# COSTA RICA COAL PROGRAM

Progress Report January 1 - March 16, 1985

Plans April 1 - September 30, 1985

by

E. R. Landis

U. S. Geological Survey

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ABSTRACT

The Direccion Recursos Carboniferos, Gerencia de Exploracion, Refinadora Costarricense de Petroleo S. A., has continued working in the Venodo, Zent and Volio coal areas, and has initiated Reconnaissance Stage studies in the Valle de Estrella coal area.

By about the middle of May, a final report on the Exploration State 1 program in the Volio area should be available for review and use for planning the Exploration Stage 2 drill program.

Technical assistance to be supplied by the USGS between April 1 and Sept. 30, 1985, comprises a total of 21 man-weeks, of which as many as 13 weeks will be spent in support of the operations in the Volio coal area. If it were possible, assistance should be given in preparing the report on the Exploration Stage 1 program in the Volio area.

# INTRODUCTION

This report presents a summary of the activities of the U.S. Geological Survey personnel in the technical assistance program on coal exploration in Costa Rica during the period January 1, through March 31, 1985. Also included is a summary of the activities and progress of counterpart personnel of the Direccion Recursos Carboniferos, Gerencia de Exploracion, Refinadora Costariccense de Petroleo S. A.

This report is one of a series to be prepared during the period of existence of the cooperative coal exploration program.

## PROGRESS DURING REPORT PERIOD

### Venado Coal Area

Drilling with the Winkie drill proceeded under direction of Ragelio Samuels in the Rio Pataste area.

D. A. Coates (Attachment 1) arrived in the area Feb. 21 and worked with R. Samuels for part of two days and with Luis Obando for the remainder of his time in Costa Rica. A program of drilling and seismic investigations was planned and checked against field observations. Drilling with the Winkie rig will continue, five deeper holes to be drilled by a B-80 rig with HQ diameter tools have been located, and three seismic profiles to interpolate between drill holes have been planned.

Some preliminary results from the Winkie drilling indicate that the subsurface structure, below the influence of landsliding, may be considerably simpler than it appears from the exposures in the area. Based on his past experience in geomorphology in other areas, Coates is cautiously optimistic that the structural complications observed to date may be largely surface effects. The drill program and seismic profiles will supply pertinent information about this possibility.

R. Samuels has been transferred to the Volio area. Geologist Luis Obando, Assistant G. A. Adrian Vega, nine helpers and one driller will continue the effort in the Venado coal area.

### Zent Coal Area

Reconnaissance in the eastern and western parts of the Zent coal area was continued during this report period by Alfredo Garcia and Rodrigo Estrada. Manuel Gomez and Topographer Jose Bisset have been doing more reconnaissance and road building in the Corina subarea in preparation for more detailed study including drilling and seismic surveys.

In the eastern part of the area, Zent/Rio Peje, Garcia reports progress in the reconnaissance and that future drilling may be required in the Quebrada Sopilote area. In the western part of the area, Zent/Rio Barbilla, Estrada has been traversing streams and measuring sections and reports finding some coal outcrops and some fossil-bearing units similar to units in the Zent/Corina area.

J. N. Weaver, (Attachment 2) assisted the RECOPE personnel in evaluating the field work to date, and selecting the locations for seven sites for drilling by the portable Winkie rig, the location of the first B-80 drill hole, and the location of the seismic profiles that will interpolate between drill holes and outcrops (both natural and trenched).

At this point, the farm road that extends west (northwest) from Corina has been worked on by bulldozer as far as the first (PC-1) drill hole location. A B-80 drilling was preparing to drill in mid-March. Locations for future drill holes have been tentatively discussed but final selection should await results of drilling and seismic profiling.

## Volio Coal Area

The area here called the "Volio Coal Area" includes the Carbon Volio, Rio Sand Box, and Carbon Uno areas of the Baja Talamanca district. Progress and plans for RECOPE activities and USGS assistance were presented in our memorandum of March 22, 1985, which is Attachment 3 to this document.

S. B. Roberts (Attachment 4) worked with RECOPE personnel in the Volio area during the latter part of February, 1985. He and R. G. Hobbs also worked in San Jose on correlation problems and interpretation of data from the drilling in the Volio area.

Hobbs prepared a suggested outline for the report on the Exploration Stage I drilling report in the Volio area. This report must be detailed and completely comprehensive to allow planning for the Exploration Stage II drill program. Hobbs, Roberts and Landis are prepared to guide, assist and review during preparation of this report to the maximum extent possible.

## Well site coal exploration technology course

A one-week course emphasizing the duties and responsibilities of the geologist in the conduct of coal exploration drill programs was presented to a group of geologists, engineers, and technicians from RECOPE and ICE. March 4-6 were lecture sessions and March 7-10 were field exercises in the Volio area.

A total of  Costa Rican personnel attended the course. A summary of the course and of the comments made about the course are in part II of Attachment 2. Part of attachment 4 also addresses the course.

## Geophysical well-logging equipment

R. N. Babcock spent several weeks in Costa Rica overhauling the geophysical logging equipment loaned to RECOPE by the USGS; making the new MLS geophysical logging unit of RECOPE functional and designing a density probe for that unit, and assisting with the coal technology course (as part of the course he field tested and demonstrated the MLS logger in the Volio area).

His report (Attachment 5) contains recommendations based on his Costa Rica observations. His arm, the site of the Leishmaniasis Cutanea infection, has not completely healed yet.

## Valle de Estrella Coal area

Reconnaissance in the Valle de Estrella area was started in January by Ragelio Samuels; and following transfer of Samuels to the Volio area, the work was resumed by Fernando Alvarado. The V. de E. area reportedly contains coal on both sides of the Rio Estrella and coal has also been found south of the Rio Bananito.

The sketch map (Attachment 7) shows that the planned reconnaissance work in the V. de E. area will take place in the three areas of coal-bearing rocks that lie between the Rio Estrella and the eastern edge of the Zent coal area. The southernmost of these areas, designated E-1 zone will be studied during the remainder of the dry season and will, hopefully, be completed before the rainy season begins in earnest. During the rainy season, the two northern zones, RB1 and RB2, are more accessible than is E-1.

The Porvenir No. 1 oil and gas exploration well, which penetrates the coal-bearing rocks of the Zona E-1, had coal in the samples at four elevations in the hole. The available sample log is a percentage type based on drill-cutting samples only (probably as well was being drilled) and is not corrected to the geophysical logs. Coal was penetrated at no more than three elevations

in the well but this information should be a guide to future surface and subsurface work in the area.

As shown on the map (Attachment 7), the Valle de Estrella area spans the gap between the Zent coal area and the Baja Talamanca district. A regional understanding of the coal resources of the Limon basin is dependent on the work in the V. de E. area.

## CONCLUSIONS ANMD RECOMMENDATIONS

As pointed out in Attachment 3, we have reduced our planned technical assistance in the Venado and Zent coal areas to less effort than we feel is desirable and necessary.

Our effort in the Volio coal area is aimed at assisting the RECOPE personnel in preparing a definitive comprehensive report on the Exploration Stage I in the Volio area and in planning the Exploration Stage II program of activities. We will assist the Coal Production and Utilization contractor to the extent possible. If it was possible, we would like to be more deeply involved in preparation of the Exploration Stage I final report but under the present situation the responsibility for preparation of that report must rest almost completely on the RECOPE geologists.

# PROGRESS REPORT ON FIELD STUDIES

## PATASTE ARRIBA AREA, NEAR MONTERREY, PROVINCIA ALAJUELA, COSTA RICA

FEBRUARY 21-28, 1985

Donald A. Coates, U.S. Geological Survey

## Introduction

The purpose of USGS participation in coal studies in the Rio Pataste area during February 1985 was to assist in planning a program of deep drilling, including coring and borehole geophysics. Shallow refraction seismic studies are planned to accompany the deep drilling. At present a small drill, capable of rotary drilling but not coring, is in use.

As this is a progress report on an ongoing project, and each day brings new data that can alter interpretations, I will write it as a narrative. Most of the drilling done up to now has been for stratigraphic information and to investigate the continuity of coal beds. This will continue to be the purpose of the drilling for the present.

February 21 and the morning of the 22nd I spent with Rogelio Samuels in Quebrada Pozo, Rio Pataste, and Quebrada la Cuca examining surface exposures and discussing drilling plans. Rogelio departed for San Jose at midday. Luis Obando arrived on the evening of February 22, and over the next several days we extended the exploratory drilling to the west of Quebrada la Cuca.

## Quebrada Pozo, Rio Pataste, Quebrada la Cuca

Arriving in the field about 3:00 pm. February 21, Rogelio Samuels and I examined outcrops in Quebrada Pozo and Rio Pataste. In this area RECOPE interpretations, which are based on dips seen in outcrop, show an anticline trending about north-south. This interpreted structure has controlled the drilling strategy that we discussed in San Jose. However, I think that the relationship of dips to topography requires that dips observed be treated with considerable suspicion. Rocks are exposed only in the quebradas and only at water level and for a few meters above the water. Trenches have been dug only a few meters above the outcrops. With one or two expections the rocks seen in both trenches and outcrops dip into the hillside and away from the stream; this is the classic attitude of rocks within a rotational slump block.



8

Virtually without exception the hillsides are a series of hummocks and swales typical of large compound landslides. In many places landslide head scarps are visible. In general the only areas not demonstrably shaped by mass wasting are the ridge tops. And the ridge tops themselves are ambiguous at best.

The outcrops tell us clearly that there is coal in the area and something about coal quality and the thickness of the beds. On the other hand, the outcrops tell us little if anything about the attitude of beds at depth or at what level the coal will be found at depth. The slumps have moved down, but how far down and with how much change in orientation only drilling or a seismic survey will tell.

