# MINERAL INVENTORY SYSTEMS TRAINING HANDBOOK

Compiled by L.D. Jones

## OPEN FILE 1994-20

British Columbia
Ministry of Energy, Mines and Petroleum Resources

Mineral Resources Division
Geological Survey Branch

BC

Ministry of Energy, Mines and
Petroleum Resources

# Development and Management of Computerized Mineral Inventory Systems, using MINFILE as an Example

# Forward

In November, 1993, the Geological Survey Branch of the Ministry of Energy, Mines and Resources offered a two-week training course to two geologists from the Mineral Resources Department in Tanzania. The purpose of the course was to provide guidelines on the organization, development and management of mineral resource data using personal computers. The course included talks on systematic database development and used MINFILE and other databases as practical models for managing resources.

The intent of this publication is to document most of the notes and overheads used in the course. It will be of interest to those planning and developing mineral inventory and other earth science related database systems.

MINFILE is a comprehensive, computerized mineral inventory of over 11 400 metallic, industrial mineral and coal occurrences in British Columbia. The information is used for geoscience research, mineral exploration, prospecting, land-use management and other applications requiring data for managing mineral resources. The MINFILE system was a pioneer of computerized mineral inventories. It began in the 1970s and now, after over two decades of research, development, and practical usage, is a stable, powerful, easy-to-use, mineral inventory system for IBM PC's and compatibles. The design of MINFILE, the depth of geological data, and the ability to distribute digital data to clients ensures its continued applicability, data-integrity and system-flexibility.

Through licensing agreements, the Province of British Columbia offers the MINFILE system for sale. This proven system can easily be customized to immediately capture data in other localities. Participating agencies could also use MINFILE as a model to design a new system or enhance an existing inventory system. Either way, savings, both in time and cost, would be realized in designing, developing and testing the resulting system. For further information on licensing or training contact Larry Jones, MINFILE Project or Gib McArthur, Manager, Geoscience Information Section, Geological Survey Branch, 5th Floor, 1810 Blanshard Street, Victoria B.C., V8V 1X4; phone (604) 952 0382; fax (604) 952-0381.

Some of the course material is based on a training course on Computerized Databases in Mineral Exploration and Development, which took place in Lusaka, Zambia in May 1993, sponsored by the International Atomic Energy Agency (IAEA) and the Government of Zambia. The course was a follow-up on previous work with the IAEA in Vienna in 1990 and 1991, which resulted in a 200-page technical document titled: "Guidelines for the Organization and Management of Earth Science Data on a Personal Computer." The document is aimed at providing government organizations in developing countries with guidelines in the organization, management and preservation of earth science data.

As coordinator of the course, I acknowledge the assistance from Ministry staff including Gib McArthur, Vic Preto, Cindy McPeek, George Owsiacki, Dorthe Jakobsen, Kim Stone, Don Porter, Laura de Groot, Allan Wilcox, Sherri Proceviat, Sharon Ferris, Eric Grunsky, Ward Kilby, Bill McMillan, Dave Grieve, Dave Lefebure, Steve Sibbick, and Brian Grant.

Larry Jones
Senior Geologist
MINFILE Project
Geological Survey Branch

# Development and Management of Computerized Mineral Inventory Systems, using MINFILE as an Example

15 - 26 November 1993, Victoria, B.C., Canada

## OUTLINE:

Course Introduction and Outline
The Role of the Geological Survey Branch (GSB)
Overview of Geological Survey Branch Databases
Geology and Mineral Resources of B.C.
The Strategy and Philosophy in Mineral Resources Databases
Guidelines to Database Systems
Mineral Deposit Databases
MINFILE Project Management
- Concept, designing, planning (budget, staff)
- Database Design and Data Dictionary
- System Testing and Quality Assurance
- Database Administration and Maintenance (documentation and manuals)
- Data Acquisition and Processing Procedures (coding procedures)
- Training and Client Support
- Marketing and Distribution of Data
- New Technology and Future Planning
- Designing and Producing Computer Generated Products for Users

Mineral Titles
Mineral Exploration Databases
Earth Science Information Databases (ARIS example)
Using the MINFILE System:
- Basic Disk and File Management Techniques (DOS and dBase)
- Installing MINFILE
- Searching, Reporting, Data Entry, Data Transfer and Utilities

Data Integration, Mineral Potential and GIS Applications

Branch Tours

Myra Falls Mine Visit

# Development and Management of Computerized Mineral Inventory Systems, using MINFILE as an Example

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15 - 26 November 1993, Victoria, B.C., Canada

## FINAL PROGRAM

| Monday, 15 November | | Time: |
|---|---|---|
| 1. | ***Introduction***<br>Introduction of participants and lecturers<br>Course outline and materials | 09:00 - 09:30 |
| 2. | ***The Role of the Geological Survey Branch*** (GSB): G. McArthur | 09:30 - 09:45 |
| 3. | ***Overview of Geological Survey Branch Databases***: L. Jones | 09:45 - 10:15 |
| | - COFFEE BREAK - | |
| 4. | ***Geology and Mineral Resources of B.C.***: V. Preto | 10:30 - 12:00 |
| | - LUNCH - | |
| 5. | ***Strategy and Philosophy in Mineral Resources Databases***: L. Jones | 13:30 - 14:30 |
| 6. | ***Guidelines to Database Systems***: L. Jones | 14:30 - 15:30 |
| | - COFFEE BREAK - | |
| 7. | ***Mineral Deposit Databases***: L. Jones | 16:00 - 17:00 |

| Tuesday, 16 November | | Time: |
|---|---|---|
| | - Discussions - | 09:00 - 09:15 |
| 8. | ***MINFILE Project Management Overview***: L. Jones, D. Jakobsen | 09:15 - 10:15 |
| | - COFFEE BREAK - | |
| 9. | ***Database Design and Data Dictionary***: L. Jones | 10:45 - 12:00 |
| | - LUNCH - | |
| 10. | ***System Testing and Quality Assurance***: L. Jones, C. McPeek | 13:30 - 14:30 |
| 11. | ***Database Administration and Maintenance***: C. McPeek, L. Jones<br>- Documentation and Manuals | 14:30 - 15:00 |
| | - COFFEE BREAK - | |
| 12. | ***Data Acquisition and Processing Procedures***<br>(Coding Procedures): L. Jones, G. Owsiacki | 15:30 - 16:30 |
| | - Discussions - | 16:30 - 17:00 |

| Wednesday, 17 November | | Time: |
|---|---|---|
| | - Discussions - | 09:00 - 09:15 |
| 13. | ***Training and Client Support***: D. Jakobsen | 09:15 - 09:45 |
| 14. | ***Marketing and Distribution of Data***: L. Jones | 09:45 - 10:15 |
| | - COFFEE BREAK - | |

| | | |
|---|---|---|
| 15. | ***Mineral Titles***: J. Chan, K. Stone, D. Porter | 10:30 - 12:00 |
| | - LUNCH - | |
| 16. | ***New Technology and Future Planning***: L. Jones | 13:30 - 14:00 |
| 17. | ***Designing and Producing Computer Generated Products for Users***: L. Jones, G. Owsiacki | 14:00 - 15:00 |
| | - COFFEE BREAK - | |
| 18. | ***The QuikMap Mapping System***: G. Owsiacki, L. Jones | 15:30 - 16:30 |
| | - Discussions - | 16:30 - 17:00 |

## Thursday, 18 November — Time:

| | | |
|---|---|---|
| | - Discussions - | 09:00 - 09:15 |
| 19. | ***Data Modelling Concepts***: L. de Groot, L. Jones | 09:15 - 10:30 |
| | - COFFEE BREAK - | |
| 20. | ***Data Modelling Practical*** (Host Rock Hierarchy): L. Jones, L. de Groot | 11:00 - 12:00 |
| | - LUNCH - | |
| 21. | ***Data Modelling Practical***, continued: L. Jones, L. de Groot, G. Owsiacki | 13:30 - 16:30 |
| | - Discussions - | 16:30 - 17:00 |

## Friday, 19 November — Time:

| | | |
|---|---|---|
| | - Discussions - | 09:00 - 09:15 |
| 22. | ***Mineral Exploration Databases***: L. Jones<br>- Geological Database System (GSB-GDS), COALFILE Database<br>- Regional Geochemistry Survey (RGS) Database | 09:15 - 10:15 |
| | - COFFEE BREAK - | |
| 23. | ***Earth Science Information Databases***<br>- Their Elements and Functions: L. Jones<br>- Assessment Report (ARIS) Database: A. Wilcox, L. de Groot | 10:45 - 12:00 |
| | - LUNCH - | |
| 24. | ***Bibliography Database Demonstration***<br>- ARIS Database, CDS-ISIS, GEOSCAN: A. Wilcox<br>- ARIS Maps: S. Proceviat | 13:30 - 15:00 |
| 25. | ***GeoHighlight Talks:***<br>- *Exploration Highlights in B.C.*, Tom Schoeter<br>- *Geology and Mineral Potential of Tanzania*:, P. Ndonde, A. Ishegize | 15:00 - 17:00 |
| | ***Geological Survey Branch Slide Show***, Oak Bay Beach Hotel | 18:00 - 22:00 |

## Sunday, 21 November — Time:

| | |
|---|---|
| Drive to Campbell River<br>Accommodation at Discovery Coast Inn | 12:00 - 18:00 |

## Monday, 22 November — Time:

| | | |
|---|---|---|
| 26. | ***Myra Falls Mine Tour***, S. Juras (Westmin) | 09:00 - 15:00 |
| | Drive to Victoria | 15:00 - 20:00 |

| Tuesday, 23 November | | Time: |
|---|---|---|
| 27. | ***Computer Program Demonstrations***<br>- Bedrock, COALFILE, Metadata File; ARISTRAN, ATLAS,<br>- MINERAL, UDEPO, GSB-GDS, NEWPET, RGS, Help Desk, Pro-Cite | 09:00 - 12:00 |
| | - LUNCH - | |
| 28. | ***Tour of Ministry Activities***<br>- Information Resource Centre (Georef Search) | 13:30 - 15:00 |
| | - Discussions - | 15:00 - 16:00 |

| Wednesday, 24 November | | Time: |
|---|---|---|
| | - Discussions - | 09:00 - 09:15 |
| 29. | ***Workshop on Using the MINFILE System***: D. Jakobsen, G. Owsiacki | 09:15 - 12:00 |
| 30. | ***Basic Disk and File Management Techniques*** (DOS and dBase) | |
| 31. | ***Introduction to MINFILE*** | |
| | - LUNCH - | |
| 32. | ***Installing MINFILE/pc*** | 13:30 - 14:00 |
| 33. | ***Searching, Reporting, Data Entry, Data Transfer and Utilities*** | 14:00 - 16:30 |
| | - Discussions - | 16:30 - 17:00 |

| Thursday, 25 November | | Time: |
|---|---|---|
| 34. | ***MINFILE Workshop*** continued | 09:00 - 12:00 |
| | - LUNCH - | |
| 35. | ***Data Integration, Mineral Potential and GIS Applications***:<br>- W. Kilby | 13:30 - 15:00 |
| | - COFFEE BREAK - | |
| 36. | ***Tour of Ministry Activities***<br>- Mineral Potential Project: E. Grunsky. P. Desjardins, J. Cunningham<br>- Scientific Review: B. Grant | 15:30 - 16:30 |

| Friday, 26 November | | Time: |
|---|---|---|
| 37. | ***Tour of Ministry Activities***<br>- Mapping Section: B. McMillan | 09:00 - 10:00 |
| | - COFFEE BREAK - | |
| 38. | ***Tour of Ministry Activities***<br>- Economic Geology Section: D. Lefebure, D. Grieve | 10:30 - 12:00 |
| | - LUNCH - | |
| 39. | ***Tour of Ministry Activities***<br>- Environmental Geology Section: S. Sibbick | 13:30 - 14:30 |
| 40. | ***Wrap-up*** | 14:30 - 17:00 |

Ministry of Energy, Mines and Petroleum Resources

# Development and Management of Computerized Mineral Inventory Systems, using MINFILE as an Example

**Larry Jones, Coordinator**

**Notes from a Training Course held in**
Victoria, B.C., 15 - 26 November 1993

# Introduction

## Participants:

Tanzania Mineral Development

## Coordinator:

Geological Survey Branch

- Larry D. Jones

## Contributors:

- Gib McArthur
- Vic Preto
- Cindy McPeek
- George Owsiacki
- Dorthe Jakobsen
- Janice Chan
- Laura de Groot
- Allan Wilcox
- Eric Grunsky
- Ward Kilby

# Introduction

## Purpose

- √ provide guidelines on the organization development and management of mineral inventory systems
- √ systematic database development
- √ mineral resource data
- √ use of personal computers
- √ MINFILE example

# Introduction

## Course Outline

Course Introduction and Outline
The Role of the Geological Survey Branch (GSB)
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Branch Tours

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# Introduction

## Course Materials

√ **Course Binder**
- lecture notes
- handouts

√ **MINFILE Manuals**
- Coding Manual
- User's Manual
- Workshop Notes

√ **Government Publications**
- Style Guide
- Introduction to Prospecting
- NTS Location & Author Index
- Mineral Market Update
- B.C. Exploration & Development Highlights
- Ore Deposits, Tectonics and Metallogeny
- Other publications

√ **Diskettes**
- MINFILE/pc
- Sample Data
- Various programs and utilities

# Introduction

## Lusaka Workshop

### Place & date

- Lusaka, Zambia, May 10-28, 1993

### Participants

- 20 participants from Geological Surveys of 13 Countries in Africa

### Technical Document (TECDOC)

- Guidelines for the Organization & Management of Earth Science Data on Personal Computers

### Consultants

- Larry D. Jones, B.C. Geological Survey
- Caj R. Kortman, Geol. Surv. of Finland
- Maksimilijan Pecnik, IAEA
- Dr. Richard B. Taylor, USGS

# Lusaka Workshop

## Course Content

- Mineral Exploration & Development in Africa
- Geology & Mineral Resources of Zambia
- Computers in Geological Studies & Mineral Exploration
- Exploration & Development Strategy & Planning
- Strategy & Philosophy in Mineral Resources Databases
- Computer Hardware & Software
- Guidelines to Database Systems
- Geoscience Databases
- Earth Science Information Databases
- Mineral Deposit Database
- Exploration Databases

**IAEA-TECDOC-. . .** in press

***Guidelines for the organization and management of earth science data on a personal computer***

INTERNATIONAL ATOMIC ENERGY AGENCY **IAEA**

## ABSTRACT

The understanding of database systems for the organization, management and presentation of earth science data is a major challenge for geological organizations. The management of digital data sets includes the systematic collection, storing, retrieving, transforming and displaying of data. The IBM-PC and compatibles are considered the most suitable, either as temporary or permanent, solutions for the creation of an information system. The dBASE-compatible, Lotus 1-2-3-compatible and ISO-ASCII files are recommended formats for data storage. Database design includes the understanding of data modelling, format standardization, data specifications and types, and data access methods. Geoscience information systems comprise several thematic databases, starting with the master database, which contains information about other databases, such as those handling bibliographies, mapping indexes, mineral deposit information, and exploration information. Most of these subject databases follow a multi-level model. Well designed databases are potentially valuable for integration into more sophisticated and enhanced information systems at a later date when such are required and available. Organizations may benefit by modelling after simple to complex examples of solutions to database management systems in the planning and developing of database systems to meet their needs.

