

Rome Trough Consortium

A Proposed Joint Geologic Study of the Knox and Pre-Knox Interval in Eastern Kentucky

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Executive Summary

Since the 1994 discovery of commercial gas in the Rome Trough, a new phase of deep gas exploration in eastern Kentucky has begun. This activity has been focused in the Elliott, Morgan, and Lawrence Counties, Kentucky, and the success in this area suggests that potential exists in other parts of the Rome Trough. The Kentucky Geological Survey (KGS) is proposing to form an industry-funded consortium to undertake a comprehensive geologic study of the Knox Group and underlying pre-Knox rocks (Conasauga Formation, Rome Formation, and basal sands). Based primarily on well data, the study is designed to provide a detailed stratigraphic and regional structural framework on which to base your in-house geophysical interpretations of the Rome Trough. Limited proprietary reflection seismic data available to the KGS will be used to supplement the well data, but a detailed seismic interpretation is *not* a part of the proposed study at this time. This research will, however, provide the geological data and interpretations necessary to correctly interpret seismic data and develop prospects in this play.

The study will be conducted in two phases, each lasting one year with an interim report and data transfer after the first year. Preliminarily, Phase I would consist of stratigraphic top determinations, database construction, and development of stratigraphic and structural cross sections. Phase 2 would consist of data interpretation, including structure and isopach mapping and exploration model development. Preliminary objectives and deliverables are discussed more fully below, but the **final work plan will be determined by the companies participating in the study**. Data and interpretations resulting from the study will be held confidential for a period of one year from the end of the project. Project costs will be shared equally by all participants. A greater number of participants will result in a lower per-company cost.

KGS has substantial prior experience in conducting proprietary industry-funded research. Since 1990 we have completed a study on the Precambrian East Continent Rift Basin (Cincinnati Arch Consortium) funded by six companies, and a study on the Mississippian “Big Lime” in eastern Kentucky, funded by three companies. After an initial confidentiality period, the results of these studies are now available to industry.

KGS’s experience with the Rome Trough dates from the early 1990’s and several publications have resulted (Drahovzal and others, 1992; Drahovzal, 1994; Drahovzal and Noger, 1995; Harris and Baranowski, 1996; and Harris and Drahovzal, 1996a, 1996b).

Introduction

A Cambrian gas discovery in Elliott County, Kentucky in mid-1994 confirmed the commercial viability of a deep gas play in the Rome Trough of eastern Kentucky. The Homer pool, a Cambrian Rome Formation reservoir currently being developed by Carson Associates is a significant milestone in the frustrating history of exploration in the Rome Trough. The Carson discovery has resulted in renewed exploration in the Rome, with deep tests having been drilled by three other companies since 1994. The play is attractive because of the moderate drilling depths involved (7,000 - 9,000 ft.), and the high productivity reported from these wells to date (11 MMCFGD to 21 MMCFGD IOF). Very little data has been released from the Homer pool to date (only 2 wells), but data from 4 additional wells are scheduled to be released in 1998.

To assist industry in this exploration effort the Kentucky Geological Survey (KGS) is proposing to form an industry consortium to conduct a geologic study of the Rome Trough in eastern and central Kentucky. The main objective of this study is to interpret a detailed stratigraphic and regional structural framework for the Knox and pre-Knox interval in the Rome Trough, and develop an exploration model based on these geologic data. Success in this structurally-complex play will require seismic data that is accurately interpreted within the context of a valid geologic model. This study will result in a comprehensive geologic data set and model that can be integrated with seismic data to improve prospect evaluation.

Project Objectives

The project will consist of two one-year phases, with an interim report after the completion of Phase I, and a final report after the completion of Phase II. The exact objectives and deliverables for each phase will be determined by the participating companies before the start of the project. The preliminary objectives discussed below are indicative of the scope and nature of work that KGS can undertake. All of these objectives will be subject to approval and/or modification by participants.