## West of Quebrada la Cuca

From February 23 to February 27 I worked with Luis Obando westward from the drainage divide west of Quebrada la Cuca. Two coal beds are exposed in the quebradas, dipping into the hills for the most part, as do the beds farther east. Much of the land surface is landslide topography, as it is to the east. Finding a place to drill that is not on a landslide is out of the question so drilling is done with the full knowledge that each hole starts in landslide.

The four holes completed through February 27 are encouraging. Three of them contain a coal zone 1.5-2 m thick that contains some dull to vitrious brittle coal that breaks with a sub-conchoidal to conchoidal fracture. In all cases dark organic shale is included in the zone. Details of this coal and stratigraphic columns of the holes are in the possession of Luis Obando. Geologically a very important result that comes from these four holes is that the elevation at which the identifiable beds were penetrated varies little from one hole to another. This suggests very simple structure and nearly horizontal beds. A fifth hole is being drilled as this report is written, extending the drilling pattern another 200 meters to the west.

## Discussion

Clearly landsliding throughout the Pataste Arriba area has clouded the question of geologic structure. Drilling west of Quebrada la Cuca suggests nearly flat-lying beds and does not bear out structures suggested by the dips in outcrops. The dips in surface exposures are the result of landsliding, which is evident in the topography.

Similar landsliding is evident east of Rio Pataste, and we can infer that here too the attitudes in outcrops do not reflect the attitudes in undisturbed bedrock.



9

Recommendations

1. The initial deep drilling should be (and in fact has been) planned without consideration of the structural attitudes seen in outcrop. As drilling progresses and cores and geophysical logs become available for correlation, stratigraphic and structural interpretations will emerge that will be much more reliable than present interpretations.

2. The program of drilling in this area should be continued and expanded as more becomes known of the stratigraphy and coal beds. Objectives of drilling are to define the extent, thickness, and quality of coal beds; establish stratigraphic correlations within the Pataste Arriba area and between this area and Rio la Muerte; and define the geologic structure of the area. After the presently planned program of five holes, further drilling will be planned based on knowledge gained in the completed drilling.

3. Where to drill. The presently planned drill sites are on drainage divides. From these locations one has the best chance of penetrating the most complete sequences of undisturbed bedrock. Fortunately for the geologic effort, the ridge tops generally are among the more accessible places for vehickles. Many of the slopes and valley bottoms are inaccessible to heavy equipment or would require an expensive effort, perhaps including some road building, that would disrupt soil cover and land surface.

4. USGS participation should be continued. I feel that I was able to aid the RECOPE geologists by bringing in a widerr perspective and a wider range of expertise. One example of this was in choosing a reach of a stream along which to measure a section in the Rio la Muerte-Rio Burio area. This problem was under discussion when I arrived in San Jose in 1984. The first move I requested, which had not already been done, was to assemble all the data that had been gathered by anyone in the area. By the time this information was summarized on one map, an area of relatively simple structure and not-too-terrible outcrops emerged. We agreed this was the place to measure the first section, and in fact we found a nearly continuous section about 300 m thick. Considerable time had been spent previously in considering where to look for a measureable section, but all the available information from diverse sources had not been gathered into one place.

A second example is the interpretation of strikes and dips in the Pataste Arriba area this year. RECOPE geologists, using strikes and dips measured in outcrops along streams, had interpreted a major anticline corssing the area where coal is exposed. As explained above, the attitudes leading to this

interpretation were produced by landslides and the structure at depth appears to be much simpler. A better recognition of all geologic factors involved, including very active surficial processes, could have led to changes in drilling plans earlier.

I feel that the broader view offered by a more experienced geologist is a major contribution of the U.S. Geological Survey, both in helping to accomplish the task at hand and in "technology transfer", which is a major objective of the U.S.A.I.D. cooperative program. I feel that continued participation of the U.S.G.S. in the Pataste Arriba-Rio la Muerte area is important to both objectives.

ATTACHMENT 2

# Cooperative Coal Exploration Project

U.S. Geological Survey

Branch of Coal Resources

and

Refinadora Costarricanse De Petroleo

Direccion De Recursos Carboniferos

Updated Trip Report

February 9, - March 16, 1985

Jean N. Weaver

U.S. Geological Survey

Branch of Coal Resources

Denver, Colorado 80225

Foreign trip/meeting report

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

Jean N. Weaver, Feb. 9 - March 16, 1985
San Jose and Zent coal area in Costa Rica

2. Names of others accompanying you:

| Name | U.S. Agency |
|---|---|
| E. R. Landis | U.S. Geological Survey |
| R. G. Hobbs | U.S. Geological Survey |
| S. B. Roberts | U.S. Geological Survey |
| R. N. Babcock | U.S. Geological Survey |

3. Key counterpart personnel:

| Name | Country | Agency |
|---|---|---|
| Oldemar Ramirez | Costa Rica | RECOPE |
| Alfredo Garcia | Costa Rica | RECOPE |
| Manuel Gomez | Costa Rica | RECOPE |

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

The purpose of the trip was two fold: 1) to assist geologist from RECOPE in the preliminary stages of setting up a drill program in the Zent coal area; 2) in conjuction with US/AID, I taught a course in Spanish on "Well-site Coal Exploration Technology" (March 4-10, 1985). Geologists from RECOPE and ICE attended.

5. Summary of trip discussions and activities:

Evaluated data compiled from field work in the Zent (Corina) area, proposed areas for cross-section and seismic profiles and site selection of drill rigs. Seven sites were selected for a shallow portable exploration drill rig ("Winkie", 0-40 m) and one site for a 200 m drill hole by a B-80 rig. The B-80 hole will be logged.

6. Conclusions and recommendations:

1. Complete the 7 shallow (40 m) holes and the 200 m hole.

2. Prepare lithologic columns from the drill holes, construct cross-sections based on seismic data and drill hole correlations.

3. Evaluate data in order to locate future drill holes.

7. Actions required if any, and responsible personnel:

To be submitted 10 days after travel is submitted.

## Purpose of Trip

Purpose of the trip was to assist the geologists of RECOPE in implementing an Exploration Stage 1 of the Zent (Corina) coal area, and to also teach a short course in Spanish entitled "Well-site Coal Exploration Technology".

## Summary of Activities

Saturday, February 9, 1985

1100: Leave Denver, Colorado

2030: Arrive San José, Costa Rica

Sunday, February 10, 1985

Day off

Monday, February 11, 1985

Meetings at RECOPE office with Oldemar Ramirez (supervisor, RECOPE) and Luis Malavassi (geologist, RECOPE) regarding general status of the Zent project.

Tuesday, February 12, 1985

Oldemar Ramirez, Luis Malavassi, Manuel Salas (RECOPE engineer) and I leave for Limon. Arrive Hotel Acón, Limon. Drove to a house that RECOPE is renting for the geologists of the Zent project. Manuel Gomez, Alfredo Garcia and Rodrigo Estrada. Returned to Hotel Acón - Ramirez Malavassi and Salas continued on to Talamanca.

Wednesday, February 13, 1985

Heavy rain. Alfredo Garcia, Manuel Gomez and I drove up the main logging road of Quebrada 25 (Q25), looked at a few coal outcrops and located sites for future trenching. Evening at RECOPE house in Limon: Oldemar Ramirez requested a brief presentation from the following people on the progress of their respective areas:

Alfredo Garcia: Zent (Peje)
Manuel Gomez: Zent (Corina)
Rodrigo Estrada: Zent (Barbilla)
Rojello Samuels: Valle de la Estrella

Arrive at Hotel Acón (2400).

Thursday, February 14, 1985

Showed Oldemar Ramirez, Luis Malavassi and Manuel Salas location of new coal beds up logging road off of Q25. In the afternoon tried to drive up Corina farm road. Got stuck due to heavy rain.

Friday, February 15, 1985

Returned to Q25 coal outcrops to show Jose Bisset (RECOPE topographer) route to map. River was still too high to start trenching project.

Saturday, February 16, 1985

Alfredo Garcia, Manuel Gomez and I drove to Talamanca to meet with Rafael Blanco (head of RECOPE's drilling program). Returned to Limón, picked up Jose Bisset and drove to San José (Hotel Balmoral).

Sunday, February 17, 1985

Day off - Don Coates (BCR) arrived.

Monday, February 18- Wednesday, February 20, 1985

Work in RECOPE office with Manuel Gomez regarding site selection for the drill rigs. Worked on logistics for the arrival of a tractor to grade the Corina farm road. Manuel Gomez and I leave for Limón (1800).

Thursday, February 21- Wednesday, February 27, 1985

Manuel Gomez, Manuel Salas and I waited for tractor. Upon arrival, started work on the Corina farm road to prepare for the arrival of the B-80 drill rig from Talamanca. Small, portable, shallow drill rig (40 m) arrived and Alfredo Garcia and I logged one of five holes located off of Q25 from the logging road. Took public bus back to San José (1700).

Thursday, February 28, 1985

Stephen Roberts and I worked on logistics and organization for the USGS/AID/RECOPE course.

Monday, March 4- Wednesday, March 6, 1985

Taught a course in Spanish entitled "Well-site Coal Exploration Technology" to 25 participants at the Hotel Irazu, San José. Ed Landis, Robert Hobbs, Richard Babcock and Stephn Roberts were present.

Thursday, March 7- Sunday, March 10, 1985

Course participants left San José (0700) and spent 3 days in Baja Talamanca visiting 2 RECOPE drill rigs. Observed logging and core retreival methods discussed in the course. Retúrn to San José approximately 2030 p.m.

Monday March 11- Friday, March 15, 1985

Meetings in RECOPE office regarding the status of the various coal areas as well as our role in each one.

Saturday, March 16, 1985

0800: Leave San José, Costa Rica
2030: Arrive Denver, Colorado

This report is divided into two parts:

1) Zent (Corina) Coal Area

2) Summary of the Course: "Well-site Coal Exploration Technology".