## FOREWORD

The International Atomic Energy Agency has long had an interest in providing manuals and guidebooks to assist workers in the most effective use of uranium exploration techniques and methods. Little has yet been done to assist the management of the earth science information needed for exploration or that produced by exploration activities. During the last several decades, the worldwide search for uranium has generated vast amounts of valuable data. The recent decline in uranium exploration has increased the risk of the loss of this data. The IAEA has produced this document to encourage the preservation of data in digital form so that they will still be available when needed in the future.

To address this need the IAEA convened meetings of consultants in October 1990 and September 1991. The three consultants, Larry D. Jones of the British Columbia Geological Survey, Canada, Caj R. Kortman of the Geological Survey of Finland, Richard B. Taylor of the United States Geological Survey, and IAEA staff member Maksimilijan Pecnik, brought their experience in the organization and management of many kinds of earth science information to this need. The capabilities of microcomputers belonging to the IBM-compatible family, using widely available software, were recommended for these tasks. Discussions and examples are provided to assist small organizations in setting up data systems. This volume provides the tangible results of these meeting.

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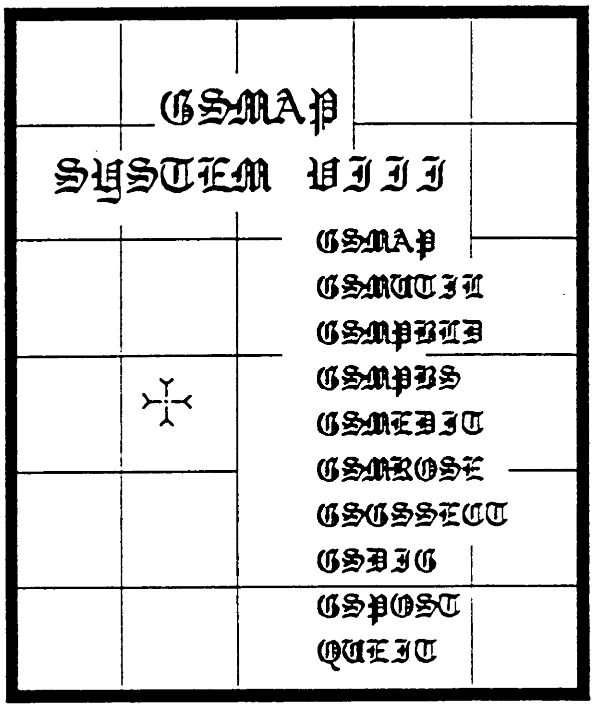
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SYSTEM 8. GSMAP, GSMEDIT, GSMUTIL, GSPOST, GSDIG AND OTHER PROGRAMS VERSION 8, FOR THE IBM PC AND COMPATIBLE MICROCOMPUTERS, TO ASSIST WORKERS IN THE EARTH SCIENCES

by
Gary I. Selner and Richard B. Taylor

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DISCLAIMER

Although program tests have been made, no guarantee (expressed or implied) is made by the authors or the U.S. Geological Survey regarding program correctness, accuracy, or proper execution on all computer systems. Any use of trade names is for descriptive purposes only and does not imply endorsement by the U.S. Geological Survey. This report and has not been reviewed for conformity with the U.S. Geological Survey editorial standards.

Denver, Colorado
February, 1992

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# Overview of Geological Survey Branch Databases

## OUTLINE:

Introduction

B.C. Geological Survey Databases

- ARIS
- COALFILE
- BEDROCK
- MINFILE
- PROPERTY FILE
- GSB-GDS
- RGS

Integration of Databases -
*Mineral Potential Maps*

System Plan Development -
*Example*

Summary

**Lecture by:** L. Jones
15 November 1993

**References:** TECDOC Section 4.2, Annex 6.1

BC

Ministry of Energy, Mines and Petroleum Resources

# Geological Survey Branch Databases

# Geological Survey Branch

## Mandate

The Geological Survey Branch of the Ministry of Energy, Mines and Petroleum Resources is charged with providing the geological inventory required to develop British Columbia's mineral resources, to improve government's stewardship of our mineral endowment, and to help manage and protect Crown lands.

The Branch's mandate is to:

> *Assemble, maintain, and market a comprehensive geoscience database for B.C. to provide a sound base for*
>
> 1. *exploration & development of the province's mineral resources;*
> 2. *planning & resource management decisions by governments; and,*
> 3. *public information on geological resources and hazards.*

# Organization Chart

Ministry of Energy, Mines & Petroleum Resources

## Mineral Resources Division

*Manages all aspects of the province's mineral resources*

### BRANCHES

**MINERAL TITLES**
*Administers laws and regulations governing mineral tenure*

**GEOLOGICAL SURVEY**
*Provides geological resource inventory for economic development and resource management*

**MINE REVIEW & PERMITTING**
*Responsible for Mine Development Assessment Act & administers environmental & engineering aspects of Mines Act*

**MINE HEALTH & SAFETY**
*Administers health, safety and reclamation codes for mines in British Columbia*

**LAND MANAGEMENT & POLICY**
*Responsible for land-use & land-management issues, policy advice to government, & maintains mineral industry statistics*

## GEOLOGICAL SURVEY BRANCH

### CHIEF GEOLOGIST

- *Scientific Review Office*
- *Finance and Administration Section*
- *Prospectors Assistance Program*
- *Mineral Potential Initiative (CRII)*

### SECTIONS

**ENVIRONMENTAL GEOLOGY**
- *Surficial Geology Unit*
- *Geochemistry Unit*
- *Analytical Services*

**ECONOMIC GEOLOGY**
- *Mineral Deposits Unit*
- *Industrial Minerals Unit*
- *Coal Unit*

**MAPPING AND RESOURCE EVALUATION**
- *Mapping Unit*

**GEOSCIENCE INFORMATION**
- *MINFILE Unit*
- *Vancouver Office*
- *Assessment Reports Unit*

SRO July 1994

# Geological Survey Branch

## Hardware

| | |
|---|---|
| Computers: | *IBM compatibles (586s, 486s, 386s)*<br>*Macintosh*<br>*Notebooks*<br>*SPARC 10 Work Stations* |
| Printers: | *HP LaserJet, Dot Matrix* |
| Plotter: | *HP 650 Colour, HP Draftmaster* |
| Digitizers: | *Kurta* |
| Slide Makers: | *Matrix Procolor* |
| Flatbed Scanner: | |
| Media: | *Disks, Tapes, CD ROM* |

## Software

| | |
|---|---|
| Operation Systems: | *Dos, Workgroup for Windows, UNIX* |
| Word Processing: | *Word for Windows, Ventura* |
| Spreadsheets: | *Excel, Lotus, Quattro Pro* |
| Databases: | *dBASE, FoxPro, Friendly Finder, R&R* |
| Communications: | *Dynacomm, Sethost, (network to VAX)*<br>*E-Mail, INTERNET* |
| Graphics: | *CorelDRAW, Harvard Graphics,*<br>*Power Point* |
| Mapping/GIS: | *AutoCad, Terrasoft, QuikMap* |
| Custom software: | *eg MINFILE/pc, ARIS, Field Data* |

# British Columbia Geological Survey Geoscience Databases

**Assessment Report Indexing System** Acronym: **ARIS**

ARIS is a relational database that is an index and an administrative tracking system to the Geological Survey Branch's Mineral Assessment Report Library of more than 22,000 reports. Approximately 1000 new reports are added annually. The database is used to display the distribution of exploration and development activity and for research and mineral potential projects. A group of fields for each Assessment Report are extracted in 8 ASCII files from the VAX mainframe to diskettes. This data may be used on the PC within database management and small mapping projects using QUIKMap software.

| | | | |
|---|---|---|---|
| Host computer: | **VAX Mainframe; PC** | Operating system: | **VMS; DOS** |
| Data model: | **Entity-relationship** | DBMS: | **SUPRA; ASCII; dBase** |
| Data size: | **22000** records; **70 MB** | Number of files: | **15** |
| | | Fields per record (maximum/average): | **60/40.** |

**COALFILE** Acronym: **COALFILE**

COALFILE contains summarized coal assessment reports dating from 1900, submitted by exploration companies in compliance with the Coal Act. The data is organized in six related files - Explore, Comment, Map, Trench, Bulk and Borehole. There is a 3-year confidential period for coal exploration assessment reports and only non-confidential data is publicly available. Distribution policy and administration of the database is currently being established.

| | | | |
|---|---|---|---|
| Host computer: | **PC** | Operating system: | **DOS** |
| Data model: | **Relational** | DBMS: | **dBase** |
| Data size: | **8025** records; **3 MB** | Number of files: | **6** |
| | | Fields per record (maximum/average): | **171/78.** |

**NTS Bibliographic Index** Acronym: **BEDROCK**

Bibliography of BC Geological Survey publications, including author, title, type of publication and map area. The data file is used to publish a map location and author index.

| | | | |
|---|---|---|---|
| Host computer: | **PC** | Operating system: | **DOS** |
| Data model: | **Flat-File** | DBMS: | **dBase** |
| Data size: | **2800** records; **10 MB** | Number of files: | **1** |
| | | Fields per record (maximum/average): | **5/5.** |

**B.C. MINFILE** Acronym: **MINFILE**

MINFILE contains over 11,000 metallic, industrial mineral and coal occurrences for B.C. Each of these occurrences contain 84 data elements describing mineral deposits in terms of geography, geology and economics. The database is used by government, industry and academia for resource management, land-use planning, exploration and research. MINFILE/pc, Version 3.0, a menu-driven data-entry, search and report program for IBM-compatible computers, accesses the database. An exploration and development module is currently in development.

| | | | |
|---|---|---|---|
| Host computer: | **PC** | Operating system: | **DOS** |
| Data model: | **Entity-relationship** | DBMS: | **MINFILE/pc; FoxBASE+/FoxPro** |
| Data size: | **11300** records; **60 MB** | Number of files: | **69** |
| | | Fields per record (maximum/average): | **84/46.** |

**PROPERTY FILE** Acronym: **PROPERTY FILE**

PROPERTY FILE is a library of research material on the mineral occurrences contained in the MINFILE database. The FILE contains news clippings, field notes, company prospectuses, and historical maps, photographs and documents. The FILE is used by government, industry and academia for research. The public has access to view these paper files.

