Chapter 1

Introduction

1.1   Background

Sin Pun and Saba Yoi coal deposits in southern Thailand were explored by Electricity Generating Authority of Thailand (EGAT) in 1967. Exploration in the Sin Pun area commenced in 1967, covering an area of 616 km^2 and encompassing 3 Changwat (Province)-Surat-Thani, Nakhon Si Thammarat, and Krabi. Twenty years later, coal exploration in the Saba Yoi area was started in 1987, covering an aerial extent of 150 km^2 in Amphoe (District) Thepha and Amphoe Saba Yoi, Changwat SongKhla. Exploration were terminated in 1985 for Sin Pun and in 1987 for Saba Yoi. Seismic exploration programs were launched for both coal deposits, and subsequent drilling programs were conducted after seismic interpretation and evaluation. The principal emphasis of the coal deposits is placed on the estimation of the quality and quantity of the resources.

Although both deposits are large with the approximate measured reserves of 35 million metrictons at Sin Pun and 203 million metrictons at Saba Yoi, coals of both basins have never been exploited for coal industry due to several environmental and cultural problems.

However, EGAT has spent a great deal of expenses for these exploration campaigns, and a lot of data acquired have never been employed. No further academic or research works have been conducted so far after the cessation of both exploration programs. It is also noted that Sin Pun and Saba Yoi geological data were consequently stored in the UNIX system.

Therefore, it is much better, as parts of the thesis objective, to rearrange and to develop a new database which can be essentially run on the IBM-compatible PC (or Personal Computer) format with the more familiar and easy-using Microsoft program. So the newly available data can be easily manipulated, analyzed, and simulated. In this study, five software programs were selected for this current study in order to run all the data in the PC computer. It is, therefore, anticipated that the appropriate outcome of the research successfully form the basis in the development of these two deposit areas in the future.

1.2 Locations of the Study Areas

The two study areas (Sin Pun and Saba Yoi deposits) are situated in the southern part of Thailand (see Fig.1.2). The areas form two separated basins. The Sin Pun basin is mostly located in areas of Changwat Krabi, and the Saba Yoi bain is occupied mainly in Changwat Sonkhla. Detailed description of both areas are explained in the next chapter.

1.3 Objectives

The prime aims of this investigation include

1. to develop a new coal-quality database system from the previously, more complicated available data from Sin Pun and Saba Yoi areas, and

2. to construct the coal-quality model for these two areas.

1.4 Methods of Study

The methods of investigations are described in a consecutive step below. Flow chart showing the procedure of this study is illustrated in Fig.1.1.

PROGRAM   DATA   PERFORMANCE

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                              ┌──────────────────┐
                              │  Source of Data  │
                              └──────────────────┘
                                       │
                                       ▼                      ┌──────────────────┐
                                                              │  EGAT's Database │
                                                              │     Retrieval    │
                              ┌──────────────────┐            └──────────────────┘
                              │  Data Accession  │
                              └──────────────────┘            ┌──────────────────┐
                                       │                      │  Entry of Quality│
                                       ▼                      │       Data       │
                                                              └──────────────────┘

      ⬭ VULCAN ⬭  ──────▶     ┌──────────────────┐            ┌──────────────────┐
                              │  Data Selection  │  ──────▶   │  Bore Hole Data  │
                              └──────────────────┘            │ with Analytical Data│
                                       │                      └──────────────────┘
                                       ▼

  ⬭ Spread Sheet Program ⬭ ─▶  ┌──────────────────┐          ┌──────────────────┐
                              │ Data Accumulation│  ──────▶   │   New Database   │
                              └──────────────────┘            │     Creation     │
                                       │                      └──────────────────┘
                                       ▼