## 1. Zent (Corina) Coal Area

### a. Summary of work

The Zent coal area located in southeastern Costa Rica extends over an area of approximately 268.5 square kilometers as estimated by RECOPE geologists. The Rio Banano, Barbilla, and Matina topographic sheets (1:50,000 scale) cover the area of the Zent coal project. The selected area, a portion of the Zent area (Matina topographic sheet), showed the most potential for coal-bearing rocks and coal beds. In this report, the selected area will be called the Zent (Corina) area.

Coal outcrop occurrences in river beds are continuing to be investigated by Alfredo Garcia (RECOPE) in the Zent (Peje) area to the SE and the Zent (Barbilla) area, by Rodrigo Estrada (RECOPE) to the Northwest.

The Zent (Corina) area is currently entering Exploration Stage I. In accordance with the work plan, this stage is defined as the following:

Exploration Stage I.--During this stage, the correlation and lateral continuity of the coal seams and strata are determined as well as the likely exploitation methods and utilization potential for various possible end uses. This is achieved by the drilling of a number of boreholes, mostly cored, on a widely spaced drill pattern. Surface geophysical techniques may also be employed, to assist in defining the geological structure. Down-hole geophysical logging techniques may also be employed. The stage is completed when resources can be estimated to indicated status.

The area is bounded on the north and south by a Corina farm road and the logging road, respectively. The three weeks in the field were spent between these two roads. A considerable amount of time was spent on logistical arrangments regarding the acquisition of a large road grader to improve the Corina farm road for the arrival of the B-80 drill rig. A drill site was selected approximately 4-5 kilometers west of

the town of Corina, accessible only by way of the farm road. The site was selected due to the proximity of two outcrops in a nearby stream. One of the two outcrops (downstream from the site) has a "4 m thick coal bed", however, it is actually composed of three coal beds, separated by interbedded sandstones, siltstones, and shales. The site is the best place between the two outcrops for accessability. The average dip of the beds is between 12 and 15 degrees to the N/NW. The road grader also leveled and prepared the drill site. In this report, the B-80 drill hole will be called the ZPC-1 (Zent Pozo Corina-1). The B-80 rig has the capacity to drill up to 200 m. The proposed 200 m hole will be cored mainly because it will be the first time in the Zent coal area that geologists will have an accurate lithologic column of the stratigraphy. Plans are to run a suite of four geophyscial logs (natural gamma, density, resistance and caliper) upon completion of the hole. The coal core will be analyzed by the U.S. Geological Survey. A coal data base was established for the Volio Talamanca area and the ZPC-1 core will initiate a coal data base for the Zent area.

The other access road into the Zent (Corina) area is the logging road. It is south of the town of Corina and heads west, south of Quebrada 25 (see map). A small, very portable drill rig was acquisitioned to drill five to seven holes. The rig was called a "Winkie" and has a shallow drilling capacity of up to 40 m. It is well suited for this type of exploration drilling, because it is easy to off set from the preselected outcrop. On the attached map, all Winkie drill holes will be labeled ZQ25-1, 2 etc-- The code Q25, represents holes which use the logging road for access. As of early March, 1985, the status of the Zent (Corina) area is as follows:

- all of the geology along Quebrada 25 and its associated tributaries has been mapped, bed attitudes notes and eight measured sections drafted
- additional geology has been recorded but has not been placed on a geologic map;
- one B-80 rig was on site (ZPC-1) and had started to drill
- the "Winkie" rig had drilled two holes (ZQ25-1 and ZQ25-2).

B. RECOMMENDATIONS

I have stated that this area had entered the Exploration Stage 1 phase only because there are drill rigs operating. The current geologic information, in its present form, has not been adequately interpreted to allow for proper selection of future drill hole sites.

I propose the following to the RECOPE geologists:

1. All geology to be placed on a base map.
2. Prepare lithologic columns from all drill holes.
3. Correlate lithologic units and, if possible, walk out key beds.
4. Run seismic profiles to pick up structural features.
5. Prepare cross-sections based upon seismic profiles and drill hole correlations.
6. All cross-sections and seismic lines should go through drill holes and/or outcrops.

The accumulated data should be compiled and evaluated. Cross-sections would hopefully present an overall picture of lateral continuity or discontinuity of units. This in itself is key information in both planning future drill hole sites as well as the eventual goal of estimating the coal resources of the Zent (Corina) coal area.

II. Course Summary

The United States Geological Survey (USGS) and the Agency for International Development (US/AID) in conjunction with RECOPE offered a 6 day course entitled "Well-site Coal Exploration Technology". The course was divided into two parts:

March 4-6: three days of lecture in the Hotel Irazu in San José, Costa Rica.

March 7-10: field trip to the Baja Talamanca (Volio) coal area to visit two RECOPE drill rig operations.

The 3 day course was taught in Spanish to approximately 25 participants. Stephen Roberts (USGS/BCR) ran the technical end of the course. Robert Hobbs, Richard Babcock and Edwin Landis were present and helped answer questions.

Day 1 of the couse dealt with the basic duties of a well-site geologists methods for examining cuttings, describing and sampling core, rig safety, coal description, boxing core and driller/geologist relationship.

Day 2 was devoted to the suite of 4 geophysical logs used for coal exploration: natural gamma, density, resistivity and caliper. Each log was discussed, as well as the role of the geophysical logs and their correlation to each other. Time was spent looking at logs, picking lithologies and examining corresponding core.

Day 3 was a general review, period for question and answers; Kenneth Bolanos of RECOPE presented a short talk on the Volio coal program. Oldemar Ramirez of RECOPE gave a brief overview on the peat development program of Costa Rica.

The field trip to Baja Talamanca was very useful and well received. We visited two drill rigs and saw a wireline rig pull out core. Richard Babcock, Steve Roberts, and Robert Hobbs demonstrated how the logging equipment worked and explained various features of the drill rig. Mr. Carlos R. Molina Jr., a representative from Longyear, gave the class a short presentation on the different types of drilling rigs, bits, steel, and core barrels that his company had to offer.

Attached is the list of participants as well as a summary of their responses to the course. It should be noted that there was a fair mixture of geologist, engineers, and technicians. This helps to explain the strong interest in the operation and maintenance of equipment associated with a drilling program. Overall, the course was well received. The course comments were valuable in that they will aid in improving any feature US/AID courses .....

ACKNOWLEDGEMENTS

This was the first time I have ever taught a course and I would like to express my thanks to Stephen B. Roberts whose constant help and advice greatly contributed to the course success. The course itself would not have been possible without the support of US/AID, USGS and RECOPE.

In August 1984, the early stages of reconnaissance work were being started in the Zent coal area. Since that time, investigation for coal outcrop occurrences in river beds have been completed in 90 percent of the Zent (Corina) area and approximately 60 percent of the area east of the Rio Chirripo including tributaries to the Rio Zent

and Peje. March 1985, RECOPE has started exploratory drilling. I feel that the RECOPE geologists have made very good progress in their coal exploration program for the Zent area and should be commended. Elements such as few roads, complex and hidden geology, dense vegetation, and heavy rains contribute to an already difficult task of coal exploration. Much progress has been made and I would encourage US/AID to continue their support in an area which shows great potential for economic coal development.

Well-site Coal Exploration Technology

March 4 - 10, 1985

San Jose, Costa Rica

| | | | |
|---|---|---|---|
| Jean Weaver | USGS | BCR | |
| Stephen Roberts | USGS | BCR | |
| Robert Hobbs | USGS | BCR | |
| Richard Babcock | USGS | BCR | |
| Ed Landis | USGS | BCR | |
| Fernando Alvarado | | | RECOPE/Coal |
| Alfredo Garcia | | | RECOPE/Coal |
| M. L. Antonio Gomez | | | RECOPE/Coal |
| Luis Obando | | | RECOPE/Coal |
| Asdrubal Delgado | | | RECOPE/Technician/Coal |
| Manuel Antonio Salas | | | RECOPE/Engineer/Coal |
| Luis R. Malavassi | | | RECOPE/Coal |
| Gladys E. Cubilla | | | RECOPE/Coal |
| Rojelio A. Samuels | | | RECOPE/Coal |
| Nestor Rodriguez Quesada | | | RECOPE/Geophysics |
| Oldemar Ramirez Escribano | | | RECOPE/Coal/Director |
| Marlene Salazar Alvarado | | | Direccion de Geologia |
| Teresa A. Hernandez | | | RECOPE/Director Geology and Geophysics |
| Manuel Monge | | | Director of Geology |
| Rodrigo Estrada | | | RECOPE/Coal |
| Kenneth Bolanos | | | RECOPE/Coal |
| German Leandroc | | | ICE - Geophysics |
| Juan F. Martinez | | | RECOPE |
| Roberto Gutierrez | | | RECOPE - Geophysics |
| Jorge Malavassi | | | RECOPE/Engineer/Coal |
| Francisco Sanchez | | | RECOPE |

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## Responses of Course Participants

1. Do you feel that the course was worthwhile?

- the course was quite worthwhile
- a must for geologists who know nothing about drilling
- a good overall view of the subject

2. Strong points of the course?

- log description
- core description/core recovery
- geophysical logs
. good course organization
. teacher showed she had good experience in coal exploration
. logistics of drilling; role of geologist vs. driller

MAIN POINT: IMPORTANCE OF GEOPHYSICAL LOGS IN A DRILLING PROGRAM.

3. Weak points of the course?

. course was too long for what was covered
. course too basic/too elementary/should cover more material *
. more explanation on the physical aspects of the suites of logs *
. should have emphasized more on the different types of drilling and their comparisons/cost comparison
. correlation between holes
. operation and maintenance of drilling and logging equipment *
. elaborate on choosing a drill site/drill bits *

4. Were there other subjects that should have been discussed?

. more discussion on drilling equipment *
. practical examples - regarding interpretation
. different types of logging equipment *
. a Spanish handout regarding physical aspects of radioactivity/resistance
. selection of drill sites
. types of muds used for drilling *

5. Comments on the instructor and should any changes be made to improve the course?

. more participation from other "instructors" of the course
. teacher should be a little more familiar with Spanish drilling vocabulary
. room was too big with poor acoustics
. teacher was very good, dynamic and knew her subject/ good presentation

6. Would you recommend the course to other geologists?

- yes - good course for geologists as well as assistants
- very good course but should go into the subject more in depth
- geologists from the University of Costa Rica have more knowledge of geology than those who taught the course (one person's comment)



27

## Overall Conclusions

The course was well received, participants felt that it was worth while, and all were very appreciative of the effort made by the USGS personnel.