**Geological Field and Analytical Data (Geological Database System)** Acronym: **GSB-GDS**

A dBase relational database contains locations for stations in UTM coordinates, structural measurements, alteration codes, mineralization, rock type and map unit, lists of fossils, age dates, geochemistry and isotopic data. Areas have been mapped at 1:50 000 scale since 1986. Data is not being marketed; available as flat ASCII files on request by interested users.

| | | | |
|---|---|---|---|
| Host computer: | **PC; Notebook PC** | Operating system: | **DOS** |
| Data model: | **Relational** | DBMS: | **GSB-GDS; dBase** |
| Data size: | **30000** records; **20 MB** | Number of files: | **15** |
| | | Fields per record (maximum/average): | **280/50.** |

**B.C. METAL** Acronym: **BCMETAL**

BCMETAL is the historical metal production database for British Columbia. It contains mine location and name, and metal production since 1888. BCMETAL is a proto-type software, written in FoxBase, that allows query by name. location (NTS and Mining Division), year of operation, and metal type produced. Total production for any mine, year or Division may be calculated.

| | | | |
|---|---|---|---|
| Host computer: | **PC** | Operating system: | **DOS** |
| Data model: | **Relational** | DBMS: | **BCMETAL; dBase** |
| Data size: | **1452** records; **8 MB** | Number of files: | **2** |
| | | Fields per record (maximum/average): | **33/25.** |

**Regional Geochemical Survey** Acronym: **RGS**

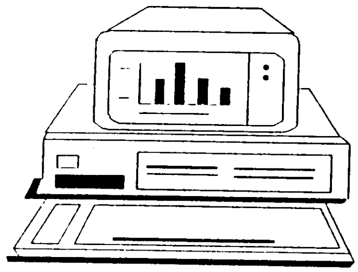
RGS database contains multi-element analytical determinations, sample location information, bedrock associations and field observations of over 38,000 stream sediment and water samples in British Columbia. The database is used for exploration and development activities; geochemical, metallogenic and environment studies; and mineral potential, resource management and land-use projects. Digital data are stored in standard ASCII format.

| | | | |
|---|---|---|---|
| Host computer: | **MacIntosh; PC** | Operating system: | **Mac; DOS** |
| Data model: | **Flat-File** | DBMS: | **ASCII; dBase; .WKS** |
| Data size: | **38000** records; **10 MB** | Number of files: | **1** |
| | | Fields per record (maximum/average): | **62/60.** |

Assessment Report Indexing System

# ARIS

A Mineral Assessment
Report Database
for the Public



## Geological Survey Branch

ARIS History

- 1947 1st Assessment Report
- 1981 IBM 3760 Mark IV
- 1984 NTS mini computer
- 1987 ARIS design starts
- 1987 VAX 780/8650
- 1988 ARIS production
- 1990 20 000th Assessment Report

BaTA Forum 1992

# Geological Survey Branch
## ARIS

- RELATIONAL DATABASE
- ENTITY/RELATIONSHIP MODEL
- 4TH GENERATION LANGUAGE
- 1200 NEW REPORTS ANNUALLY
- 22 000 REPORTS/RECORDS

BaTA Forum 1992

# Geological Survey Integrated Data Base
## Master File Maintenance

01 >General Data
02 >Names (Author Owner Operator)
03 >Geological Summary
04 >Keywords
05 >Work Data
06 >Approval Data
07 >Amend/Reject Data

X > Exits System

Option Number :
Assessment Report Number:

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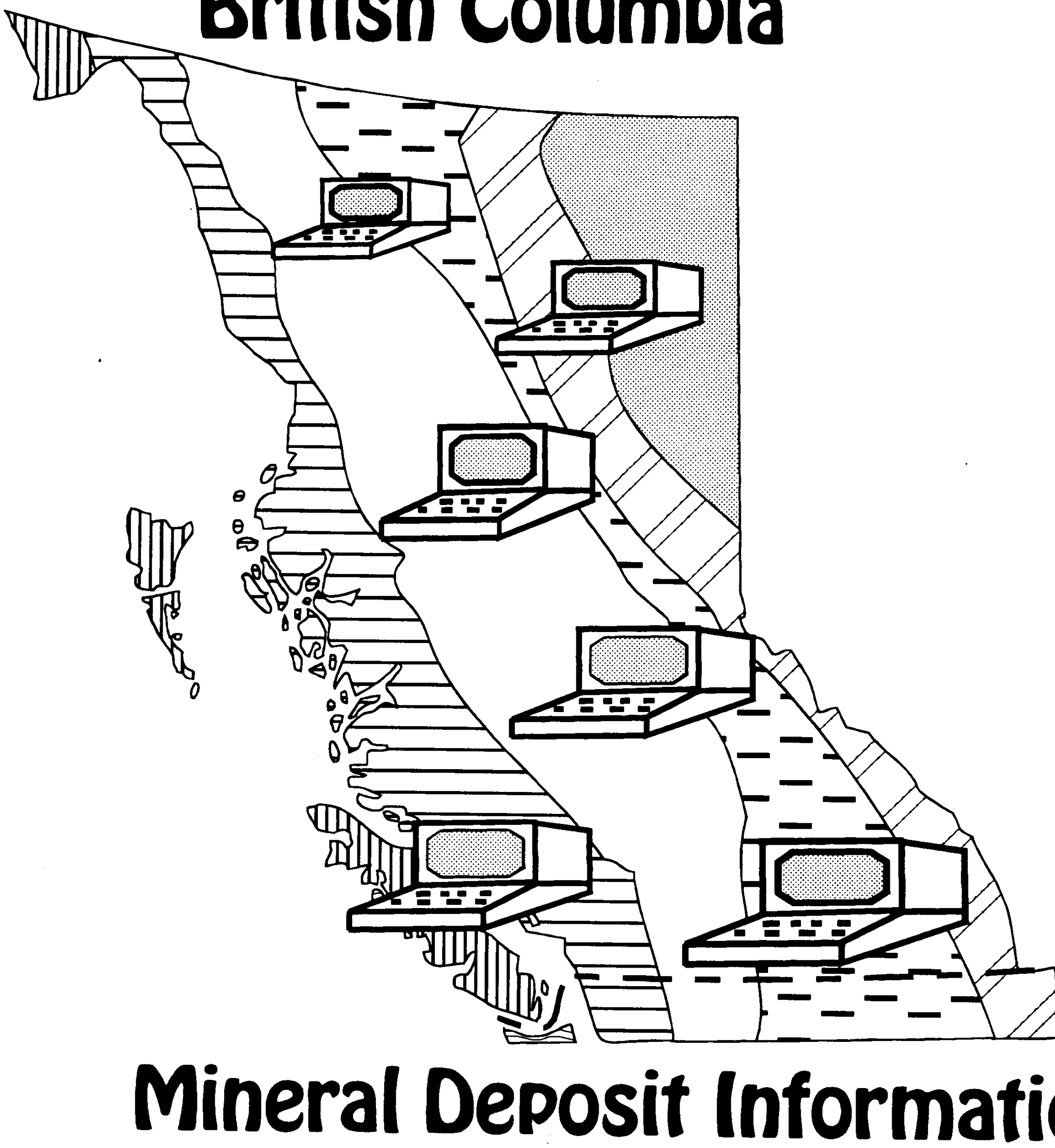
# MINFILE is ...

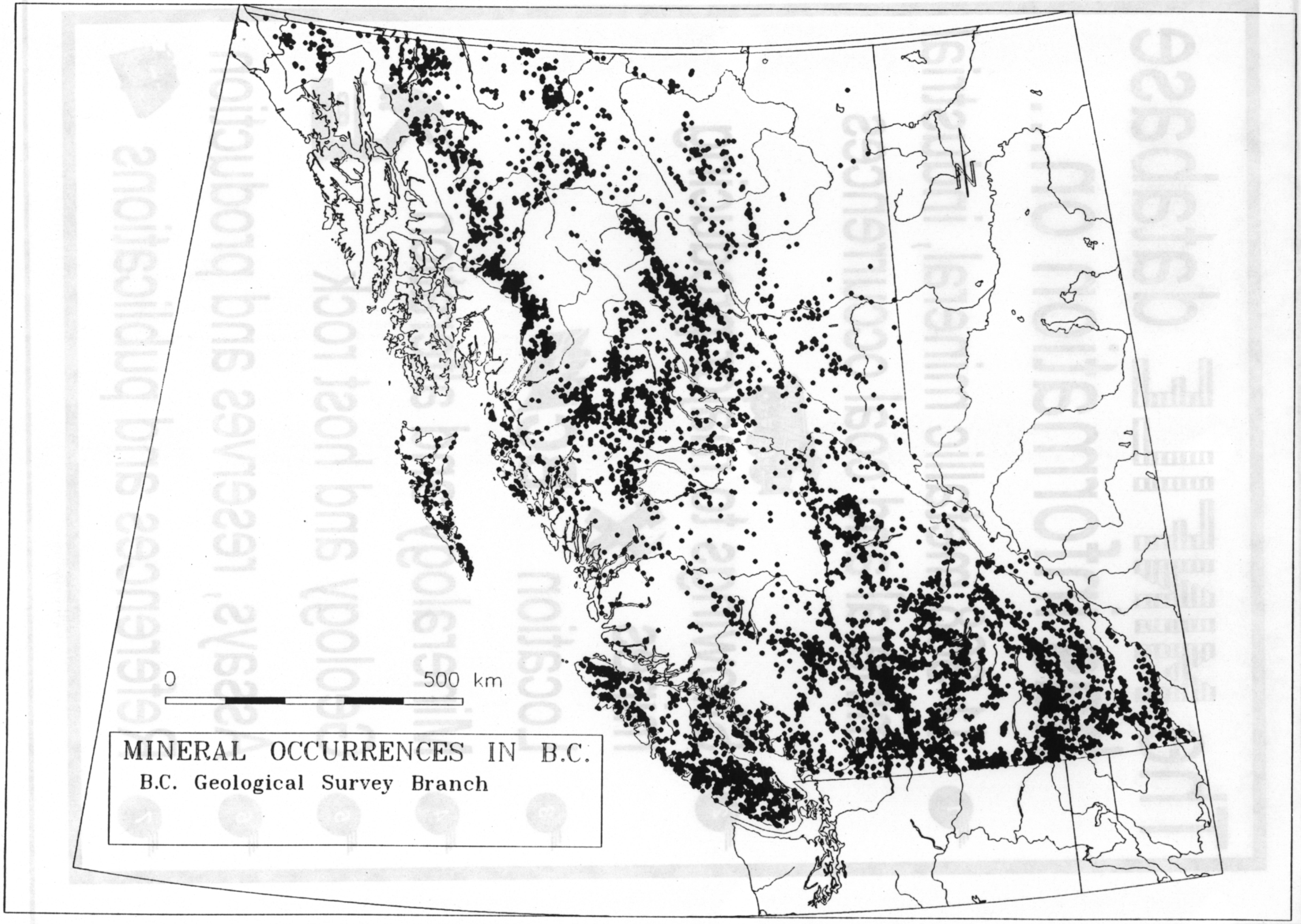
## A powerful mineral inventory and exploration database for British Columbia



## Mineral Deposit Information at YOUR Fingertips!

# The MINFILE database has information on...

1. 11 368 metallic mineral, industrial mineral and coal occurrences
2. Showings to major producing mines
3. Location **BC**
4. Mineralogy and alteration
5. Geology and host rock
6. Assays, reserves and production
7. References and publications


0
500 km
MINERAL OCCURRENCES IN B.C.
B.C. Geological Survey Branch

# MINFILE AT A GLANCE

## DATABASE

Total occurrences: 11 368 records
Size of database: 68 Mb
Area covered (B.C.): 950,000 square kilometres
Map areas (1:250K scale): ~90 Maps
Data format: 69 entity-relational ASCII files
Per cent data released: 75%

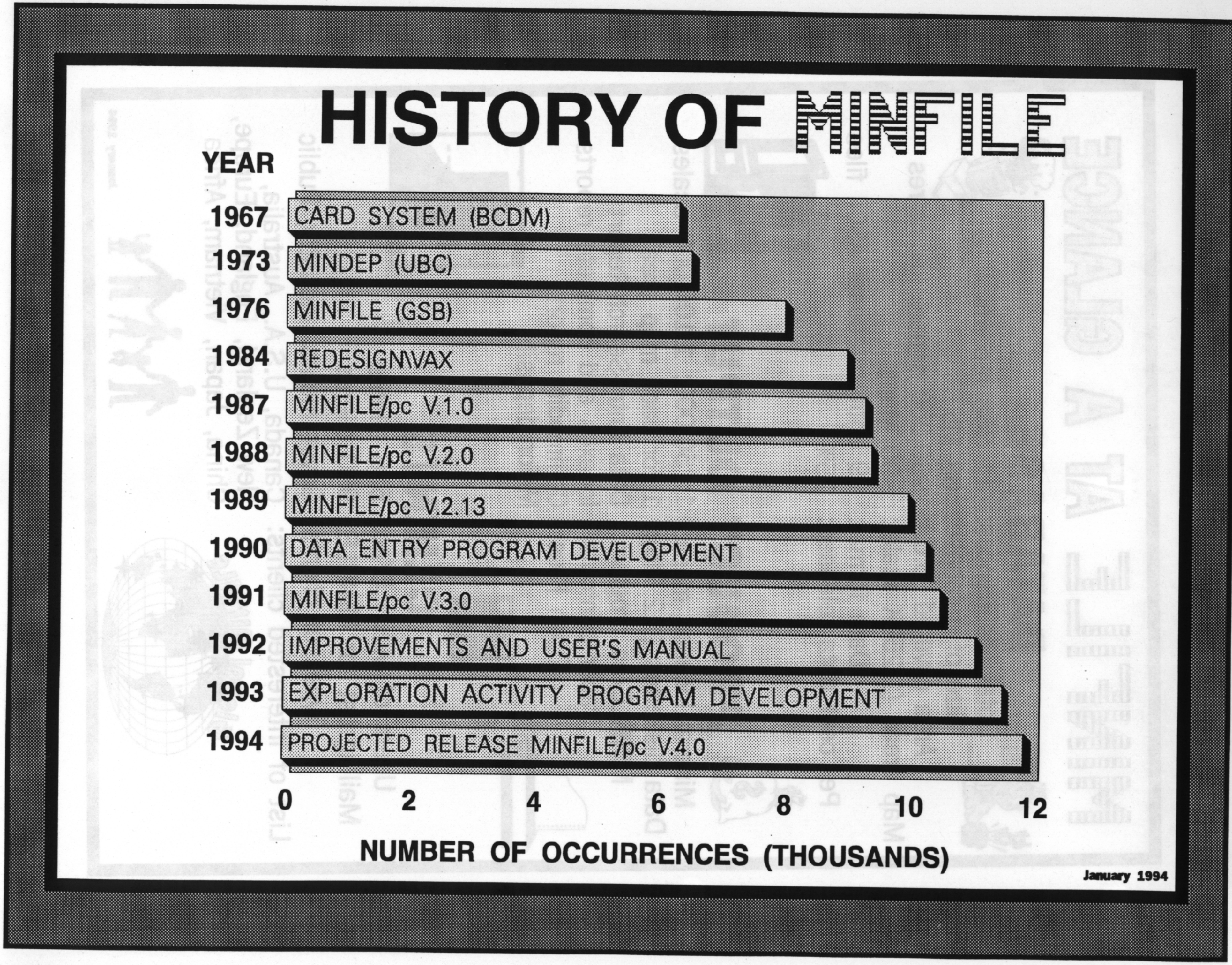
## PRODUCT OUTPUT

Mineral location maps: 1:250,000; 1:100,000 scales
Data diskettes (1.2 Mb): 1 for each map area
MINFILE/pc program: Data Entry-Search-Report
Paper printouts: Indexes and complete reports
Open Files: Commodity reports
Major deposits