  ⬭ Geostatistical Program ⬭ ─▶ ┌──────────────────┐         ┌──────────────────┐
                              │ Data Analysis &  │  ──────▶   │Variogram Analysis &│
                              │   Manipulation   │            │      Kriging     │
                              └──────────────────┘            └──────────────────┘
                                       │
                                       ▼                      ┌──────────────────┐
                                                              │ Coal Quality Models│
  ⬭ Geostatistical Program ⬭ ─▶ ┌──────────────────┐         └──────────────────┘
                              │     Modeling     │  ──────▶
                              └──────────────────┘            ┌──────────────────┐
                                                              │Error Estimation Models│
                                                              └──────────────────┘
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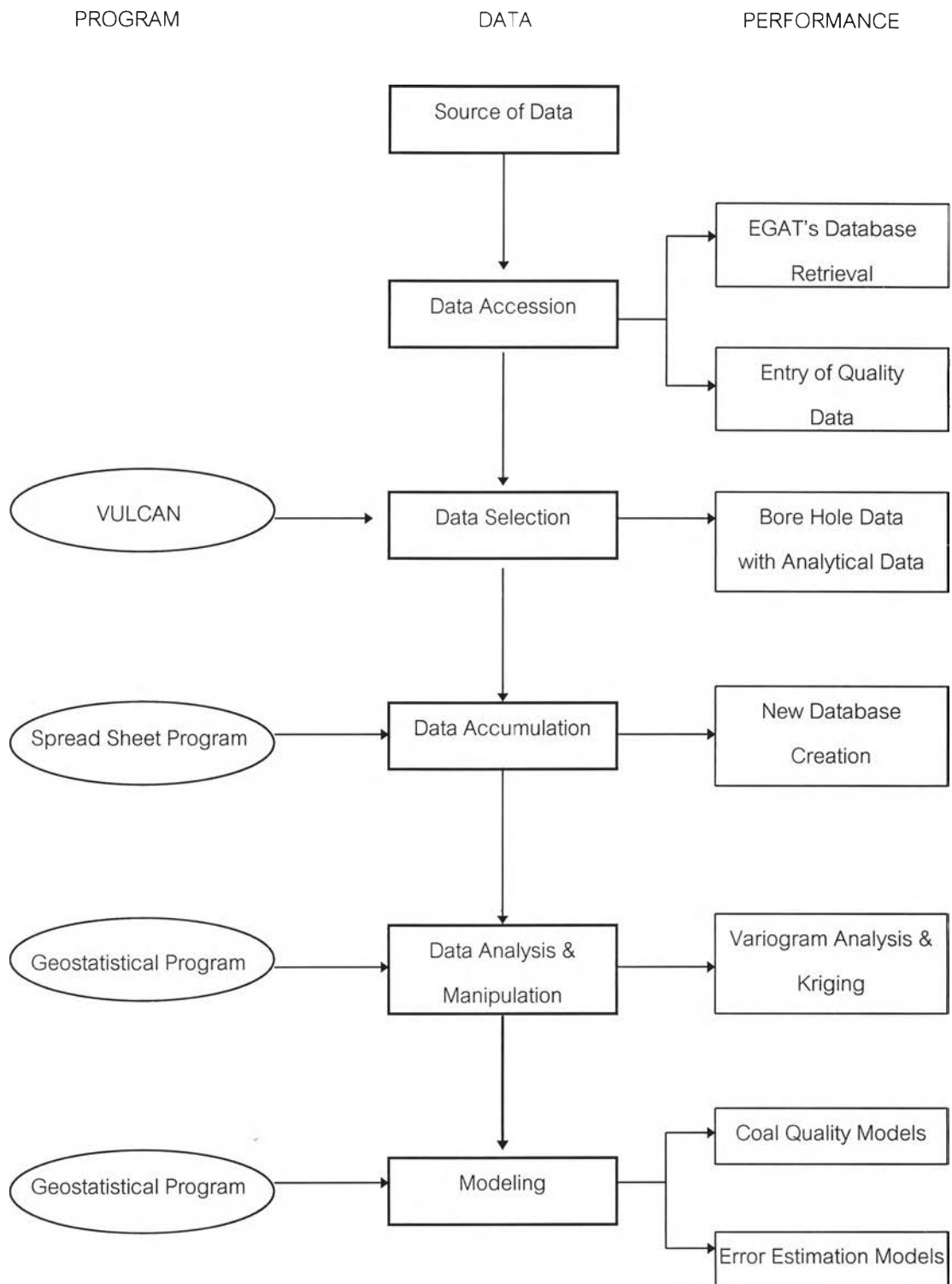
Fig.1.1.   Flow chart showing method of investigation in this study.
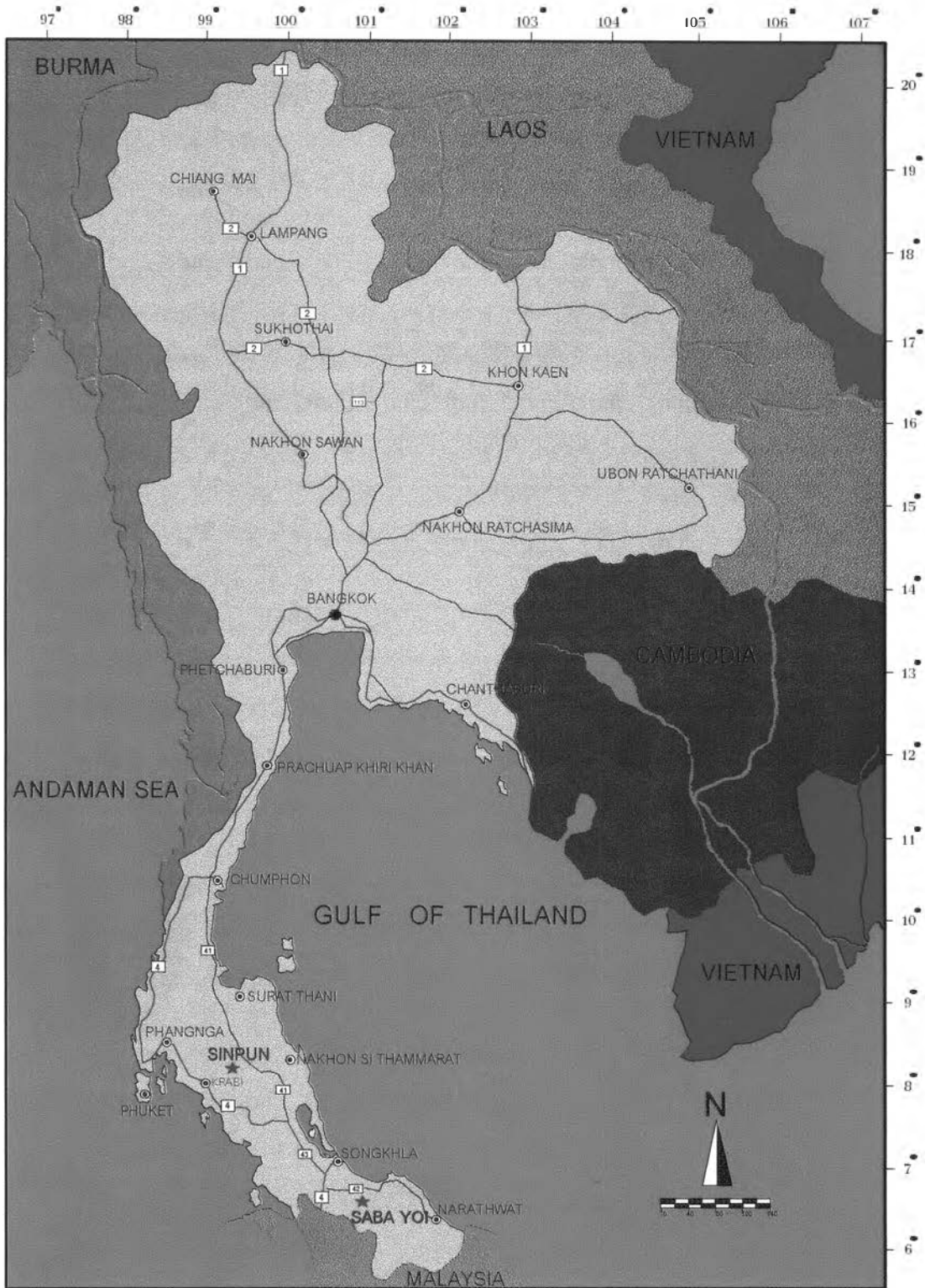
Fig. 1.2.   Index map of Thailand showing locations of the study area,