Study Area

The project study area will include all of eastern Kentucky lying east of longitude 85°W. This area includes all of the Rome Trough in eastern Kentucky. The study area will be bounded by the Kentucky border to the north, east, and south (Figure 1).

Phase I Objectives

Phase I will involve stratigraphic data collection, computer database construction, and cross-section correlation. In addition several key wells will be selected for sample description and organic geochemical analyses. If desired, KGS can also generate synthetic seismograms from digitized well logs.

Stratigraphic data collection will involve picking major formation tops for all available pre-Knox wells in the study area (approximately 95 wells), and for the approximately 700 Knox wells in the area for which geophysical logs are available (Figure 2). The Knox wells are being included to provide additional shallower stratigraphic control both within and outside the trough. The tops data will be entered into a computer database. In addition to major formation tops, detailed zonal stratigraphy within the Rome Formation will be determined. A preliminary informal zonation

scheme for the Rome (R1-R7) developed by M.C. Noger at KGS will be tested, refined and expanded to the entire study area.

Regional cross sections will be constructed using geophysical logs from the pre-Knox wells. Logs for all of the pre-Knox wells will be digitized, and computer-generated structural and stratigraphic cross sections will be generated. All digital log data will be made available to participants. Synthetic seismograms will be generated for the pre-Knox wells using parameters determined by participants.

Several key pre-Knox wells will be selected for well sample description at the KGS Core and Sample Repository. This work will document the petrology of the pre-Knox interval, and of the Rome reservoir sands in particular. This data will be used in Phase II to help constrain depositional models and facies distribution in the Rome.

A critical question that remains unanswered in this play is the hydrocarbon source. Previous source-rock studies of the Rome Trough have found poor source-rock quality in the pre-Knox interval. We will attempt to identify the source of the Rome Formation hydrocarbons using geochemical analyses of gas and condensate samples obtained from recent wells. These analyses will be done by the U.S. Geological Survey. We hope to constrain whether the source is pre- or post-Knox in age, and possibly interpret timing of hydrocarbon maturation and migration based on burial history modeling.

Phase II Objectives

The second year of the study will involve more interpretation of data collected in Phase I. Structure and isopach maps for several horizons and intervals will be constructed. The well data will be the primary source in generating the maps, but supplemental interpreted seismic-horizon data will be used from limited proprietary reflection-seismic data. The exact maps to be made will be determined by the project participants, but will likely include the following:

Structure: Precambrian basement
 Top Rome Formation and sub-zones
 Top Conasauga Formation
 Top Cambrian (Copper Ridge Dolomite)
 Top Knox Group (Beekmantown Dolomite)

Isopach: Rome Formation and sub-zones
 Conasauga Formation
 Copper Ridge Dolomite
 Rose Run Sandstone
 Beekmantown Dolomite
 Knox Group (total isopach)
 pre-Knox (total isopach)

In addition to the structure and isopach maps, several maps of reservoir quality will be made. Using the digital log data for the pre-Knox wells, net-sand and pore footages will be calculated and mapped for the Rome Formation. These maps will be subdivided by zone within the Rome.

During Phase II, the more recent well data from the Homer pool will have been released. We plan to use these data to conduct a field study on the Homer pool. More detailed maps and cross sections of this reservoir will be made using the available data. This study will document the structure, and distribution of reservoir zones within the field.

Finally, all of these data types will be integrated to develop an exploration model for the Rome Formation in eastern Kentucky. This model will be documented in a written final report. The model will enhance prediction of gas reservoirs in the Rome through a better understanding of sand distribution, porosity development, timing of structural traps, source-rock identification, maturation timing, and hydrocarbon migration pathways.