## CLIENTS

Users of MINFILE/pc: 536 clients
Mailing list for MINFILE: 950 clients
Types of clients: Governments, Industry, Public
List of interested clients: Canada, U.S.A., Australia, New Zealand, England, Europe, China, Japan, Vietnam, Africa

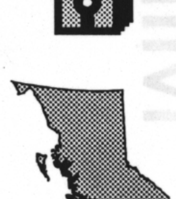

January 1994


HISTORY OF MINFILE
YEAR
1967 CARD SYSTEM (BCDM)
1973 MINDEP (UBC)
1976 MINFILE (GSB)
1984 REDESIGN\VAX
1987 MINFILE/pc V.1.0
1988 MINFILE/pc V.2.0
1989 MINFILE/pc V.2.13
1990 DATA ENTRY PROGRAM DEVELOPMENT
1991 MINFILE/pc V.3.0
1992 IMPROVEMENTS AND USER'S MANUAL
1993 EXPLORATION ACTIVITY PROGRAM DEVELOPMENT
1994 PROJECTED RELEASE MINFILE/pc V.4.0
0
2
4
6
8
10
12
NUMBER OF OCCURRENCES (THOUSANDS)
January 1994

# MINFILE products...

1. 1:250,000 NTS area data diskettes ($5/disk)
2. Paper printouts ($5-$50)
3. Mineral inventory maps by NTS area ($5)

4. Coding manual, custom searches, MINFILE/pc and User's manual (FREE)
5. Provincial MINFILE location index ($5)
6. Open Files: Major Industrial Mineral Deposits, Major Deposits in B.C. ($10)
7. Complete digital dataset of the Province ($75)
8. Complete set of 1992 MINFILE maps for the Province on microfiche ($10)



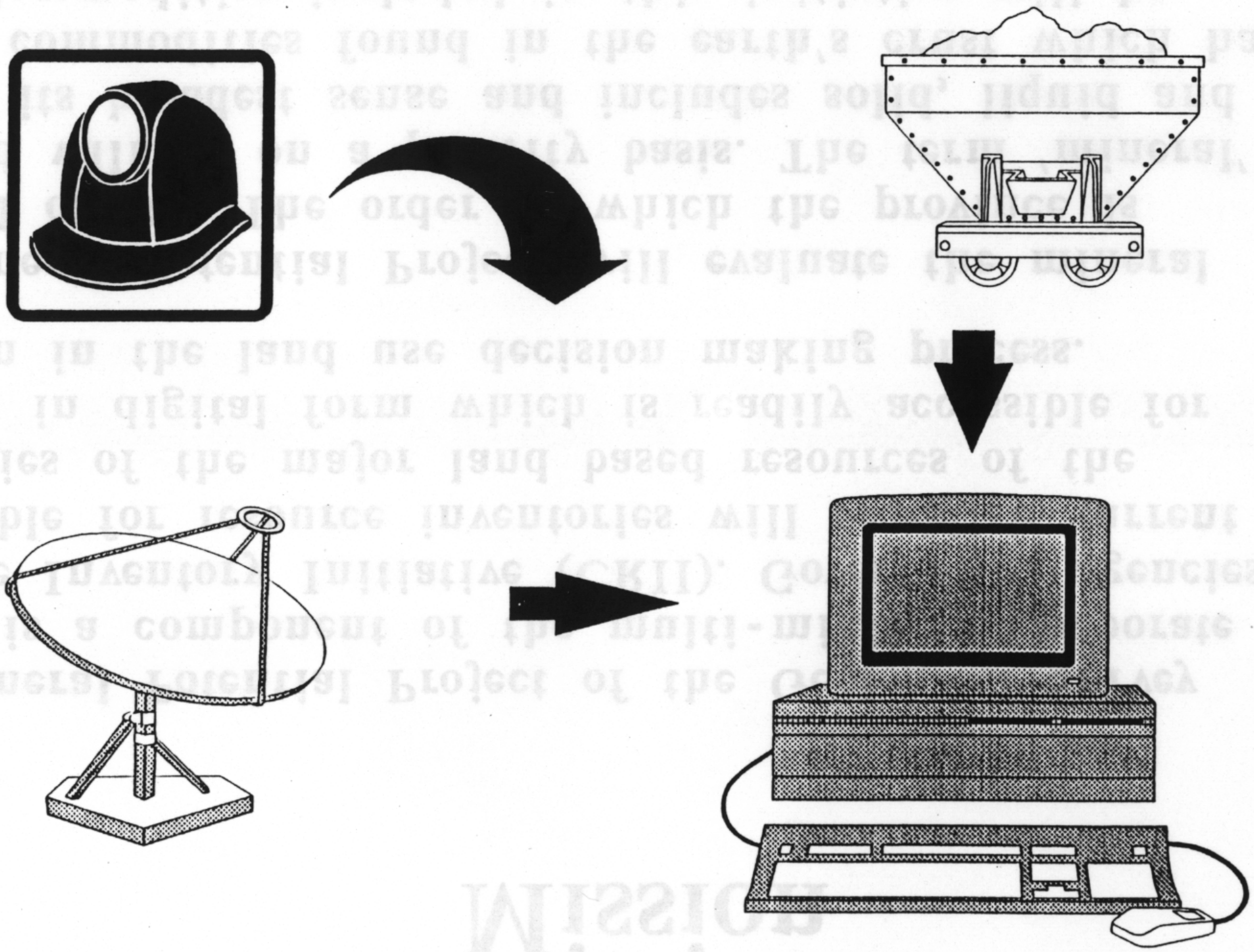
# MINERAL INVENTORY MAPS

## UPGRADES

- *Topographic Base*
- *Geological Base*
- *Sorted Index Reports:*
  - *Commodities*
  - *Name*
  - *Nts*
- *Plot by Status*
- *Computer Plotting*
- *Inserts*

GSB

# Mineral Potential Project



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# Mineral Potential Project Mission

The Mineral Potential Project of the Geological Survey Branch is a component of the multi-ministry Corporate Resource Inventory Initiative (CRII). Government agencies responsible for resource inventories will establish current inventories of the major land based resources of the province in digital form which is readily accessible for inclusion in the land use decision making process.

The Mineral Potential Project will evaluate the mineral potential of BC. The order in which the province is evaluated will be on a priority basis. The term 'mineral' is used in its broadest sense and includes solid, liquid and gaseous commodities found in the earth's crust which have value. Commodities included in this initiative will be metals, industrial minerals, coal, oil and gas.

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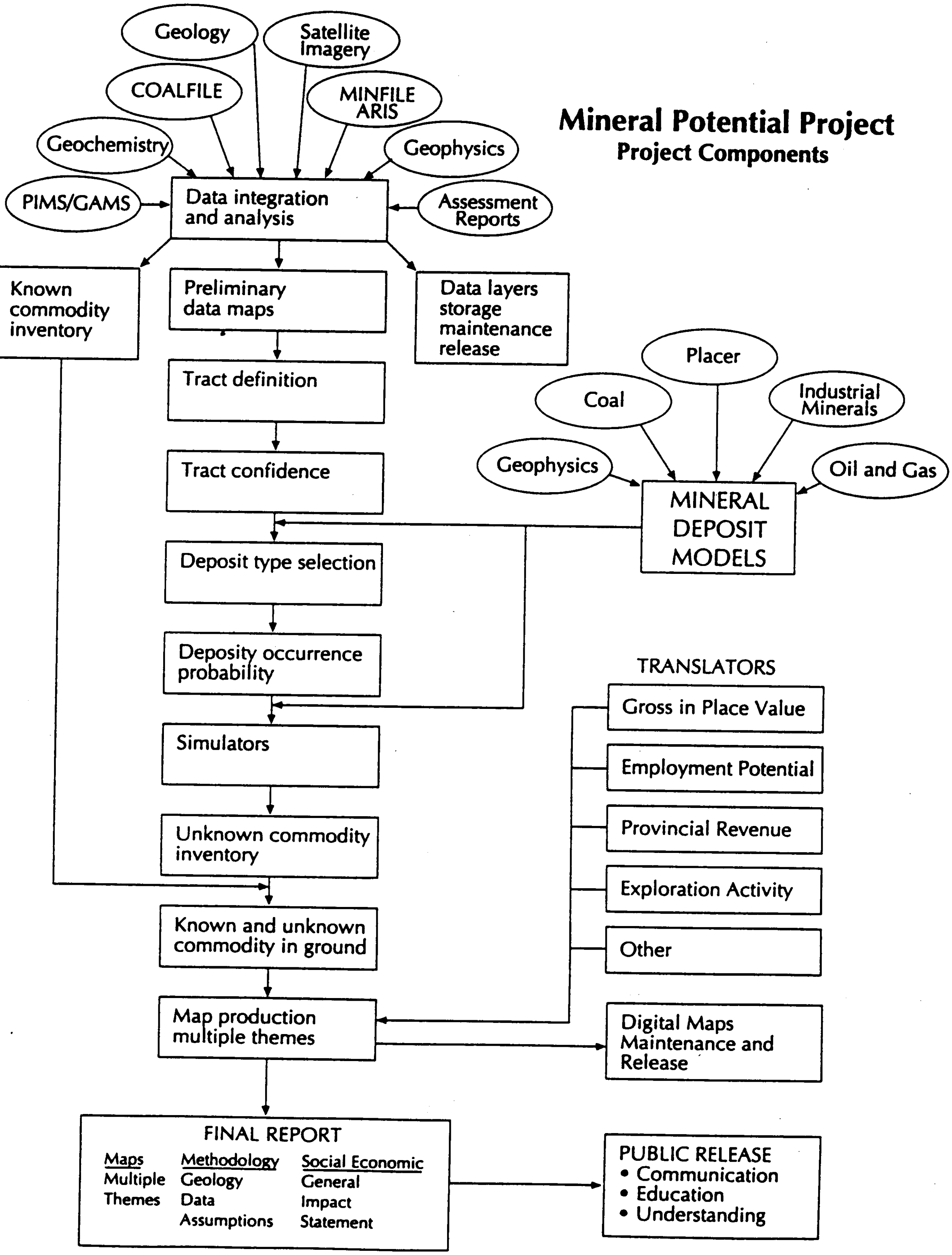
# FIGURE 2




Source: W. Kilby, Geological Survey Branch

# Geological Survey Branch
## Geographical Information System (GIS)

Objectives:

- Resource Management
- Mineral Potential Maps
- Multi-sourced Data Integration
- Land Information Infrastucture

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# Geological Survey Branch
## Geographical Information System (GIS)

Data Integration:

Polygonal Data:
- contours
- geology
- land use
- claim maps
- mineral potential

Linear Data:
- streams
- faults

Point Data:
- structural attributes
- RGS sample data
- MINFILE location
- ARIS location
- TRIM point data

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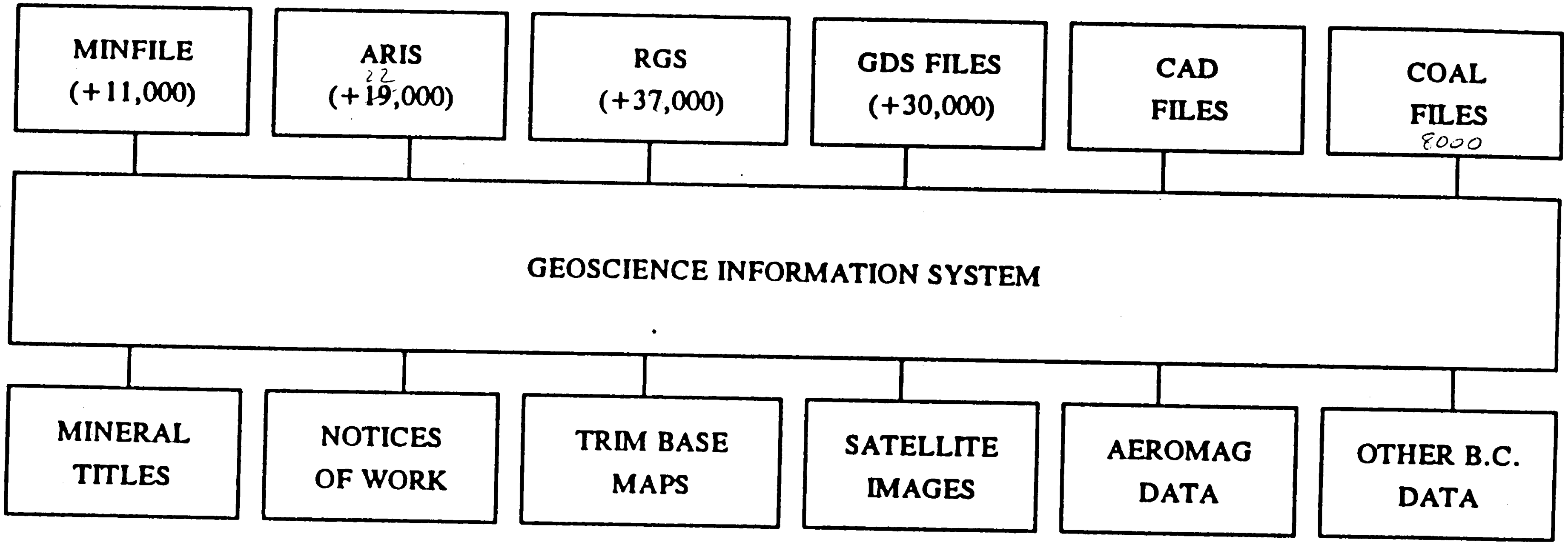


Figure 2. Data sources for a Geoscience Information System using GIS technology. Numbers in brackets indicate number of records in files.