The key comments would be:

1) should have been more detailed - it was too basic

2) more hands on experience/more examples/case studies

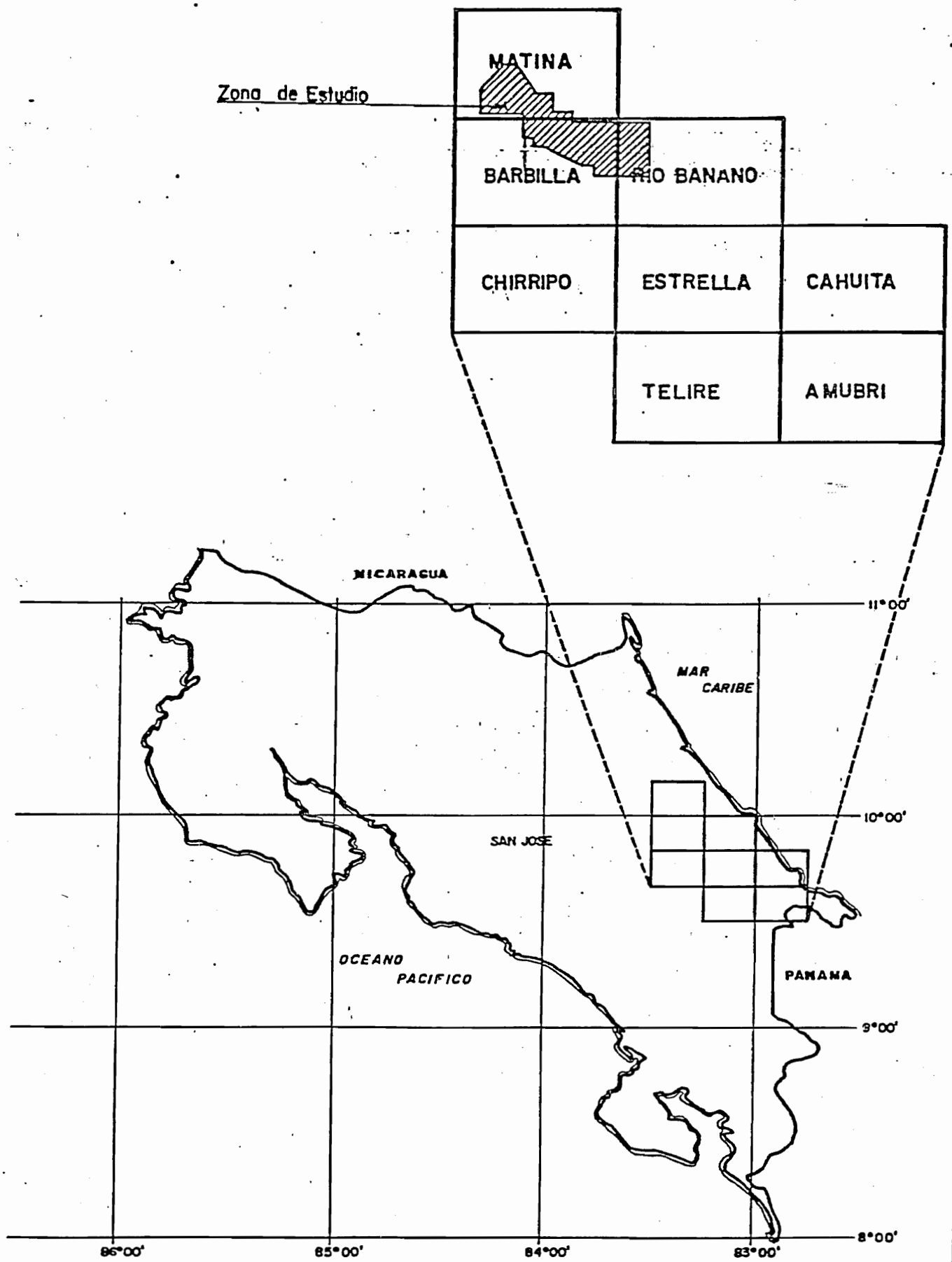
3) course should have been taught in a shorter period of time

* Material covered during the following 3 day field trip to Talamanca -

Comments from engineers and technicians, not geologists



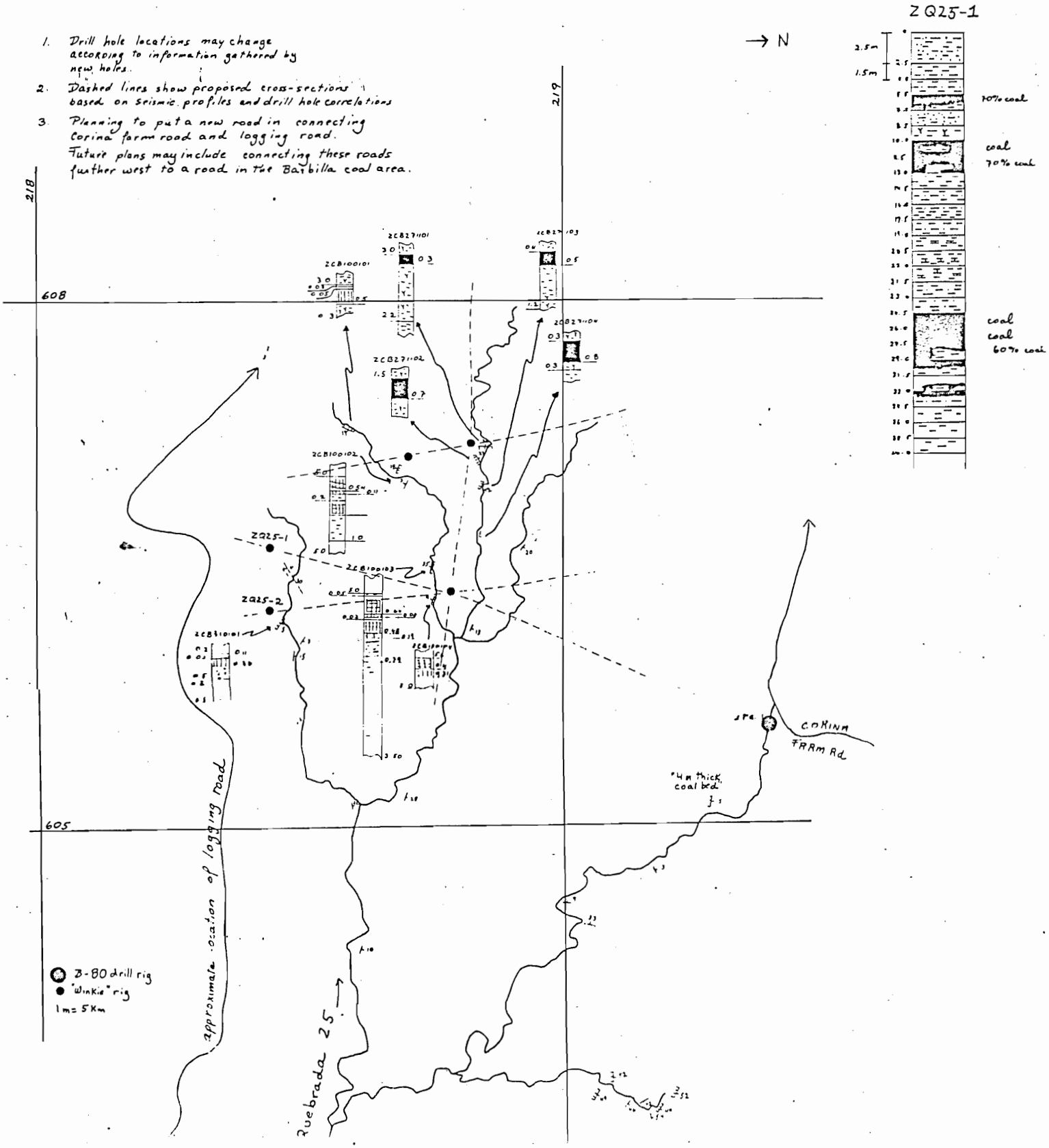
23




| GERENCIA DE EXPLORACION | Ubicación del area del Proyecto Zent. | | |
|---|---|---|---|
| DIRECCION DE RECURSOS CARBONIFEROS | Realizó: L. Malavassi R.<br>A. Garcia C. | Aprobó: Oldemar Ramirez | Dibujó: Téc. C. Urbina M. |

# ZENT (Corina) coal area

1. Drill hole locations may change according to information gathered by new holes.
2. Dashed lines show proposed cross-sections based on seismic profiles and drill hole correlations
3. Planning to put a new road in connecting Corina farm road and logging road. Future plans may include connecting these roads further west to a road in the Barbilla coal area.

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ATTACHMENT 3

# United States Department of the Interior

GEOLOGICAL SURVEY
BOX 25046 M.S. 972
DENVER FEDERAL CENTER
DENVER, COLORADO 80225

IN REPLY
REFER TO:

March 22, 1985

Memorandum

To: Alberto J. Sabadell, USAID/ST/EY

From: Edwin R. Landis, Branch of Coal Resources

Subject: Time of initiation of Exploration Stage 2 in part of the Baja Talamanca district (the "Volio area")

During the period March 4-15, 1985, the status of the Exploration Stage 1 study in the Carbon Volio, Rio Sand Box and Carbon Uno areas of the Baja Talamanca district was reviewed with RECOPE and USGS personnel.

