preliminary investigations must take place before an accurate assessment of the coal resources can be made.

Considerable work has been done in the Maissade/5<sup>e</sup> area, as shown by the drill holes, a few cross sections, and isopach, structure, and overburden maps presented in the German report. Coal analyses and resource estimates have also been presented.

Having reviewed this information, the following steps are recommended:

- the construction of a base map showing outcrop correlations with top and bottom altitudes for the B coal bed. This procedure will show the lateral continuity of units and will point out data-deficient areas. New trenches should be dug to gain information to fill-in these blanks.
- a carefully planned drill program is required. Strategically placed drill holes (150-200 m in depth) are needed to penetrate the three coal zones presented in the German report (fig. 3), the B bed being the middle one. The cross sections in the report showed that most of the drill holes were too shallow to produce a good interpretation of the stratigraphic sequence of the Maissade/5<sup>e</sup> lithologic units.
- strong subsurface control and subsequent correlations coupled with outcrop data will establish a lateral continuity and areal extent of coal beds. These data will comprise more accurate information from which systematic and regional correlations will be possible. Such information is critical in establishing a connection geologically between the Maissade/5<sup>e</sup> and Savane-Haleine coal fields. The Savane-Haleine area also includes a sequence of three coal zones with associated fossiliferous shales, but correlations are uncertain. Good stratigraphic control is essential to delineate the boundaries of each coal field, and in turn, to properly assess the resource potential for the entire Central Plateau region.

## Equipment

The Department of Mines and Energy Resources has mineralogic, petrographic, and sedimentologic equipment in their laboratories in Port-Au-Prince. Three geologists are on staff in the physics branch. With good core data from the proposed drill program, petrographic analyses will be readily available. Chemical analyses for coal quality studies depends on the availability or acquisition of equipment to determine the following:

- rank
- calorific value
- proximate and ultimate values
- sulfur content and forms of sulfur

This list is far from complete but it illustrates the basics of coal quality analysis. This procedure may vary with regard to briquette analysis because of the judging of different parameters.

The drilling program is an essential element in the continuation of the coal assessment of the Maissade/5<sup>e</sup> coal field. A drill rig that has the capacity to drill both rotary and core holes to depths of at least 200 m will be needed. A split core barrel, which has proven to be the most efficient way to retrieve samples, should be used.

A geophysical well logging unit should be available to obtain the standard suite of four logs (natural gamma, density, resistivity, and caliper) from each hole. This cross-check procedure confirms the position of coal beds plotted during drilling of the holes, determines positions of coal beds that may have been missed during logging of the cuttings, and more closely defines the depths and thicknesses of each coal bed penetrated in the hole. Support vehicles, such as a diesel truck, should be figured into the program. Location of water near each drill site should be established. Drilling in the rainy season is not recommended. A stuck drill rig in a river or on a muddy road is a costly and time consuming problem.

## SUMMARY AND ACKNOWLEDGMENTS

In response to the urgency to develop an alternative fuel source for Haiti, the investigation into the feasibility to develop smokeless lignite briquettes is well underway. Approximately 500 pounds of Miocene lignite from the Maissade 5<sup>e</sup> coal field in Haiti have been sent to the University of North Dakota Energy Research Center for analysis. Previous studies by Haitian, French, and German investigators have established a basic geologic and coal resource framework on which future assessments can build. Data from the proposed drilling program as well as correlation of lithologic units at the outcrop and through geophysical well logs will enable the geologist to have a stronger control of the coal area boundaries and more adequately determine the resources of the Maissade/5<sup>e</sup> coal field.

I would like to express my appreciation to Betonius Pierre, Nicole Dieudonne, and Claude Jean Poix for their assistance, insight, and ideas while in the field. They have a good geologic background of the field area, and with their enthusiasm, the project can only proceed with profitable results. The director general, Michel Simon, as well as the project chief, Wilfrid Saint Jean, were most gracious in their support and assistance. This project was made possible by the support and assistance of the Agency for International Development. The future of the Haiti lignite project looks promising and we await the results of analyses from the North Dakota Energy Research Center to see exactly how and where to proceed.