# Geological Survey Branch
# GEOSCIENCE DATABASE DIRECTORY

| | |
|---|---|
| **ARIS** | B.C. Assessment Report Indexing System |
| **BEDROCK** | B.C. Bedrock Geology, 1:50 000 (Geological Database System) |
| **BIBLIOGRAPY** | B.C. GSB Bibliographic Index |
| **COALFILE** | B.C. COALFILE |
| **MINFILE** | B.C. MINFILE |
| **MINPOT** | B.C. Mineral Potential |
| **PROFILES** | B.C. Mineral Deposit Profiles |
| **PROPERTY FILE** | B.C. PROPERTY FILE |
| **RGS** | B.C. Regional Geochemical Survey |
| **SURFICIAL** | B.C. Surficial Geology, 1:50 000 |

# GEOSCIENCE DATABASE DIRECTORY

Geological Survey Branch
Ministry of Energy, Mines and Petroleum Resources
Province of British Columbia, Canada

## B.C. Assessment Report Indexing System **ARIS**

Organization: **BC Ministry of Energy, Mines and Petroleum Resources, Geological Survey Branch, Geoscience Information Section, Assessment Report Unit**

Description: **ARIS is a relational database that is an index and an administrative tracking system to the Geological Survey Branch's Mineral Assessment Report Library of more than 23,000 reports, dating from 1947. About 1000 new reports are added annually.**
**The database is used to display distribution of exploration and development activity, and for research and mineral potential projects.**

Keywords: **Assessment reports; Bibliography; Mineral deposits; Owner, operator, location; Work done, exploration results**

Location: **BC**

Coverage: **All BC; Not uniform** 48° min - 60° max ; 114° min - 140° max
Notes:
Map areas: **82, 92, 102, 83, 93, 103, 94, 104, 114** Scales: **1:20 000 to 1:250 000**
Geographical references: **Lat./Long.; UTMs**
Map projections: **Mercator; Polyconic; Universal Transverse Mercator (UTM)**

Data form: **Digital** Hard copy form: **Map; Text**

Positional accuracy: Positional resolution:
Dimensionality: **F** (depth and/or height measurement used?)
Time span: Date began: **1947** Date end: **Continues** Last revised: **1994**
Data quality: **Encoded for areas only** Data set status: **Operational**
Access: **Restricted** User base: **All**

Host Computer: **VAX 8650 (Mainframe); PC** Operating system: **VMS; DOS**

Data structure (model): **Entity-relationship** Set size: **70 MB**
DBMS used: **SUPRA (Cincom); ASCII; dBASE files** Files: **15**
GIS software: **QUIKMap; AutoCAD; GIS** Records: **23000**
Output formats: **Point Data Flat File; ASCII and .DBF relational files** Fields: **60**
Output media: **Floppy Disk; Paper; Accessible online; Comfiche, Microfiche** Average fields: **40**
Document status: **Partial**

Notes: **A group of fields for each Assessment Report are extracted in 8 ASCII files from the VAX to diskettes. This data may be used on the PC within database management and small mapping projects using QUIKMap software.**
**ARIS disks are $35.00. Five volumes of index maps are $35.00 each. The complete library of 23 000 reports on fiche is $17 000.00.**

Data custodian: **Laura de Groot**
**ARIS Database Manager, Geoscience Information Section**
**Geological Survey Branch**
**BC Ministry of Energy, Mines and Petroleum Resources**
**5th Fl. 1810 Blanshard St., Victoria, B.C., V8V 1X4**
Phone: **(604)952-0387** Fax: **(604)952-0381**

Scientific contact: **Talis E. Kalnins**
**Mineral Inventory Geologist, Assessment Reports**
**Geological Survey Branch**
**BC Ministry of Energy, Mines and Petroleum Resources**
**5th Fl. 1810 Blanshard St., Victoria, B.C., V8V 1X4**
Phone: **(604)952-0385** Fax: **(604)952-0381**

Completed by: **Laura de Groot, ARIS Database Manager**
Phone: **(604)952-0387** Fax: **(604)952-0381**

Questionnaire completed: 09/20/89 (mm/dd/yy) Data entered: 01/19/94

# GEOSCIENCE DATABASE DIRECTORY

Geological Survey Branch
Ministry of Energy, Mines and Petroleum Resources
Province of British Columbia, Canada

## B.C. Bedrock Geology, 1:50 000 (Geological Database System) BEDROCK

Organization: **BC Ministry of Energy, Mines and Petroleum Resources, Geological Survey Branch, Mapping Section**

Description: **A dBase relational database contains locations for stations in UTM coordinates, structural measurements, alteration codes, mineralization, rock type and map unit, lists of fossils, age dates, geochemistry and isotopic data.**
**Areas have been mapped at 1:50 000 scale since 1986.**

Keywords: **Structural & regional geology; Rock types and alteration; Mineralization; Fossils; Geochemistry and isotopic data**

Location: **BC**

Coverage: **All BC; Uniform in areas** 48° min - 60° max ; 114° min - 140° max
Notes: **Approximately 90 1:50 000 scale sheets have been mapped.**
Map areas: **82, 83, 92, 93, 94, 102, 103, 104, 114** Scales: **1:20 000 to 1:250 000**
Geographical references: **UTMs**
Map projections: **Universal Transverse Mercator (UTM)**

Data form: **Digital** Hard copy form: **Open File Maps**

Positional accuracy: **± 3m** Positional resolution:
Dimensionality: **T** (depth and/or height measurement used?)
Time span: Date began: **1986** Date end: **Continues** Last revised: **1993**
Data quality: **Not encoded but could be obtained** Data set status: **Under development**
Access: **Open to the Public** User base: **All**

Host Computer: **PC; Notebook Computer** Operating system: **DOS**

Data structure (model): **Relational** Set size: **20 MB**
DBMS used: **GSB-GDS; dBASE files** Files: **15**
GIS software: **QUIKMap; AutoCAD; GIS** Records: **30000**
Output formats: **Point Data Flat File; ASCII and .DBF relational files** Fields: **280**
Output media: **Floppy Disk; Paper; Open File Maps** Average fields: **50**
Document status: **Partial**

Notes: **Data is not being marketed. Available as flat ASCII files on request by interested users (user supplies diskettes).**

Data custodian: **Don MacIntyre**
**Head, Mapping Unit**
**Geological Survey Branch**
**BC Ministry of Energy, Mines and Petroleum Resources**
**5th Fl. 1810 Blanshard St., Victoria, B.C., V8V 1X4**
Phone: **(604)952-0440** Fax: **(604)952-0381**

Scientific contact: **D.G. MacIntyre**
**Head, Mapping Unit**
**Geological Survey Branch**
**BC Ministry of Energy, Mines and Petroleum Resources**
**5th Fl. 1810 Blanshard St., Victoria, B.C., V8V 1X4**
Phone: **(604)952-0440** Fax: **(604)952-0381**

Completed by: **D.G. MacIntyre, Head, Mapping Unit**
Phone: **(604)952-0440** Fax: **(604)952-0381**

Questionnaire completed: 10/06/89 (mm/dd/yy) Data entered: 11/20/89

# GEOSCIENCE DATABASE DIRECTORY

Geological Survey Branch
Ministry of Energy, Mines and Petroleum Resources
Province of British Columbia, Canada

## B.C. GSB Bibliographic Index **BIBLIOGRAPY**

Organization: **BC Ministry of Energy, Mines and Petroleum Resources, Geological Survey Branch, Scientific Review**

Description: **Bibliography of BC Geological Survey publications, including author, title, type of publication, NTS map areas and keywords.**

Keywords: **Geoscience information; Author; Bibliography; map; Title; Location; NTS area**

Location: **BC**

Coverage: **All BC; Not uniform** **48°** min - **60°** max ; **114°** min - **140°** max
Notes:
Map areas: **82, 92, 102, 93, 103, 94, 104, 114** Scales: **1:50 000 to 1:2 000 000**
Geographical references: **NTS Map sheets**
Map projections: **Mercator; Lambert Conformal; Polyconic; Stereographic; Universal Tranverse Mercator (UTM)**

Data form: **Digital** Hard copy form: **Paper**

Positional accuracy: Positional resolution:
Dimensionality: **F** (depth and/or height measurement used?)
Time span: Date began: **1874** Date end: **Continues** Last revised: **1994**
Data quality: **Unknown** Data set status: **Developed**
Access: **Open to the Public** User base: **Academia; Government; Industry**

Host Computer: **PC** Operating system: **DOS**

Data structure (model): **Relational** Set size: **10 MB**
DBMS used: **dBASE files** Files: **3**
GIS software: **No** Records: **2809**
Output formats: **ASCII; .DBF; .XLS** Fields: **57**
Output media: **Floppy Disk; Paper (Information Circular)** Average fields: **35**
Document status: **Not available**

Notes: **The data file is used to publish a map location and author index. A diskette ($5.00) is available as Open File 1994-13, Digital Bibliographic Index of B.C. Geological Survey Branch Publications 1874-1993.**

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Questionnaire completed: 01/18/94 (mm/dd/yy) Data entered: 01/18/94

# GEOSCIENCE DATABASE DIRECTORY

Geological Survey Branch
Ministry of Energy, Mines and Petroleum Resources
Province of British Columbia, Canada

## B.C. COALFILE

**COALFILE**

Organization: **BC Ministry of Energy, Mines and Petroleum Resources, Geological Survey Branch, Geoscience Information Section**

Description: **COALFILE is a index of over 800 coal assessment reports dating from before 1900. The reports are submitted by exploration companies in compliance with the Coal Act. COALFILE also functions as a statistical record of exploration activity.**
**The data are organized in 6 related files: Borehole, Bulk, Comment, Explore, Map and Trench.**

Keywords: **Coal Assessment Reports; Borehole data; Map Information; Exploration data; Trench, adit or pit data**

Location: **BC**
Coverage: **All BC; Not uniform** **48° min - 60° max ; 114° min - 140° max**
Notes:
Map areas: **82, 92, 102, 93, 103, 94, 104, 114** Scales:
Geographical references: **UTMs**
Map projections: **Universal Transverse Mercator (UTM)**

Data form: **Digital** Hard copy form: **Text**
Positional accuracy: **±2-3 m for Boreholes** Positional resolution:
Dimensionality: **T** (depth and/or height measurement used?)
Time span: Date began: **<1900** Date end: **Continues** Last revised: **1991**
Data quality: **Not encoded but could be obtained** Data set status: **Operational**
Access: **Open to the Public** User base: **Industry; Government; Academia**

Host Computer: **PC** Operating system: **DOS**

Data structure (model): **Relational** Set size: **3.2 MB**
DBMS used: **dBASE files** Files: **6**
GIS software: **No** Records: **up to 8025**
Output formats: **Point Data Flat File; ASCII and .DBF relational files** Fields: **171**
Output media: **Floppy Disk; Paper** Average fields: **78**
Document status: **Partial**

Notes: **Data file (fields/records): Borehole (46/8025); Bulk (28/454); Comment (9/608); Explore (44/773); Map (39/852); and Trench (31/3323). COALFILE products include paper copy ($10.00), fiche ($5.00) and disks on request.**
**The Coal Assessment Report library of 800 reports is available on microfiche (7000 fiche) for $4500.00.**

Data custodian: **Alex Matheson**
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Scientific contact: **Alex Matheson**
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Questionnaire completed: 01/18/94 (mm/dd/yy) Data entered: 01/18/94

# GEOSCIENCE DATABASE DIRECTORY

Geological Survey Branch
Ministry of Energy, Mines and Petroleum Resources
Province of British Columbia, Canada

## B.C. MINFILE **MINFILE**

Organization: **BC Ministry of Energy, Mines and Petroleum Resources, Geological Survey Branch, Geoscience Information Section, MINFILE Unit**

Description: **MINFILE contains over 11,350 metallic, industrial mineral and coal occurrences for B.C. Each of these occurrences contain 84 data elements describing mineral deposits in terms of geography, geology and economics.**

**The database is used by government, industry and academia for resource management, land-use planning, exploration and research.**

Keywords: **Metallic & Industrial minerals; Bibliography; Mineral deposits; Location, geology, rock types; Reserves, production**

Location: **BC**

Coverage: **All BC; Not uniform** 48° min - 60° max ; 114° min - 140° max
Notes: **About 85% of the data have been coded; 75% of the data or 73 of the 105 (1:100 000 and 1:250 000 scales) map areas have been released.**
Map areas: **82, 92, 93, 94, 103, 104, 114** Scales: **1:50 000 to 1:250 000**
Geographical references: **Lat./Long.; UTMs**
Map projections: **Universal Transverse Mercator (UTM); NAD 27**