At the time of your memorandum to the Project File, dated Sept. 27, 1984, seven (7) drill holes had been completed in Exploration Stage 1. Twelve (12) more drill holes were planned for completion by the end of March, 1985, and Exploration Stage 2 was to begin about April 1.

A total of seventeen (17) drill holes have been completed as of March 10, 1985; three (3) more holes are being drilled (one is completed and preparing for geophysical logging), and five (5) more holes have been proposed (one is a previously-planned hole and four are new locations which require building of new roads). All twenty-five (25) holes should be completed by about the middle of May.

On March 18, Kenneth Bolaños and Gladys Cubilla of RECOPE will begin preparing a detailed comprehensive interpretive report on the coal exploration in the Carbon Volio, Rio Sand Box and Carbon Uno areas (the "Volio area"). The report will include the information created by the Exploration Stage 1 drill program, by trenching, the Early Exploration Stage program conducted with JICA, and all other exploration activities in the area. This comprehensive report will be completed by the middle of May, will be reviewed by RECOPE and USGS personnel both during and following completion, and will be the basis for planning an Exploration Stage 2 drill program that could start about June 1, 1985. We will assist RECOPE in planning and conducting the Exploration Stage 2 (ES2) drill program in the Volio area to the maximum extent allowed by personnel availability and funds up to our termination date of Sept. 30, 1985.

Your memorandum of Sept. 27, 1984, lists eight (8) specific tasks that are to be done in the Coal Production and Utilization (CPU) part of the Coal Development Project:

1) Coordinate with USGS in Denver, during Stage 2 drilling to obtain necessary information for mine planning at Volio.

2) Select the geographic area/s most suitable for mine development for mine-mouth power plant installation.



26

3) Develop conceptual mining plans and select appropriate mining methods and equipment. Address labor intensive versus capital intensive mining methods.

4) Define capital, operation and maintenance and manpower requirements.

5) Assess the requirements and order of magnitude costs associated with coal fired power generation. Compare coal versus alternate forms of power generation.

6) Evaluate conversion of cement factories to coal. Identify process changes and estimate costs. Analyze transportation and handling as related to use of coal in industry using the cement sector as case study.

7) Formulate alternative systems for coal development and utilization of indigeneous coal as well as imported coal. Compare coal use versus competitive alternate energy resources.

8) Synthesize the results of the above tasks and make recommendations that appear technically and economically viable in Costa Rica.

We will cooperate and coordinate with the CPU contractor(s) when they are available to enter the project (Task 1). We had hoped that the CPU contractor would be available during the planning of the ES2 drill program. Presumably, if the drill program extends beyond Sept. 30, 1985, the CPU contractor can provide any needed assistance. Maximum overlap time between the USGS and CPU personnel is desirable, so we hope that the CPU contractor can be available as soon as possible. In our telephone conversations you have indicated that a long-term CPU contractor might be available by about the middle of July and that is the basis used in our planning for the period from now until Sept. 30.

This memorandum only addresses the time of introduction of the CPU contractor into the Coal Development Project from the standpoint of Task 1 of the eight specific tasks to be undertaken by the CPU personnel. RECOPE is presumably preparing suggestions and recommendations regarding the time of initiation of efforts to satisfy the remaining seven tasks. We assume these recommendations will be transmitted to the USAID/San Jose office in the near future.

Attached are a diagram showing our tentative plan for assistance during the remainder of fiscal year 1985. Please note that our assistance in the Venado and Zent areas are minimal and that our assistance in the Volio area is strongly keyed to assisting in review of the report on Exploration Stage 1 and planning of the Exploration Stage 2 drill program.

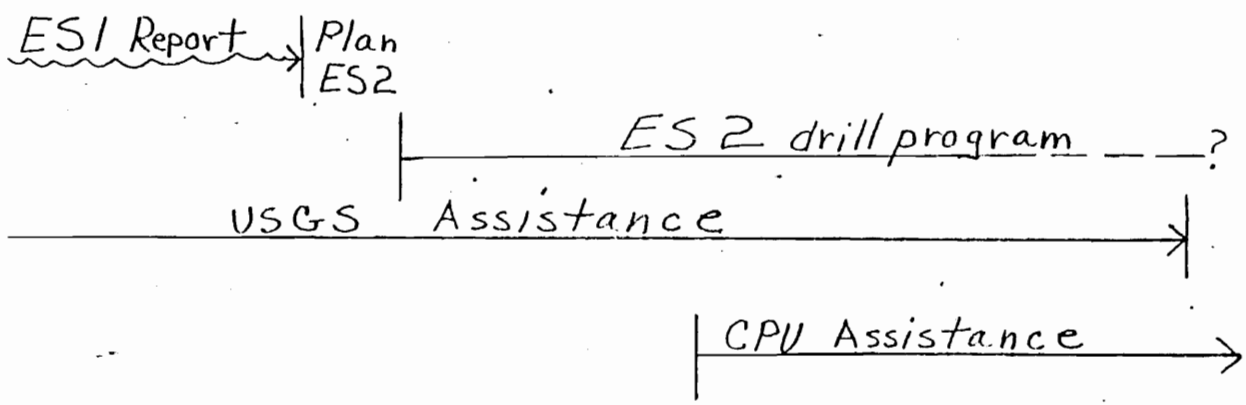
Obviously, if it were possible we could very profitably spend more time in the actual preparation of the comprehensive report on the Exploration Stage 1 activities in the Volio area. As now planned, the bulk of our assistance will be only in review phases and in helping plan and inititate the Exploration Stage 2 drill program. We would consider continuing technical assistance in geological exploration in the future but we understand that the Office of Energy, USAID, will not be able to support such activity after September 30, 1985. We have informed RECOPE that our assistance will terminate as of that date.



27

| Name | Location | April | May | June | July | August | September | Weeks Costa Rica | Weeks USA |
|---|---|---|---|---|---|---|---|---|---|
| Coates | Venado | | 4 | | | | | 0 | 4 |
| Weaver | Zent | | | 2 | | | 2 | 4 | 0 |
| Roberts | Volio -Zent | | 2 | 2 | | | 2 | 4 | 2 |
| Hobbs | Volio | | 2 | | | | | 0 | 2 |
| Landis | Volio -all | | 1 | 1 | | | 2 | 4 | 1 |

Bolaños Volio




Tentative Assistance Plan - Remainder FY 85

27a

# Foreign trip/meeting report

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

Stephen B. Roberts, Feb. 19 - March 16, 1985, Costa Rica

2. Names of others accompanying you:

| Name | U.S. Agency |
|---|---|
| Jean N. Weaver | U.S.G.S. |
| Robert G. Hobbs | " |
| Richard N. Babcock | " |
| Edwin R. Landis | " |

3. Key counterpart personnel:

| Name | Country | Agency |
|---|---|---|
| Oldemar Ramirez | Costa Rica | RECOPE |
| Kenneth Bolaños | " " | " |
| | | |

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

1. To work with J. N. Weaver on presentation of a course (3/4-10/85) entitled "Well-site Coal Exploration Technology".
2. To advise counterpart geologist on exploration program planning, geophysical log interpretation, and development of stratigraphic framework.

5. Summary of trip discussions and activities:

2/19-20/85: work in office at San José - planning and geophysical log interpretation.
2/21-23/85: working in Volio - running geophysical logs and reviewing drill program.
2/24-3/3/85: working in San José on course planning, log interpretation and report organization.
3/4-10/85: course given to RECOPE geologists - included 4 days at Volio.
3/11-15/85: working in San José - report writing and planning.

Conclusions and recommendations:

Twenty-two drill holes will probably be completed by end of April 1985. At this time K. Bolaños will compile a detailed report, complete with structure and isopach maps on major coal beds in the area of Baja Talamanca; this report will detail the progress to date of Exploration Stage 1 in Baja Talamanca, synthesizing all previous field work (JICA report) with new information derived from the Stage 1 drilling and geophysical logging.

Actions required, if any, and responsible personnel:

Continued assistance by the U.S.G.S. in development of the progress report to be written by K. Bolaños, as well as guidance in the development of Stage 2 exploration in Baja Talamanca.

## PURPOSE

The purpose of this trip was to:

1) Work with Jean N. Weaver on the planning and presentation of a course entitled "Well-Site Coal Exploration Technology" and
2) to work with counterpart geologists on geophysical log interpretation and development of a stratigraphic framework for the areas of Carbon Volio, Rio Sand Box, and Carbon Uno in the Baja Talamanca coal field.

## TRIP ACTIVITIES

Tuesday, Feb. 19, 1985: Arrive San Jose, Costa Rica via Ea. Airlines at 8:00 p.m.

Wednesday, Feb. 20: Work in RECOPE office. Meet with Oldemar Ramirez and Kenneth Bolanos--a work schedule is developed.

Continued discussions with Bolanos on progress of the coal exploration in the Volio area. Also spend time working on geophysical log interpretations.

Thursday, Feb. 21 to Sunday, Feb. 24: Work in the field in the Volio and Hone Creek (Carbon Uno area). Try running geophysical logs at drill hole le PSB-1. Drill hole is blocked at 120 meters--run resistance, natural gamma, and density logs--the density log is very erratic. Problems exist in the probe, more than likely asociated with the crystal or photomultiplier assembly within the probe.



19

Thursday, Feb. 21 to
Sunday, Feb. 24 (cont): Spend time looking over new roads and proposed drill sites.

Return to San Jose on Sunday.

Monday, Feb. 25 to
Friday, March 1: Work in RECOPE office on geophysical log correlations and stratigraphic framework development for Volio. R. G. Hobbs and R. N. Babcock arrived on Sunday evening. Babcock is working with A. Delgado (RECOPE) on the rebuilding and recalibration of the Well Reconnaissance logger. Hobbs is working on geophysical log correlations and development of depositional environments based on geophysical logs.