## REFERENCES

- Butterlin, J., 1960, Geologie Generale et Regionale de la Republique D'Haiti - Mem. Inst. Des Hautes Etudes de l'Amérique Latine. Paris
- Duplan, L., 1978, Rapport Geologiques sur les Lignites de Maissade. Nations Unies, Projet de Developpement Minier
- Woodring, W., 1922, Stratigraphy, structure, and possible oil resources of the Miocene rocks of the Central Plain, Republic of Haiti -- Washington, D.C. Haiti Geological Survey

1. Name of traveler, dates of travel, and places visited:

Jean N. Weaver, May 12 - May 27, 1985  
 Port-Au Prince and Maissade coal field, Haiti

2. Names of others accompanying you:

Name	U.S. Agency

3. Key counterpart personnel:

Name	Country	Agency
Betonus Pierre	Haiti	GOH: Dept. of Mines & Energy Resources
Wilfrid Saint Jean	Haiti	same as above
Michel Simon	Haiti	same as above

4. Purpose of trip or title and sponsor of meeting attended:

The purpose of the trip was to supervise the collection, packing, and shipment of approximately 500 lbs of Miocene lignite that will be analyzed by the North Dakota Energy Research Center and used in experimentation for briquetting.

5. Summary of trip discussions and activities:

The first week was spent in the Maissade/5<sup>e</sup> coal field with Betonus Pierre, Claude Jean Poix, and Nicole Dieudonne. We examined all the outcrops of the B coal bed, the potentially minable coal bed of the area. The sample outcrop was selected and during the second week, a bulldozer arrived to clear a road to the sampling site. Two 55-gallon drums were filled with coal and the paper work was prepared for its shipment to North Dakota Energy Research Center.

6. Conclusions and recommendations:

The feasibility of a briquetting program is contingent upon the analytical results of the coal. Correlation of measured sections throughout the Maissade coal field and a drilling program should be completed to accurately predict the extent of the coal reserves and in turn the coal resource assessment.

7. Actions required if any, and responsible personnel:

SUMMARY OF ACIVITIES

- May 12, 1985            Leave Denver, Co.  
                         Arrive Port-Au-Prince (PAP), Haiti
- May 13, 1985            Met Glenn Stevenson and Carl Petrich (Oak Ridge  
                         National Laboratories). Drove to the Department  
                         of Mines and Energy Resources (DMER) and met:
- |                    |                             |
|--------------------|-----------------------------|
| Wilfrid Saint-Jean | Project Chief               |
| Betonus Pierre     | Chief Geologist             |
| Nicole Dieudonne   | Geologist                   |
| Claude Jean Poix   | Geologist                   |
| Clarence Kooi      | Energy consultant to<br>GOH |
- Betonus and I reviewed the overall geology of the  
Maissade coal field and the equipement that would  
be required for the sampling of the coal.
- May 14, 1985            Betonus, Nicole, Claude, Simon (driver) and  
                         myself left PAP and drove to Hinche (4 hr. drive).  
                         Week was spent examining all known outcrops within  
                         the Maissade/5<sup>e</sup> coal field where the B coal bed  
                         was visible. The B coal has been established to  
                         be the thickest, and most continuous bed within the  
                         field. Betonus and I agreed on the outcrop to  
                         sample. It is labeled TT 74C on the geologic map  
                         and is located on the Riviere Sable. Returned  
                         to PAP for the weekend and also to purchase an  
                         extra hose for the bulldozer, which broke down  
                         in the field.
- May 18-20, 1985        Days off in PAP. May 20 was a local holiday  
                         (Day of the Flags). Met with Louis O'Connor  
                         (US/AID, Haiti) and discussed the current status  
                         of the the lignite project. Alberto Sabadell  
                         (US/AID, Washington, D.C.) arrived the evening  
                         of May 20.
- May 21-24, 1985        Left for Hinche. Bulldozer prepared access to  
                         sampling site and removed as much weathered outcrop  
                         as possible from the site. We filled up two 55-gallon  
                         drum containers with coal. All samples were double  
                         bagged and labeled. Visited an outcrop in Savane-Haleine  
                         coal field (adjacent to Maissade/5<sup>e</sup> ). Sampled coal  
                         for analysis. Arranged logistics for the shipment  
                         of the coal to the Univ. of North Dakota Energy  
                         Research Center with Michel Simon (Director General  
                         of DMER) and Louis O'Connor (US/AID). Simon and  
                         O'Connor will be in charge of the actual shipment of  
                         the two drums.

May 25, 1985      Betonus, Nicole, Claude, and I travelled south  
of PAP along the peninsula to the Asile coal field.  
We collected one locality for analytical samples.  
This is a new coal field in Haiti that has never had  
samples analyzed. Returned to PAP in early evening.

May 26, 1985      Day off in PAP.

May 27, 1985      Left PAP, Haiti  
Arrive Denver, Colorado