Deliverables

Final project deliverables will be determined by participants at a later date, but based on the preliminary objectives outlined above the following deliverable products are anticipated:

- Database of stratigraphic tops, including detailed Rome Formation correlations
- Regional log cross sections
- Digital-log files for pre-Knox wells
- Pre-Knox well sample descriptions
- Geochemical data, source-rock correlation
- Synthetic seismograms
- Regional structure and isopach maps
- Regional net sand and porosity maps
- Homer pool field study
- Final Report and exploration model

Personnel

The project will be conducted by the Geologic Mapping and Hydrocarbon Resources Section at KGS. The majority of the work will be carried out by Dave Harris and Jim Drahovzal. M.C. Noger, KGS geologist emeritus, will be consulted on a part-time basis. Additional staff may be hired if necessary to complete all of the project tasks.

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Project Schedule

Phase I could begin as early as April 1, 1998, depending on the amount of time necessary to obtain funding. Phase II would follow one year later, with submittal of the final report by March 31, 2000. Confidentiality of all project data can be maintained for one year from the completion of Phase II (March 31, 2001).

Project Budget

An exact project budget cannot be determined until a final work plan is agreed upon by participants. Costs of the project will be shared equally by all participants. It is anticipated that the total cost of the 2-year project will fall in the range of \$140,000 - \$255,000, depending on scope. It is hoped that about 10 companies would participate, placing the cost per participant in the \$20,000 range.

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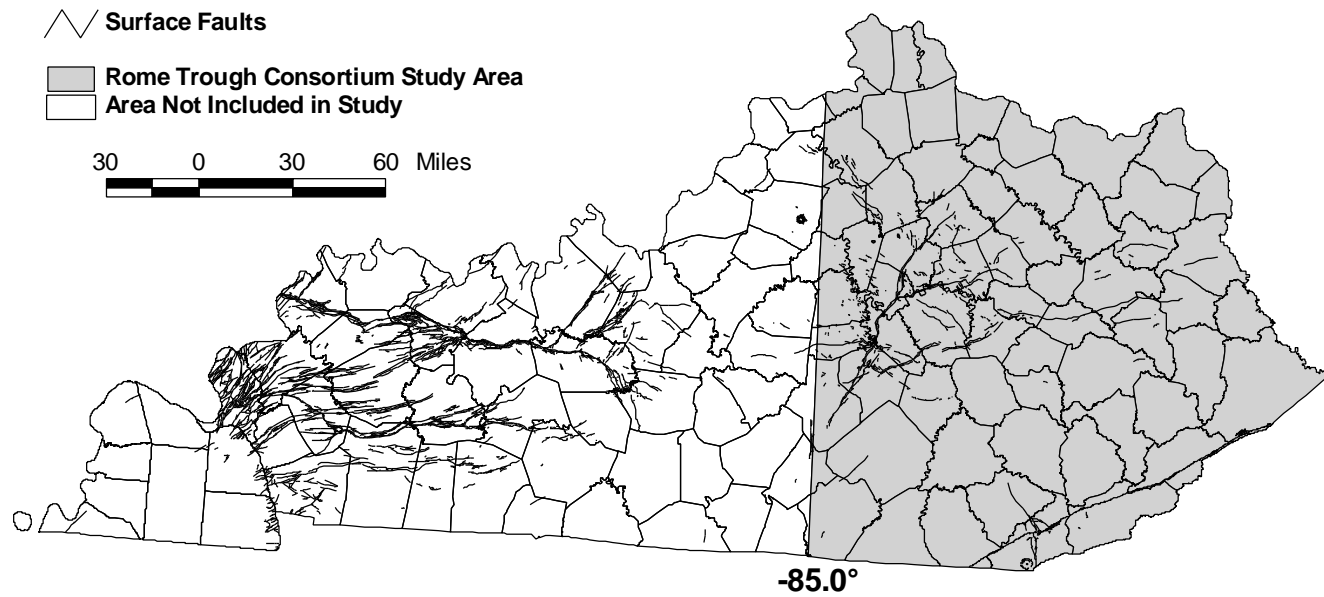
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**Figure 1. Rome Trough Consortium
Index Map**