On Thursday, Feb. 28, there was a meeting with Roberto Dobles (Executive President/RECOPE) at El Alto. Emphasis of the meeting was on the development of a chemical lab for Lourdes Quesada (chemist) in order to do quality analyses on Costa Rican coal samples.

Working with J. N. Weaver on course planning for next week.

Saturday, March 2 to
Sunday, March 3: Free days--complete some additional planning for the course.



30

Monday, March 4 to Wednesday, March 6:

Working with J. N. Weaver--the course "Well-Site Exploration Technology" is presented at the Hotel Irazu. These three days of lectures emphasized well-site duties of the geologist, sample description and packaging, geophysical log interpretation, and drill program planning. Oldemar Ramirez gave a short talk on the peat program and Kenneth Bolanos talked about the geology and drilling in the Volio area. Class adjourns at 12:00 noon Wednesday.

Thursday, March 7 to Sunday, March 10:

Field trip to Baja Talamanca as a continuation of the course. Friday was spent at drill site PSB-1 observing operation of geophysical logging equipment and description of core samples. Saturday morning, there was a presentation of drilling equipment by representatives of Longyear, Inc., from San Jose. In the afternoon a trip to drill hole PCU-3 took place and the operation of core drilling and retrieval was observed.

Return to San Jose Sunday evening.

| | |
|---|---|
| Monday, March 11 to Friday, March 15: | Meeting at RECOPE offices for scheduling of future work, exploratory drill program planning, and discussion of report to be written by K. Bolanos by the end of April or mid-May. The report will summarize all work done in Baja Talamanca during the Exploration Stage 1 phase. |
| Saturday, March 16: | Return to Denver; arrive Denver 8:00 p.m. |

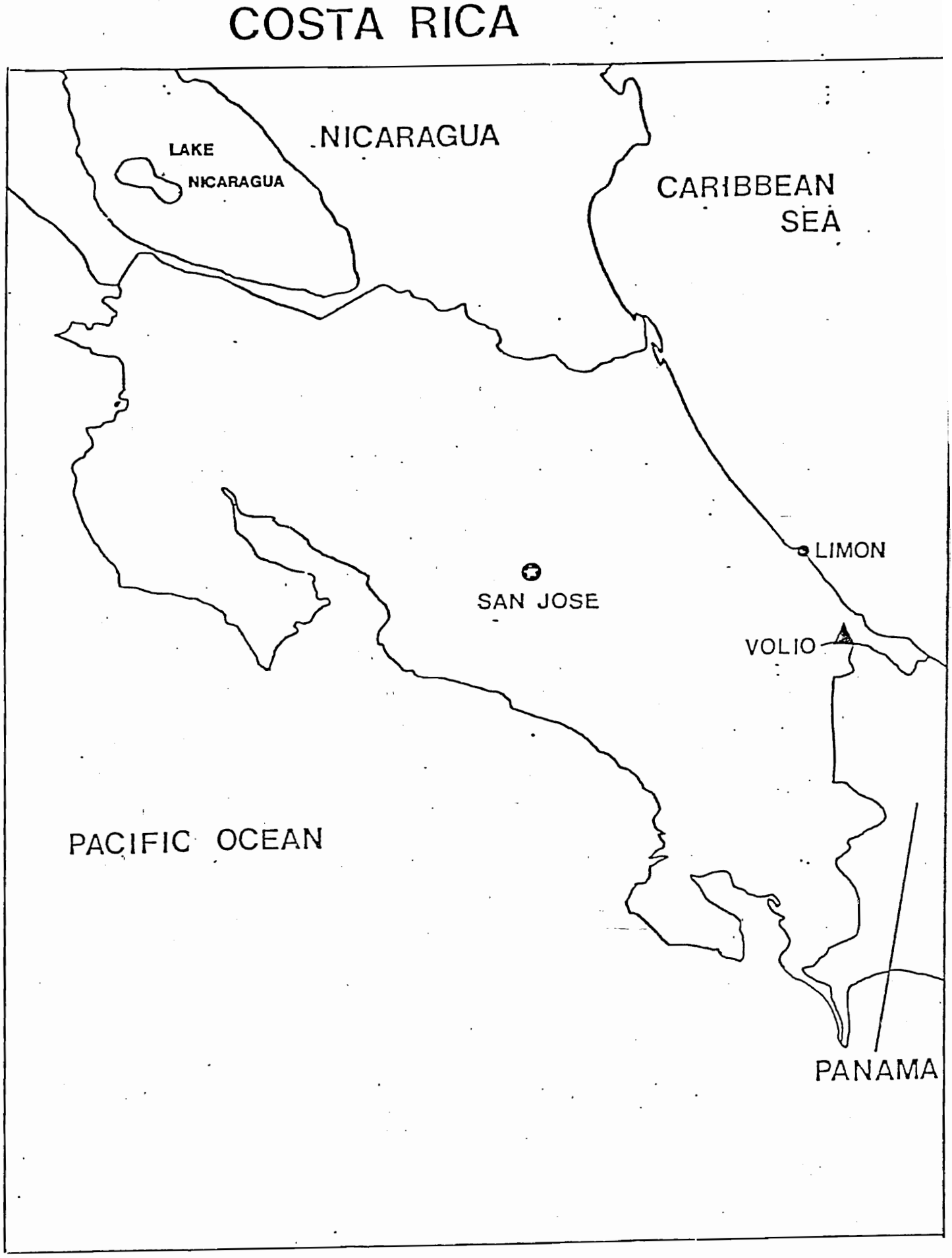



Figure. 1: Location of Field Study Area

## I. Drilling Program

The Exploration Stage 1 drill program began in Baja Talamance in the early months of 1984, with one contracted wireline core rig. The first drill hole was a continuous core hole (PCU-1) in the Carbon Uno area (Hone Creek). Upon completion of roads into Carbon Volio, the rig was moved to location PCV-1 and drilling commenced in this area. By mid 1984 two of RECOPE'S Mobil B-80 drill rigs were brought in to work with the contract rig. Initial drilling continued to concentrate in the Carbon Volio area and nine drill holes were completed by October, 1984.

In late 1984, drilling operations were halted in Campo Diablo, an area of oil exploration in Baja Talamance, and additional equipment (drill rigs, bulldozers) was made available to the coal exploration program. The contract rig was terminated and all drilling was being done by RECOPES'S own rigs.

At the time of this visit, 3 drill rigs were operating; 2 were drilling in the Rio Sand Box area (PSB-1, PSB-2) and one in Carbon Uno (PCU-3). A total of 18 drill holes had been completed besides these 3 drill holes in progress. Drill hole PSB-2 had been drilled to target depth but geophysical logs had not been run due to breakdowns of the logging equipment.

Five additional drill sites have been planned: PCU-4 in the Carbon Uno area, another in a central location between Carbon Uno and Rio Sand Box areas aimed at drilling near the axis of the Sand Box syncline, and 3 more in the Carbon Volio area targeting the V-1 and V-9 coal beds primarily. Figure 2 shows the locations of the proposed and completed drill holes.



34

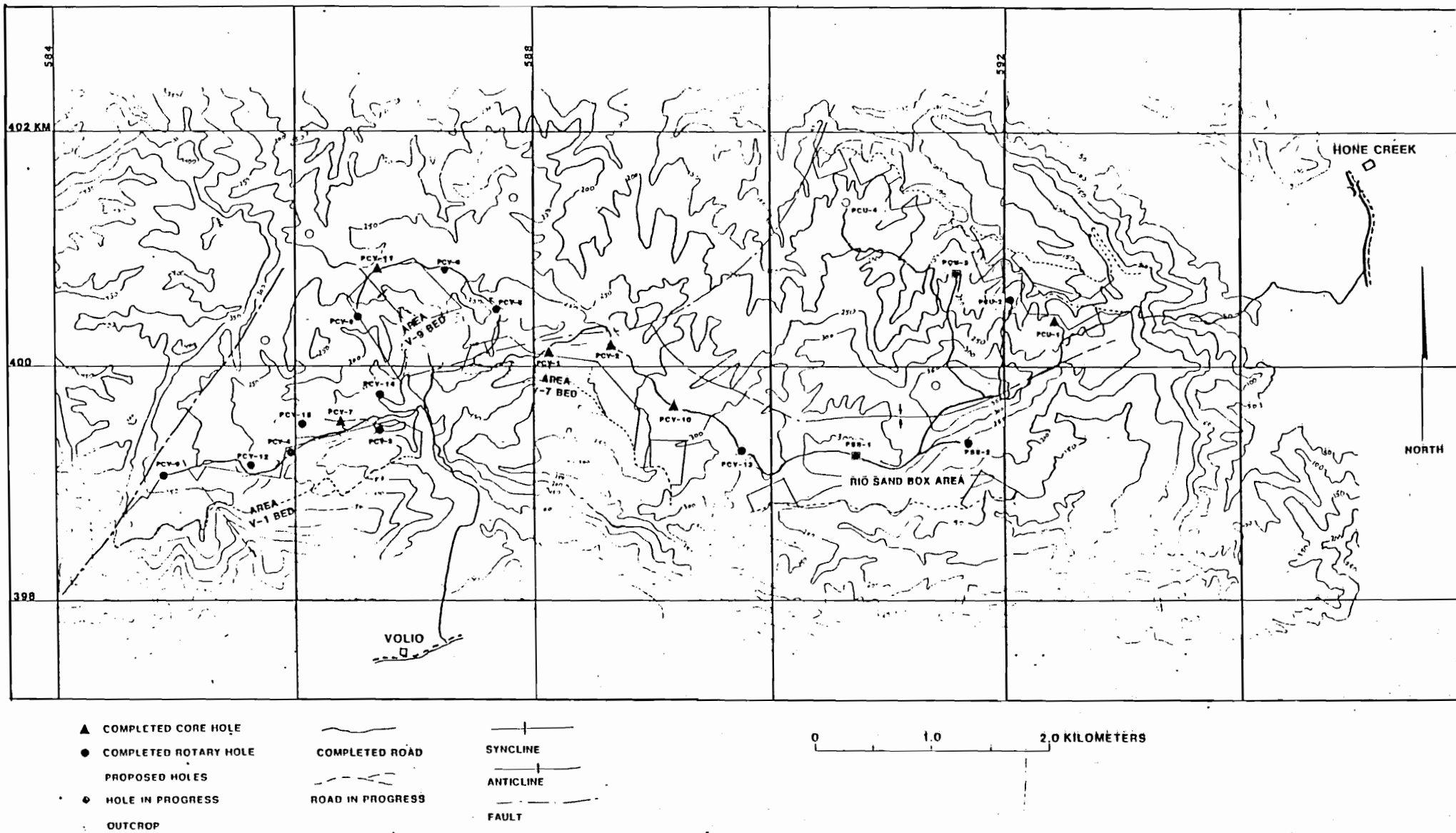



Figure 2.--Locations of drill holes, geologic features, and progress of roads in the Baja Talamanca coal field.