Sin Pun and Saba Yoi, shown as red stars.

1.4.1   Data Accession and Selection

All bore-hole data were drilled by teams of EGAT geologists during 1985-1990. All data were stored using VULCAN program (version 3.2).

A total of 1,181 bore-hole data of Sin Pun were investigated and compiled by the author, and out of these, the 56 drill-hole data containing the reliable analytical data. For the Saba Yoi, 110 bore-hole data from totally 581 data were selected for further compilation and synthesis. Two types of data can be grouped, namely attribute data and numerical data. Both data types are involved in the spatial database (-a database containing information indexed by location). Attribute data which are mainly the descriptive information includes lithological data comprising coordinates of drill holes, elevation, rock type, color, and other physical properties.

Numerical data in this study comprise only analytical data consisting of some selected proximate analysis, i.e., ash content (% ar), moisture content (% ar), and density (g/cc ar) and another analysis, calorific value (Kcal/Kg) and sulfur content (% ar). The term 'ar' means as-received basis.

1.4.2   Data Accumulation

Since all of the data were originally stored in UNIX system by a quite intricated using VULCAN program, so transformation and re-editing of data were performed in order to develop the more easily used database ready for modeling. With the combination of FoxPro and EXCEL programs (Microsoft corporation, 1994), the Sin Pun and Saba Yoi data were stored in the FoxPro program (version 2.6).

1.4.3   Data Analysis and Manipulation

After database creation with FoxPro software program, the numerical data in the spatial database were determined statistically using EXCEL program. The calculated basic statistical values, such as minimum, maximum, variance, and standard deviation, were applied for variogram analysis (see definition below). This part of analysis is regarded the important part of this study, therefore, variogram parameters needed to be taken into account prior to the analysis of variogram.

Such parameters including direction of related samples (or orientation), lag spacing, were manipulated in order to cluster the related samples in areas dominated by irregular bore-hole drilling. As a result of the variogram analysis, models of variogram were encountered by applying Geo_EAS program. The cross-validation analysis was then tested using the same program in order to point out level of data confidence. In the light of conceptual model, values gained from computerized estimation should be nearly similar to those from the actual results.

1.4.4   Model Simulation

After cross-validation was analyzed to increase level of confidence, properties of variogram parameters were subsequently estimated using kriging method (see definition below). The outputs from this method were elucidated in the form of coal-quality model.

1.4.5   Definition of Some Important Geostatistical Terms

Variogram

As defined by Clark (1979), vairogram , γ(h), is a graph (and / or formula) describing the expected difference in values between pairs of samples with a given relative orientation.