Data form: **Digital** Hard copy form: **Reports and Maps**

Positional accuracy: **500 meters** Positional resolution: **500 meters**
Dimensionality: **T** (depth and/or height measurement used?)
Time span: Date began: **1967** Date end: **Continues** Last revised: **1994**
Data quality: **Encoded with each data value** Data set status: **Under development**
Access: **Open to the Public** User base: **All**

Host Computer: **PC** Operating system: **DOS**

Data structure (model): **Entity-Relationship** Set size: **70 MB**
DBMS used: **MINFILE/pc; FoxBASE+/FoxPro** Files: **69**
GIS software: **QUIKMap; AutoCAD; GIS** Records: **11368**
Output formats: **Point Data Flat File; ASCII and .DBF relational files** Fields: **84**
Output media: **Floppy Disk; Paper; Maps; Custom Queries; Open Files** Average fields: **46**
Document status: **Complete**

Notes: **MINFILE/pc, Version 3.0, a menu-driven data-entry, search and report program for IBM-compatible computers, accesses the database. An exploration and development module is currently in development.**

**MINFILE data are available as printouts, hardcopy maps (101 maps are on fiche at $10.00) and disks (complete data is on 15 disk at $75.00).**

Data custodian: **Cindy McPeek**
**MINFILE Database Manager, Geoscience Information Section**
**Geological Survey Branch**
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Scientific contact: **Larry Jones**
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Questionnaire completed: 01/18/94 (mm/dd/yy) Data entered: 01/18/94

# GEOSCIENCE DATABASE DIRECTORY

Geological Survey Branch
Ministry of Energy, Mines and Petroleum Resources
Province of British Columbia, Canada

## B.C. Mineral Potential **MINPOT**

Organization: **BC Ministry of Energy, Mines and Petroleum Resources, Geological Survey Branch, Mineral Potential Project**

Description: **A series of geological map compilations, at a 1:250 000 scale, in digital (.dxf) format. These accurate geological base maps are useful to researchers and mineral exploration personnel who are working with computer systems.**

Keywords: **Geological contacts and units** **Structural features**

Location: **BC**

Coverage: **All BC; Uniform in areas** 48° min - 60° max ; 114° min - 140° max
Notes: **41 of the 88 map areas (1:250 000 scale) have been released.**
Map areas: **82, 83, 92, 93, 102, 103, 104** Scales: **1:250 000**
Geographical references: **NTS**
Map projections: **Universal Transverse Mercator (UTM)**

Data form: **Digital** Hard copy form: **Map; Text**

Positional accuracy: **1:100 000** Positional resolution:
Dimensionality: **F** (depth and/or height measurement used?)
Time span: Date began: **1992** Date end: **Continues** Last revised: **1994**
Data quality: **Not encoded but could be obtained** Data set status: **Operational**
Access: **Open to the Public** User base: **Academia; Government; Industry**

Host Computer: **PC** Operating system: **DOS**

Data structure (model): **Line/Polygonal** Set size:
DBMS used: **AutoCAD** Files:
GIS software: **AutoCAD; Terrasoft** Records: **59-123**
Output formats: **AutoCad data exchange format (.DXF)** Fields: **68**
Output media: **Floppy Disk; Maps** Average fields: **60**
Document status: **Partial**

Notes: **The digital files comprise: polylines of geological contacts and structural features; polygons of geological units; labels for geological units; NTS 1:50 000 map sheet grid reference lines; geological legend as a text file; metadata descriptor file.**
**Open File packages ($25.00) contain disks, map, legend and notes. Each package contains 8 to 11 NTS map areas.**

Data custodian: **Ward Kilby**
**Manager, Mineral Potential Project**
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Scientific contact: **Eric Grunsky**
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Questionnaire completed: 01/20/94 (mm/dd/yy) Data entered: 01/20/94

# GEOSCIENCE DATABASE DIRECTORY

Geological Survey Branch
Ministry of Energy, Mines and Petroleum Resources
Province of British Columbia, Canada

## B.C. Mineral Deposit Profiles **PROFILES**

Organization: **BC Ministry of Energy, Mines and Petroleum Resources, Geological Survey Branch, Economic Geology Section**

Description: **The Mineral Deposit Profiles database is a table of deposit types and standard descriptions found in British Columbia. Global and B.C. examples are given.**

Keywords: **Mineral deposits** **Deposit types** **Deposit models**

Location: **BC**

Coverage: **All BC; Not uniform** **48°** min - **60°** max ; **114°** min - **140°** max
Notes: **90 Deposit Profiles exist for B.C.**
Map areas: Scales:
Geographical references:
Map projections: **N/A**

Data form: **Digital** Hard copy form: **Text**

Positional accuracy: **N/A** Positional resolution: **N/A**
Dimensionality: **F** (depth and/or height measurement used?)
Time span: Date began: **1992** Date end: **Continues** Last revised: **1994**
Data quality: **Not encoded but could be obtained** Data set status: **Under development**
Access: **Internal use** User base: **Academia; Government; Industry**

Host Computer: **PC** Operating system: **DOS/Windows**

Data structure (model): **Flat-file** Set size: **0.5 MB**
DBMS used: **Excel and Word for Windows** Files: **95**
GIS software: Records: **155**
Output formats: **ASCII and worksheet** Fields: **10**
Output media: **Floppy Disk; paper** Average fields: **9**
Document status: **Partial**

Notes: **The file is currently being developed and is only available for internal users.**

Data custodian: **Dave Lefebure**
**Manager, Economic Geology Section**
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Scientific contact: **Dave Lefebure**
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Questionnaire completed: 01/20/94 (mm/dd/yy) Data entered: 01/20/94

# GEOSCIENCE DATABASE DIRECTORY

Geological Survey Branch
Ministry of Energy, Mines and Petroleum Resources
Province of British Columbia, Canada

## B.C. PROPERTY FILE

**PROPERTY FILE**

Organization: **BC Ministry of Energy, Mines and Petroleum Resources, Geological Survey Branch, Geoscience Information Section**

Description: **PROPERTY FILE is a library of research material on the approximate 11 000 mineral occurrences contained in the MINFILE database. The FILE contains news clippings, field notes, company prospectuses, and historical maps, photographs and documents. The FILE is used by government, industry and academia for research.**

Keywords: **Metallic & Industrial minerals; Geology, sketch maps; Bibliography; Drill logs; Mineral deposits**

Location: **BC**

Coverage: **All BC; Not uniform** 48° min - 60° max ; 114° min - 140° max
Notes:
Map areas: **82, 92, 93, 94, 103, 104, 114**
Scales: **Range of scales**
Geographical references: **Lat./Long.; UTMs**
Map projections: **Various projections**

Data form: **Paper**
Hard copy form: **Reports and Maps**
Positional accuracy:
Positional resolution:
Dimensionality: **F** (depth and/or height measurement used?)
Time span: Date began: **1940s**
Date end: **Continues**
Last revised: **1993**
Data quality: **Unknown**
Data set status: **Operational**
Access: **Open to the Public**
User base: **All**

Host Computer: **none**
Operating system:

Data structure (model):
DBMS used:
GIS software:
Output formats:
Output media: **Paper; Maps**
Document status: **Partial**

Set size: **50 file cab.**
Files:
Records:
Fields:
Average fields:

Notes: **The public has access to view these paper files.**

Data custodian: **Dorthe Jakobsen**
**Research Geologist, Geoscience Information Section**
**Geological Survey Branch**
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Scientific contact: **Dorthe Jakobsen**
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Questionnaire completed: 09/21/89 (mm/dd/yy)
Data entered: 08/25/93

# GEOSCIENCE DATABASE DIRECTORY

Geological Survey Branch
Ministry of Energy, Mines and Petroleum Resources
Province of British Columbia, Canada

## B.C. Regional Geochemical Survey **RGS**

Organization: **BC Ministry of Energy, Mines and Petroleum Resources, Geological Survey Branch, Environmental Geology Section**

Description: **RGS database contains multi-element analytical determinations, sample location information, bedrock associations and field observations of over 40,000 stream sediment and water samples in British Columbia.**
**Used for exploration and development activities; geochemical, metallogenic and environment studies; and resource management projects.**

Keywords: **Geochemistry; moss mat seds. Sediment & water - stream,lake Elemental values; Location; stream parameters Rock types; formation**

Location: **BC**

Coverage: **All BC; Uniform in areas** **48°** min - **60°** max ; **114°** min - **140°** max
Notes: **46 of the 88 map areas (1:250 000 scale) have been released.**
Map areas: **82, 83, 92, 93, 102, 103, 104 114** Scales: **1:250 000**
Geographical references: **UTMs**
Map projections: **Universal Transverse Mercator (UTM); NAD 27**

Data form: **Digital** Hard copy form: **Map; Text**

Positional accuracy: **1:50 000** Positional resolution:
Dimensionality: **T** (depth and/or height measurement used?)
Time span: Date began: **1976** Date end: **Continues** Last revised: **1993**
Data quality: **Not encoded but could be obtained** Data set status: **Operational**
Access: **Open to the Public** User base: **All**

Host Computer: **PC** Operating system: **DOS**

Data structure (model): **Flat-File** Set size: **10 MB**
DBMS used: **ASCII; dBASE files** Files: **1**
GIS software: **QUIKMap; AutoCAD; GIS** Records: **40 000**
Output formats: **Point Data Flat File** Fields: **80**
Output media: **Floppy Disk; Paper** Average fields: **60**
Document status: **Complete**

Notes: **Digital data are stored in standard ASCII format.**

Data custodian: **Wayne Jackaman**
**Research Officer**
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Questionnaire completed: 01/19/94 (mm/dd/yy) Data entered: 01/19/94

# GEOSCIENCE DATABASE DIRECTORY

Geological Survey Branch
Ministry of Energy, Mines and Petroleum Resources
Province of British Columbia, Canada

## B.C. Surficial Geology, 1:50 000 — SURFICIAL

Organization: **BC Ministry of Energy, Mines and Petroleum Resources, Geological Survey Branch, Environmental Geology Section**

Description: **Surficial Geology maps are currently released in hard copy.**

Keywords:

Location: **BC**

Coverage: **48°** min - **60°** max ; **114°** min - **140°** max
Notes:
Map areas: Scales:
Geographical references:
Map projections: **Universal Transverse Mercator (UTM)**

Data form: **Paper** Hard copy form: **Map**

Positional accuracy: Positional resolution:
Dimensionality: **F** (depth and/or height measurement used?)
Time span: Date began: Date end: Last revised:
Data quality: Data set status: **Under development**
Access: **Internal use** User base: **Academia; Government; Industry**

Host Computer: Operating system:

Data structure (model): Set size:
DBMS used: Files:
GIS software: Records:
Output formats: Fields:
Output media: **Maps** Average fields:
Document status: **Partial**

Notes:

Data custodian: **Paul Matysek**
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Scientific contact: **Peter Bobrowsky**
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Questionnaire completed: 01/19/94 (mm/dd/yy) Data entered: 01/19/94

# 1993-94
# Computer Systems Plan
# Geological Survey Branch

**Contents:**



Prepared by:
Geosystems Advisory Group (L. Jones, Chair)

April 28, 1993

***PERSONAL COMPUTER***
***Hardware Strategy Matrix***

*11-Jun-91*

| Hardware Component | Current Norm DOS | Current Norm APPLE | Recommended Configuration DOS | Recommended Configuration APPLE | Longterm Direction DOS | Longterm Direction APPLE |
|---|---|---|---|---|---|---|
| Central Processing Unit | 80286 | 68030 | 80386 | 68030 | 80486/80586 | 68040/68050 |
| CPU Memory | 1 megabyte | 1 megabyte | 4 megabytes | 8 megabytes | 8 megabytes | 12 megabytes |
| Monitor / Display | EGA | HiRes Mono | VGA | HiRes Color | HDGA | HDGA |
| Backup | Floppy | Floppy | Shared Tape | Shared Tape | Compact Disc | Compact Disc |
| High Speed Disk Storage | 40 megabytes | 40 megabytes | 80 megabytes | 80 megabytes | 200 megabytes | 200 megabytes |
| Low Speed Diskette Stor: | 1 x 5.25 | 1 x 3.5 | 1 x 3.5<br>1 x 5.25 | 1 x 3.5 | 1 x 3.5 | 1 x 3.5 |
| Med. Speed - Compact Di: | === | === | === | === | 1 - gigabyte | 1 - gigabyte |
| Networks | DNET | AppleLink | DNET<br>Local Area Network | AppleLink | Local Area Network<br>MAN | Local Area Network<br>MAN |
| Mouse.....etc | === | Yes | Yes | Yes | Scripting Device | Scripting Device |
| Printer | Deskjet | Personal Laser | Deskjet<br>Network Laser | Personal Laser<br>Network Laser | Personal Laser<br>Network Color Printer | Personal Laser<br>Network Color Printer |
| Energy Comsumption | 900 watts | 1700 watts | 700 watts | 1200 watts | 500 watts | 500 watts |
| Cooling Requirements | 1800 BTU's | 1400 BTU's | 1200 BTU's | 1000 BTU's | 700 BTU's | 700 BTU's |