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All in all, the drilling program has been quite successful. Operation of heavy equipment for road construction and drilling is difficult in this area due to dense vegetation, heavy rainfall and resulting mud, and the very rugged topography. Considering these factors, the progress made to date is good.

The combination of drilling both continuous core holes and rotary holes with geophysical logging has proved to be a good approach for this type of Exploration Stage 1 program. The core samples provide lithologic information of the coal-bearing sequence which otherwise would be unknown due to the poor exposures of the section on the surface. This type of information is vital for the determination of depositional environments and development of a stratigraphic framework necessary for planning more detailed coal exploration prospects in the future. Also, cores of individual coal beds provide the fresh samples needed to ascertain coal quality.

The importance of the rotary drill holes is the faster rate at which they are completed. A core rig may drill 15 to 25 meters on a good day while depths of 50 meters/day have been accomplished on a rotary hole. Though cutting samples obtained through rotary drilling have proven to be only marginal lithologic indicators, they should continue to be collected and described carefully. The method employed in Costa Rica for rotary drilling and sample collection is to drill 1 meter (sample interval) and circulate mud until all cuttings have been brought to the surface. Once no cuttings appear to be returning to the sampling screen, drilling is resumed for 1 meter more and the procedure repeated. This does slow the drilling process somewhat, but it helps in deriving as much information as possible from the drill hole.

The type of bit used primarily in the rotary drilling is a carbide "blade" bit, generally considered a softer formation bit. At times, resistant lithologies in the drill holes have necessiated the use of rollercone bits, but the majority of the drilling was accomplished with the blade bits. For coring, diamond bits have been used exclusively. The drillers indicate that the core holes have been quite successful with 90-90% recovery of samples.

With the apparent success of the carbide blade bits for rotary drilling, I recommend experimenting with carbide tipped core bits as opposed to diamond bits. The primary reason for this is that a carbide bit may cost half of what a diamond bit does. Also, the drillers indicated problems in cutting the softer shales with the diamond bits and the carbide bit might alleviate this problem. These items were discussed in a meeeting with Carolos Molina, and Carlos Molina, Jr. (Longyear, San Jose, Costa Rica) along with Juan Felix Martinez, Oldemar Ramirez, and myself. A style of core bit, called a "crackerjack" bit will probably be tried in Volio. It may be that the carbide bits will not work for coring but they should be tried. It may also end up that this type of bit will work in some areas but not in others. For example, the thick coal-bearing sequence in Carbon Volio may accomodate this type of bit whereas the area in Rio Sand Box, containing a much higher percentage of sandstone, may not. RECOPE should continue their close contact with Longyear in San Jose and carefully experiment with alternate bit types. If the carbide bits are found to work it would lower coring costs substantially.



37

## II. Geophysical Logging

One of the specific tasks to be accomplished during this trip was the rebuilding and recalibration of the Well Reconnaissance logging unit furnished by the USGS. Richard Babcock (Branch of Coal Resources, Denver) was assigned to this task and he worked closely with A. Delgado (RECOPE) on calibration and maintainance of the recording unit and probes. A report is forthcoming from him that will detail his work in Costa Rica.

It is critical that RECOPE purchase the necessary equipment for a good solid geophysical logging program. To date, the geophysical logs from the drill holes in Baja Talamanca have proven to be the single most important tool for cross section development and coal bed correlations. The geophysical logs from rotary holes have made lithologic changes and coal bed occurrence, not indicated in cuttings samples, more obvious. Geophysical logs from core holes have been vital in determining zones of lost core and at times have shown that more coal beds occur than were recovered in core samples. I anticipate that the most definitive and most reliable correlations between drill holes will be developed primarily from geophysical log information. For this reason, the logging program must be firmly established and the necessary equipment purchased immediately in order to keep pace with the now accelerated drilling program. RECOPE should consider purchasing a more sophisticated, 4 conductor unit. It my be possible that used equipment of this type is available in the states. The USGS should continue to aid RECOPE in choosing equipment and developing their logging program. There can be no question that geophysical logging capabilities are vital to the coal program in Costa Rica.

## Summary

The original schedule of Exploration Stage 1 activities in Baja Talamance called for 22 drill holes in a pattern approximating that shown on figure 2. At this point, it is anticipated that 26 drill holes will be completed by May, 1985. As drilling progressed and new geologic information was obtained, deviation from original plans was required but, in total, the program remained quite close to plans established at the inception of drilling.

A report synthesizing the information gathered to date from Exploration Stage 1 activites is scheduled for completion by late April or early May of this year. RECOPE geologists Kenneth Bolanos, Gladys Cubilla, and Rojelio Samuels will prepare the bulk of the report in Costa Rica. The USGS has offered assistance on the compilation of the report and it is anticpated that our involvement will begin in late May or early June. Drilling will continue during the time that the report is being written and new information will be incorporated as it becomes available.



39

Trip Status

Summary of Events and Recommendations

by

Rich Babcock

2-24-85 to 3-16-85

Sunday, Feb. 24: Leave Denver U.A.L.-E.A.L.

Arrive San Jose 10:00 P.M.

Monday, Feb. 25: Meet with K. Bolanos, O. Ramirez, L. Malavassi, A Delgado and other RECOPE personnel in A.M., discussed format and time table of events.

El Alto in the P.M. with A. Delgado. Perform maintenance and calibration of U.S.G.S. equipment on loan to Costa Rica. Two probes down P.M. tubes and crystals. (As a result of too vigerous spudding?)

Tuesday, Feb. 26: A.M. meet with U.S. Embassy officials H. Rodriquez, explain problems. Call Jim Cathcart and request two well reconnissance probes.

P.M. returned to El Alto work on recorders, perform repairs.

Wednesday, Feb. 27: El Alto all day work on M.L.S. logger. After slight modification logger is functional. Design density probe for M.L.S. logger. Met R. Gutierrez for the first time, typical electrician (no geology). Interest seems to be in seismology.

Thursday, Feb. 28: A.M. go to Embassy, no probes, being held in Custons. Met with executives of RECOPE. Roberto Dobler, present problem he will attempt to get probes released.

P.M. spent afternoon at El Alto working on equipment

| | |
|---|---|
| Friday, March 1: | San Jose in A.M. El Alto in afternoon. Loading vehicle for Talamanca. |
| Saturday, March 2: | Leave San Jose 5:00 A.M.. Arrive Talamance 11:30 A.M., drill site at 4:00 P.M. Log hole (de bug M.L.S. logger). Arrive Talamance 3:00 A.M. |
| Sunday, March 3: | Leave Talamance about 10:00 A.M., diesel fuel in fuel tank, arrive San Jose 8:00 P.M. |
| Monday, March 4: | Start class on well site geology and log interpretation. |
| Tuesday, March 5: | Class in San Jose all day. |
| Wednesday, March 6: | Class in San Jose in A.M., met with R. Gutierrez in P.M. Discuss logging practices and procedures. |
| Thursday, March 7: | Leave San Jose 7:00 A.M. Arrive Talamance 2:00 P.M. |
| Friday, March 8: | Drill site - work with N. Rodrequez Quesada (technician). |
| Saturday, March 9: | Course on logging at Talamance - work with N. Rodriquez Quesada (technician). |
| Sunday, March 10: | Soccer in A.M. Leave Talamance 2:00 P.M. Arrive San Jose 8:30 P.M. |
| Monday, March 11: | Meeting with RECOPE, no probes being held up in customs. |
| Tuesday, March 12: | Bob left A.M. Doctor in A.M.<br>Meet with ICE in P.M., G. Calvo, L. Sanchez. Look over Log Master logger. |
| Wednesday, March 13: | A.M. Shot in butt., Dr. Esquizel. P.M. Met ICE at dam site, work with Log Master logger. Discussions with G. Calvo. |



41

| | |
|---|---|
| Thursday, March 14: | See dermatologist H. Hidalgo, M.D., shot in wrist. Go to volcano in P.M. |
| Friday, March 14: | RECOPE doctor R. Esquivel, M.D., get vaccine A.M. Get probes, finally. El Alto P.M., work on Well Recon equipment OK. |
| Saturday, March 15: | Leave San Jose E.A.L., 8:00 A.M.<br>Arrive Miami U.A.L., 5:30 P.M.<br><br>Arrive Denver 8:00 P.M. |



42

## CONCLUSIONS AND RECOMMENDATIONS

While I was favorably impressed with the over all work attitude and knowledge of the persons I came in contact with, who will be running the geophysical logging equipment, I think more training is a necessity.

It appears the persons who have training in geology do not have training in electronics and the ones who have training in electronics do not have training in geology.

Therefore I think individualized training with the equipment and a general course in interpretation of data would be of great importance to the project. This training should be directed at the person who will be in charge of the equipment, it's operation and maintenance.

I also think a person with experience should be consulted before contracts are released for the purchase or lease of geophysical equipment. As manufactors and brokers of this type of equipment have been known to not be fully truthful in their presentations.

A four (4) conductor logging unit would be of tremendous use in the project as three (3) geophysical logs could be obtained in one run, thus freeing the drill crew and equipment for other endeavors.

Because of the nature of the host rock (incompetence) it can be of great value to get a suite of logs with one pass of the probe.

Also in conclusion I feel a drill hole should be made available, in competent rock, for in calibration and standardization of logging equipment. The hole should be of sufficient depth and penetrate a number of strata so as to determine the competence of equipment and methodology.

## ASIA

### Investment is needed if output is to meet demand

The Indian government needs to invest $11-billion in the country's coal industry over the next five years if domestic production is to meet an estimated demand of 240-million mt/y, according to a recently released report by a special working group on coal and lignite.

The working group report lays down guidelines for a constant 9.6%/y increase in indigenous coal production during the 1985-90 period. To achieve this, however, India will need to open up new mines in the northern part of the country because production from existing mines will probably suffer a decline through natural shrinkage in the coming years, the report says.

India's present output is approximately 147.8-million mt with 28.5-million mt of that used by the electricity sector. That need is projected to grow to 110-million mt/y by 1990. The steel sector is India's other large coal consumer also using 28.5-million mt/y, but the demand only will grow to about 41.4-million mt by 1990. With respect to coking coal, the working group believes that India's requirements will rise marginally from the 32-million mt used in the 1984-85 period to 39-million mt by the 1989-90 period.

Meanwhile, a 2-day Indo-British joint steering group on coal in New Delhi met recently with both sides reviewing the on-going collaborations between the two countries with respect to opencast and underground mining projects. Britain also has agreed to prepare a master plan for developing the Wardha Valley coal field in western India.

### Elsewhere in Asia

**National Power Corp.'s** coal-fired power plant at Calaca will continue to use imported Australian coal together with locally-mined coal until its test program demonstrates that the plant could run on 100% local coal. According to company sources, NPC can't operate at 300-mw unless it uses Australian coal, which is blended on a 50-50 ratio with locally-mined coal. The test program, which started in March 1984, is scheduled to end in March. NPC adopted this program after initial shipments of coal produced by Semirara Coal Corp. failed to meet specifications on moisture and clay content, which reportedly caused clogging in the plant's conveyor system.

## CENTRAL AMERICA

### Costa Rica looks to domestic coal as an alternative to oil

Costa Rica recently has become the first Central American country to begin a systematic coal explortion program, and geologists predict that the coal could soon help the country reduce its dependance on imported oil by as much as 50%.

National Refinery's (Recope) coal project director Oldemar Ramirez says open pit and underground mining at one site in the Talamanca Mountains along the southern Atlantic Coast could begin in late 1986, yielding as much as 10-million mt of steam coal. Recope also is evaluating eight other potential sites throughout the nation—El Tablazo, Puriscal, Esparza, Venado, Upala, San Carlos, Zent and Estrella.

Ramirez says the coal could be used as a substitute for costly imported oil in the country's production of electricity, cement and carbochemicals. In 1984, Costa Rica imported 4.5-million barrels of oil at a cost of $150-million from Venezuela and Mexico. The country currently only imports a small, costly amount of coal from Europe for use in its metallurgic industries.

National consumption of coal will depend primarily on the cost of hauling the coal by train or truck to industrial plants and there currently are reliable estimates only for truck costs, according to Ramirez. He says Recope has determined that truck costs would be about $20/mt for transporting the coal from Talamanca to San Jose. Based on that figure, Recope believes that mining will be feasible, but he says that should transportation costs become prohibitive, Recope might consider building a coal-fired plant near the mining site to utilize the coal.

Recope also is trying to determine Costa Rican industry's capability for switching to coal. "There are some industries that can use it right now, while others will need to make conversions in the factory," he says, adding that "the rate of conversion will depend on the price of coal."

Because of such uncertainties, Recope officials are unable to predict how much, if any, of the coal could be available for future export. "We are thinking right now in terms of national consumption," says Ramirez, but that scenario could change if transportation costs can be kept low enough for Costa Rica to compete on the international market.

Recope estimates that the Btu value of the coal averages between 10,000 and 11,000 Btu/lb., with sulfur content less than 2% and ash, about 10%. Currently only the government is legally permitted to mine the coal, but Ramirez says the law eventually may be modified to allow private companies to begin excavating the fields.

The exploration project is being carried out by Recope, which has received $700,000 in technical assistance from the US Agency for International Development as well as aid from Japan's Agency for International Cooperation.

## AUSTRALIA

### Despite increased coal sales Coal & Allied records a loss

Australian steam and coking coal producer, Coal & Allied Industries, Ltd. reported a pre-tax loss of $2.18-million (Aus $3.09-million) on its coal operations from July to Dec. 31, 1984, despite increasing coal sales in the 6-month period to 3.479-million mt.

In its half year report, the company blamed continuing weak world prices for coking coal and oversupply for its poor result. Coal & Allied Chief General Manager, J.B. Thomson confirms that the 1985 coking coal prices for Japanese steel mills were agreed at a 1984 rollover level of $44.50/mt. However, the disparity in the value of the Australian dollar against the US dollar will provide some revenue benefits to Australian shippers in the coming year.

Reorganization within the Howard Smith Group, which owns 50% of Coal & Allied, will include bringing the wholly owned R.W. Miller operation under the control of Coal & Allied in a bid to cut back administrative costs and overheads, according to Thomson. Coal & Allied's Hunter Valley No. 1 mine in New South Wales will increase production to 5-million mt/y and a longwall system will be installed at the company's Liddell mine at a cost of $11.28-million (Aus $16-million) in a further bid to increase efficiency of operation and reduce costs per metric ton.

Marketing success in Sweden, France and Greece lifted sales in the 6-month period from 2.730-million mt in the 1983 period to 3.479-million mt. Total saleable output from Coal & Allied's operations in the July to December period was 3.684-million mt. The company reports that 48 mine days were lost in the period due to industrial action.



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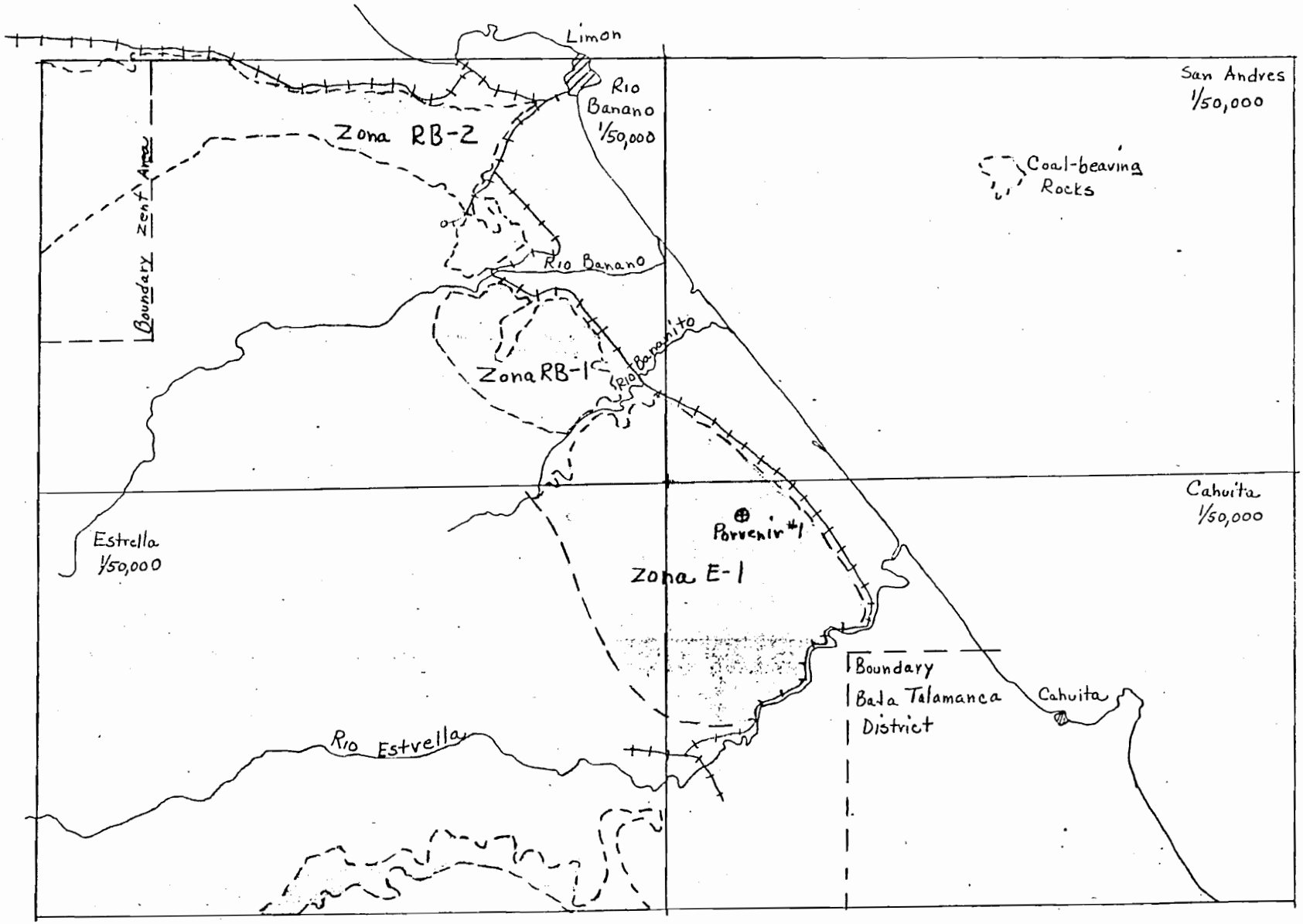


ATTACHMENT 7