***PERSONAL COMPUTER***
***Software Strategy Matrix***

APPENDIX: B

*11-Jun-91*

| Business Function | % Use | Currently Used | 1 to 2 Year Strategy | 3 to 5 Year Strategy |
|---|---|---|---|---|
| Operating System | 93% | DOS 3.3 | DOS 5.0/Windows | UNIX/XWindows (Open Systems) |
| | 5% | DOS 3.3/Windows | | |
| | 2% | MacIntosh 6.x | MacIntosh 7.x | |
| Word Processing | 95% | MSWord 5.0+ | Word for Windows | Word / UNIX |
| | 5% | Word for Windows | | |
| Spreadsheet | 80% | Lotus | Excel | Excel / UNIX |
| | 12% | Excel | | |
| | 5% | I.F.P.S. | I.F.P.S. (When required) | |
| | 2% | Supercalc | | |
| | 1% | Quatro | | |
| DataBase | 40% | FoxBase/FoxPro | OMNIS | OMNIS/UNIX |
| | 55% | DBase III/IV ++ | | |
| | 5% | Symphony | | |
| Communications | | | | |
| - Mini/Mainframe | 85% | Set Host | Pathworks | Pathworks / UNIX |
| | 5% | Telex | | |
| | 3% | Mobius | | |
| | 3% | Mac 240/241 | | |
| | 2% | Procomm | | |
| - Enh. Term. Em. | 3% | Mac 240/241 | DynaComm Mac 241 | Pathworks / UNIX |
| - File Transfer | 90% | Kermit | Pathworks | Pathworks / UNIX |
| | 8% | Mobius | | |
| | 2% | FT Term | | |
| Graphics | | | | |
| -Presentation | 90% | Harvard<br>PowerPoint<br>Impressionist<br>Freelance | PowerPoint | PowerPoint / UNIX |
| - Charting | 90% | Harvard<br>Lotus<br>Excel | Excel | Excel / UNIX |
| - Mapping/GIS | 60% | AutoCAD<br>Quickmap<br>TerraSoft (GIS) | Application Driving | UNIX standard platform |

# Geology & Mineral Resources of British Columbia

## OUTLINE:

Introduction

Tectonic Belts

Metals Distributed by Belts

Mineral Deposit Types

Value of Mineral Output

Operating Mines

Coal Basins and Production

Conclusion

**Lecture by:** V. Preto
15 November 1993

**References:** Geological Survey Branch Publications:
Paper 1991-4
Mineral Market Update, July 1993
Open File 1992-1
Information Circular 1993-1

# MINERAL RESOURCES OF BRITISH COLUMBIA, AN OVERVIEW

SLIDES NOAA # 16,19,20.

B.C. is strategically located on the Pacific Ring of Fire,so called because of the great concentration of earthquackes of magnitude 5.5 or greater which ring the Pacific Ocean. This is a ring of active volcanoes, due to active plate subduction which goes on all around this ocean. Such activity over geologic time has been the reason for B.C.'s geological framework and its world class mineral endowement.

Tha province exactly straddles the North American Cordillera, from the boundary of the Pacific Plate on the west, where subduction is active and mineral deposits are being formed, to the craton on the east. The American Cordillera is the backbone of the Americas, and throughout its length, from Bering Strait on the north to Cape Horn on the south, a distance of some 20,000 kilometres is richly endowed with minerals.B.C.'s rocks, as most cordilleran rocks, are relatively young when compared to shield areas of the world. Most are palaeozoic and younger,but in the central and eastern parts of the province we do have precambrian Hadrynian and Helikian rocks which host significant mineral deposits.

SLIDE Tectonic Belts

From the Pacific Ocean to the Plains,B.C. is divided into five Tectonic Belts and at least seven distinct mountain chains across its southern part.

SLIDE Metals distribution by belts

The distribution of metals is controlled by these belts with the Insular Belt containing mostly Fe,Cu,Zn,Au, and Ni, the Coast Belt some Cu,Au,and Ni, the Intermontane Belt Mo,Cu,Au,Sn, and Hg, the Omineca Belt mostly Ag,Zn,Au,Pb,Sn,W,and U, and the Eastern Belt being the least mineralized with only some Zn,Pb,and Ag.
Most of our coal,as will be seen in another slide,occurs in the great coal basins of the north and south Eatern Belt,with lesser amounts in the Intermontane and Insular belts.

SLIDE Mineral Deposit Types by belts.

This metal distribution is also reflected in the distribution of metallic mineral deposits types,with most skarns and magmatic deposits occurring in the Insular Belt,most massive sulphide deposits in the Coast and Insular belts,most porphyry deposits in the Intermontane Belt and only some in the Coast and Insular belts,most vein and stratabound deposits in the Omineca Belt and only a sprinkling of these last two types of deposits in the Eastern Belt.

Let us now look at the size and type of the province's mineral output.

OVERHEAD Value of mineral output, '91 and '92.

Mining is B.C.'s second largest industry after timber production. Some will argue that now Tourism is #2 ,and this may be so, particularly in terms of the number of people employed. The fact is, however, that every year B.C. produces 2.5 to more than 3 billion dollars worth of coal, metals and a growing number of industrial minerals and structural materials. This industry provides well paying direct jobs to more than 20,000 men and women, and an additional 25,000 to 30,000 related jobs in the supply,service and support sectors.
The average salary in our mines is in excess of $60,000 /yr with considerably higher salaries for certain jobs.

The table shows that our two most important products are copper and coal,with first place being traded between the two depending on world prices. Gold comes third with a total yearly production or roughly 500,000 ounces. Zinc is fourth.Mo,Ag,and Pb are well back on the list. An increasingly important group of products is structural materials,mostly cement and sand & gravel, and a variety of industrial minerals including gypsum,silica,barite,dimension stone, and many others.

OVERHEAD Operating Mines, 1993

These products come from 15 metal mines,8 coal mines,7 industrial minerals mines and a great number of sand&gravel pits throughout the province.

Let us first look at coal.

OVERHEAD Coal Basins

Our most important coal basins are in the Eastern Belt,unfortunatrely a long distance from tide water.Transportation to the ports of Vancouver and Prince Rupert is provided by our two major railways, Canadian National in the north and Canadian Pacific in the south. Most of the eastern coals are Upper Jurassic to Lower Cretaceus ,high quality metallurgical coals, but some which are of lesser quality for coke making, mostly because oxidized, are sold as thermal coals.

The Intermontane Belt coal basins are soft Tertiary coals in the south and extreme north, with two large basins of Cretaceous hard thermal coals,one of which, the Klappan Basin, contains huge deposits of anthracite.There is no production from these basins at this time.

Insular coals are all Cretaceous and thermal, with one producing mine, Quinsam,at the north end of Comox Basin.

OVERHEAD Metallurgical and thermal coal production, 91&92.

Coal production is dominated by metallurgical coal largely exported to Japanese steel mills. The drop in production in the second half of '92 was due to operating problems at some of the largest mines in the southeast coalfields. Thermal coal is a distant second to metallurgical coal in terms of output.

OVERHEAD Metellurgical and thermal coal production, 92&93.

'93 is shaping up to be very similar to '92 with an anticipated output of 14.5-15 million tonnes metallurgical coal and 2-2.5 million tonnes thermal coal.

SLIDES
Six slides showing that our coal mines are large open pit operations.

Let us now turn to the metal sector.

OVERHEAD Value of mineral output,'91&'92.

Copper is the most important metal product,with gold second and Zn,Mo,Ag,and Pb following in that order.

OVERHEAD Tectonic Belts and Prospective Areas.

The bulk of our copper production comes from our large Cu-Mo and Cu-Au porphyry deposits, most of which occur in the Intermontane Belt,with some notable exceptions in the Coast and Insular belts. Current gold production is also significantly related to these deposits. Most of the Zn-Ag-Pb deposits are in the Omineca and Eastern belts and in the Coast and Insular belts.

OVERHEAD Producing Mines.

Our largest mine is Highland Valley Copper,roughly tenth on a world scale.This is a huge and highly efficient mine mill complex which treats 136,000 tonnes of ore per day but also mines an equal amount of waste, for a total of 275,000 tonnes of rock mined every day.Full production at Highland Valley began at the nearby Betlehem mine in 1963 and will continue into the next century.Past production and current reserves at Highland Valley Copper are in excess of 1200 million tonnes grading 0.4 % Cu and 0.01% Mo, with moderate gold and silver values. Other major porphyry copper deposits that are being mined are Gibraltar and Endako,both Cu-Mo, and the Cu-Au deposits at Island Copper, Afton and Copper Mountain.

SLIDES

Three slides to show the size of the highland Valley copper operation.

SLIDE Porphyry Deposit types

Tere are two classes of porphyry deposits in B.C. Those associated with calc-alkalic intrusive rocks and those associated with alkalic intusives.The alkalic deposits tend to be smaller than the calc-alkalic ones, but of higher copper grade and alwys gold rich.

SLIDE Porphyry Cu-Au deposits in B.C.

All alkalic porphyries contain significant gold while only some of the calc-alkalic ones do

SLIDE Three slides showing porphyry models

The main reason for this difference in gold content is not in the chemistry of the host intrusive rock- alkalic vs. calc-alkalic.It is in the depth of formation.
Calc-alkalic porphyries come in two major types. Deeper seated plutonic porphyries, like Highland Valley Copper, are very large masses of intrusive rock which were hydrothermally altered and mineralized entirely within a larger pluton and at a depth of about 5 kilometres below the surface.These are gold poor.
Shallower seated calc-alkalic deposits formed within or around high level, subvolcanic plugs at depths of one to two kilometres from the surface are gold rich. Alteration and mineralization involve both the intrusion and the sedimentary or volcanic host rocks.
The same can be said about alkalic deposits.These are all shallow to subvolcanic in setting,all gold rich, and very complex due to the great number of dykes,plugs and breccia pipes that cut the usually volcanic host rocks.

SLIDE Porphyry Deposit from Chile

In Chile, where the mountains are higher and barren of vegetation,thus affording clearer cross-sections through ore systems,one can actually see in one mountain side the transition between the porphyry system below and the overlying epthermal gold zone in the hosting volcanic and sedimentary rocks.

SLIDE Cordilleran Epithermal Model

In a model such as this, the shallower gold rich porphyries would fit directly below the level of Transitional and Epithermal precious metal systems.

SLIDE Strato Volcano Model.

Stratovolcanoes were the main building block of Cordilleran Island Arcs.In the model of such a system the shallow, gold rich porphyries would fit directly below the cone, at the base of which one would find Transitional and Epithermal systems.

SLIDE Ore Production.

The age of these large producers is Late Triassic to Lower Jurassic.Others, none of which are currently in production, are as young as Early Tertiary. This diagram essentially reflects the age distribution of these deposits,which dominate the provincial metal output.

SLIDE Two slides-Gold Production

Gold is the second most important metal produced in the province.From the beginning of record keeping much of the gold production has come from traditional mesothermal veins, skarns and volcanogenic massive sulphide deposits, with comparatively less from porphyries. This simply because no porphyry deposits were ever mined in B.C. prior to 1962, except for Copper Mountain which at the time was not recognized as a porphyry. If we look at gold production in more recent years,one can then readily see how porphyries dominate the field.

OVERHEAD Lode Gold Production and Reserves

The reserve picture is almost identical, with porphyries holding the largest reserve.Mesothermal veins, which were the most important source of gold earlier in the century continue as an important reserve and source ,as do massive sulphides and a newly recognized type of deposit called Transitionals. Thse are deposits which are bulk mineable or contain compact,higher grade, strongly structurally controlled ore zones and were formed at shallow depths between the porphyry environment and that of epithermal systems.

OVERHEAD Operating Mines, 1993

SLIDE Example of mesothermal vein.

The most important producers of this type earlier in the century were the Bralorne Camp at 4 million ounces and the Rossland Camp at 3 million ounces.The Snip mine , a small but very profitable underground operation in the northwest part of the province, today produces well in excess of 100,000 ounces per year

SLIDE Mesothermal veins genetic model
Using the strato volcano model,mesothermal veins fit at the base of the cone.

SLIDE Gold at Snip

A good deal of the gold at Snip is recovered directly from jigs and shaking tables with the rest coming from a bulk concentrate.

SLIDE Golden Bear

This is a view of the Golden Bear mine,similar but also somewhat different from classic mesothermal veins. The view shows the good vertical continuity that is one important characteristic of this type of veins.

SLIDE Transitional Deposits Model.
Using the strato volcano model,Transitional Deposits fit high, above mesothermal veins.

SLIDE View of Red Mountain

This is an example of a transitional deposit that is under active exploration at this time.This project had in excess of $ 7.5 million spent on it, the largest single exploration project in B.C. in 1993.This work has indicated a resource of about 2 million ounces of gold,highlighting the importance of this type of deposit.

SLIDE AGB vein specimen, Lawyers Mine.

This is a sample of amethyst gold breccia vein material from the Lawyers Mine, a small Au-Ag producer now closed.This mine started operation at 500 tonnes per day in december,1988 with reserves of 1,938,000 tonnes grading 6.72 gpt Au and 243 gpt Ag.It closed late in 1992.

SLIDE Tillicum High Grade

This is a specimen of extremely high grade ore from a small gold skarn known as Tillicum Mountain. There is more than $6,000 worth of gold,or 15-16 ounces in this 63 lb specimen.

SLIDE Afton mine pit.

This is an alkalic Cu-Au porphyry. This pit is now extinguished. It produced 31 million tonnes of ore grading 1% Cu and slightly over 0.5 gpt Au. The orebody is clearly visible in the photograph,and continues at depth beyond the deepest drill holes.This deeper ore may some day be mined by underground methods.

SLIDE View of Afton from the air.

SLIDE Galore Creek.

This is another alkalic Cu-Au porphyry deposit.Located in a very rugged and remote area. Not a mine yet. Reserves are 125 million tonnes grading 1.06% Cu and 0.5 gpt Au.

OVERHEAD Value of mineral production, '91&'92.

Zn,Mo,Ag and Pb are the next most important metallic products.

OVERHEAD Tectonic Belts and Prospective Areas.

Mo comes from Cu-Mo porphyries in the Intermontane Belt.
Zn,Ag and Pb come mainly from two types of deposits: polymetallic volcanogenic massive sulphides in the Insular and Coast belts and clastic hosted massive sulphides in the Omineca and Eastern belts.

OVERHEAD Operating Mines, 1993.

Major producers of Zn, Ag, and Pb are the Sullivan, Myra Falls and Goldstream mines, all massive sulphide deposits.

SLIDE Tectonic environment, massive sulphide deposits.

This diagram models the environment of formation of various types of massive sulphide deposits as related to subduction. Outboard at the oceanic rift where new ocean floor is formed, Cyprus type deposits are formed by black smokers like this ( forward, then back up ) Farther inboard, in sedimentary or volcanic basins, Besshi type deposits like the Goldstream are formed. Further in with high angle faulting and acid volcanic rocks, Volcanogenic Massive Sulphide deposits like Myra Falls occur. Further in yet, in areas of rifted crust clastic hosted massive sulphides like the great Sullivan deposit and carbonate hosted deposits occur.

SLIDE Volcanogenic Massive Sulphide Model

This model shows a heat source, high angle extensional faulting,a basement of mafic volcanics and sediments,and domes of acid volcanics with associated massive sulphides lenses. Myra Falls is an excellent example of this type. As other B.C. deposits of this type it is palaeozoic in age. Past production and current reserves from several distinct ore lenses total approximately 28.7 million tonnes grading 2% Cu,6.4 % Zn,0.6% Pb,2.2 gpt Au and 54 gpt Ag.
Major company sustaining world class deposits are of this type,like the great Kidd Creek deposit at Timmins, Ontario.Typically there are several ore lenses at one or two distinct stratigraphic levels.

SLIDE Proterozoic Metallogeny, Sullivan area.

This slide shows the setting of the great Sullivan deposit, a clastic hosted massive sulphide deposit. It shows a sedimentary basin rifted by extensional growth faults, and the location of mineral deposits close to these faults.

SLIDE Cross-section of basin.

A cross- section more clearly shows the growth faults and how the mineral deposits relate to them.

SLIDE Cross-section Sullivan Deposit

This slide shows a section of the deposit, its source or root , its stratabound nature and resulting great lateral continuity.Sullivan is a major world class company sustaining deposit.It has been in continuous production since the turn of the century. ~~It~~s discovery was the main stimulus for the settling of the southeastern part of our province.It also started a major company, Consolidated Mining And Smelting, now known the world over as Cominco. The trail Smelter was built to treat Sullivan ore and the southern rail line was built to transport ore and coal from the nearby coalfields to the smelter. The city of Kimberley was built at the minesite and to this day depends primarily on the mine for its existence. Sullivan past production and current reserves total more than 150 million tonnes grading 5.55% Zn,5.8% Pb and 63 gpt Ag.

CONCLUSION.

British Columbia has a wonderful mineral endowement largely due to its strategic location across the American Cordillera, the 20,000 km long backbone of the Americas.

SLIDE The country is rugged.The geology is complex and engineering and transportation problems are very challenging, but the prizes are there to be found. This is why mining is B.C. second most important industry.

SLIDE Gold crystal.

V.A.Preto. November,1993.

# # # # #

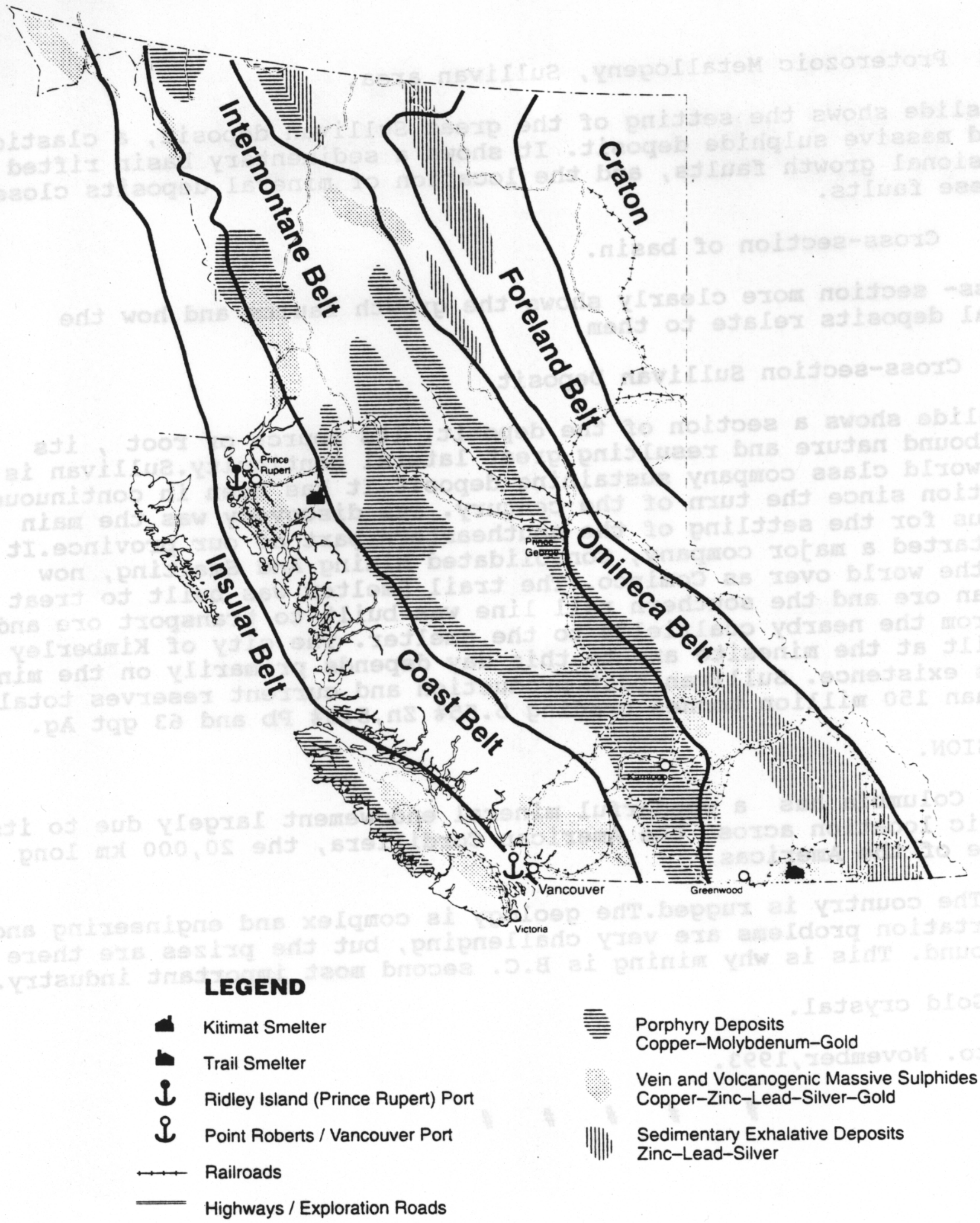


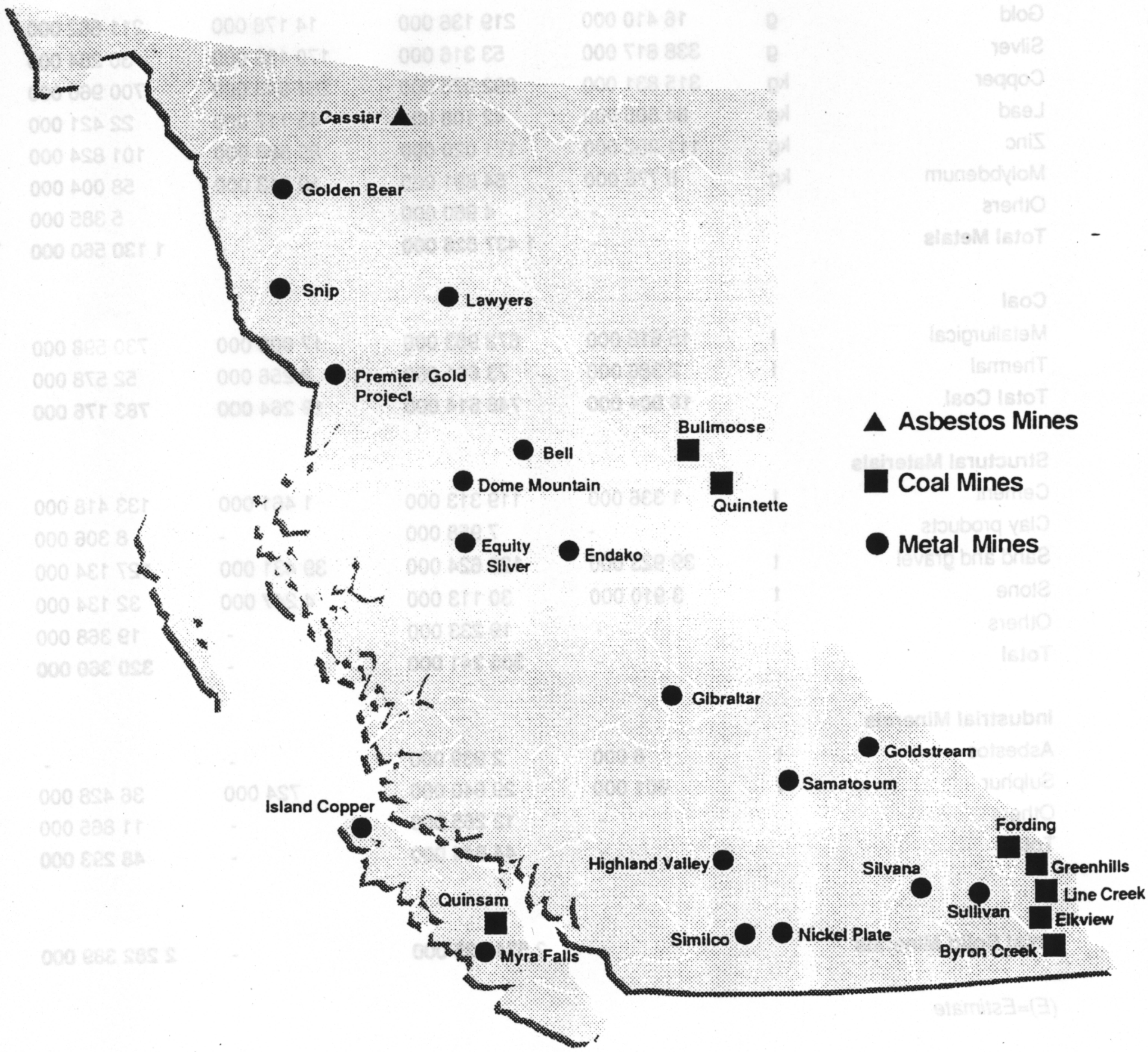

**Figure 4**
**Tectonic Belts and Prospective Areas**

# B.C. MINERAL PRODUCTION 1992 - 1993

| | Units | 1992 Quantity | 1992 Value $ | 1993 (E) Quantity | 1993 (E) Value $ |
|---|---|---|---|---|---|
| **Metals** | | | | | |
| Gold | g | 16 410 000 | 219 136 000 | 14 178 000 | 211 682 000 |
| Silver | g | 338 817 000 | 53 316 000 | 170 133 000 | 30 284 000 |
| Copper | kg | 315 831 000 | 892 075 000 | 284 943 000 | 700 960 000 |
| Lead | kg | 64 505 000 | 42 108 000 | 43 117 000 | 22 421 000 |
| Zinc | kg | 111 202 000 | 171 020 000 | 80 586 000 | 101 824 000 |
| Molybdenum | kg | 8 776 000 | 54 891 000 | 10 013 000 | 58 004 000 |
| Others | | - | 4 980 000 | - | 5 385 000 |
| **Total Metals** | | - | **1 437 526 000** | - | **1 130 560 000** |
| **Coal** | | | | | |
| Metallurgical | t | 15 618 000 | 672 953 000 | 17 008 000 | 730 598 000 |
| Thermal | t | 2 386 000 | 73 661 000 | 2 256 000 | 52 578 000 |
| **Total Coal** | | **18 004 000** | **746 614 000** | **19 264 000** | **783 176 000** |
| **Structural Materials** | | | | | |
| Cement | t | 1 336 000 | 119 313 000 | 1 461 000 | 133 418 000 |
| Clay products | | - | 7 958 000 | - | 8 306 000 |
| Sand and gravel | t | 39 923 000 | 128 624 000 | 39 431 000 | 127 134 000 |
| Stone | t | 3 910 000 | 30 113 000 | 4 247 000 | 32 134 000 |
| Others | | - | 19 233 000 | - | 19 368 000 |
| **Total** | | - | **305 241 000** | - | **320 360 000** |
| **Industrial Minerals** | | | | | |
| Asbestos | t | 6 000 | 2 939 000 | - | - |
| Sulphur | t | 601 000 | 29 640 000 | 724 000 | 36 428 000 |
| Others | | - | 12 265 000 | - | 11 865 000 |
| **Total** | | - | **44 844 000** | - | **48 293 000** |
| **Total Solid Minerals** | | - | **2 534 225 000** | - | **2 282 389 000** |

*(E)=Estimate*

# MAJOR OPERATING MINES IN BRITISH COLUMBIA 1992 AND 1993




Mines operating during 1992 or 1993 are shown above.
Names are as of the year reported

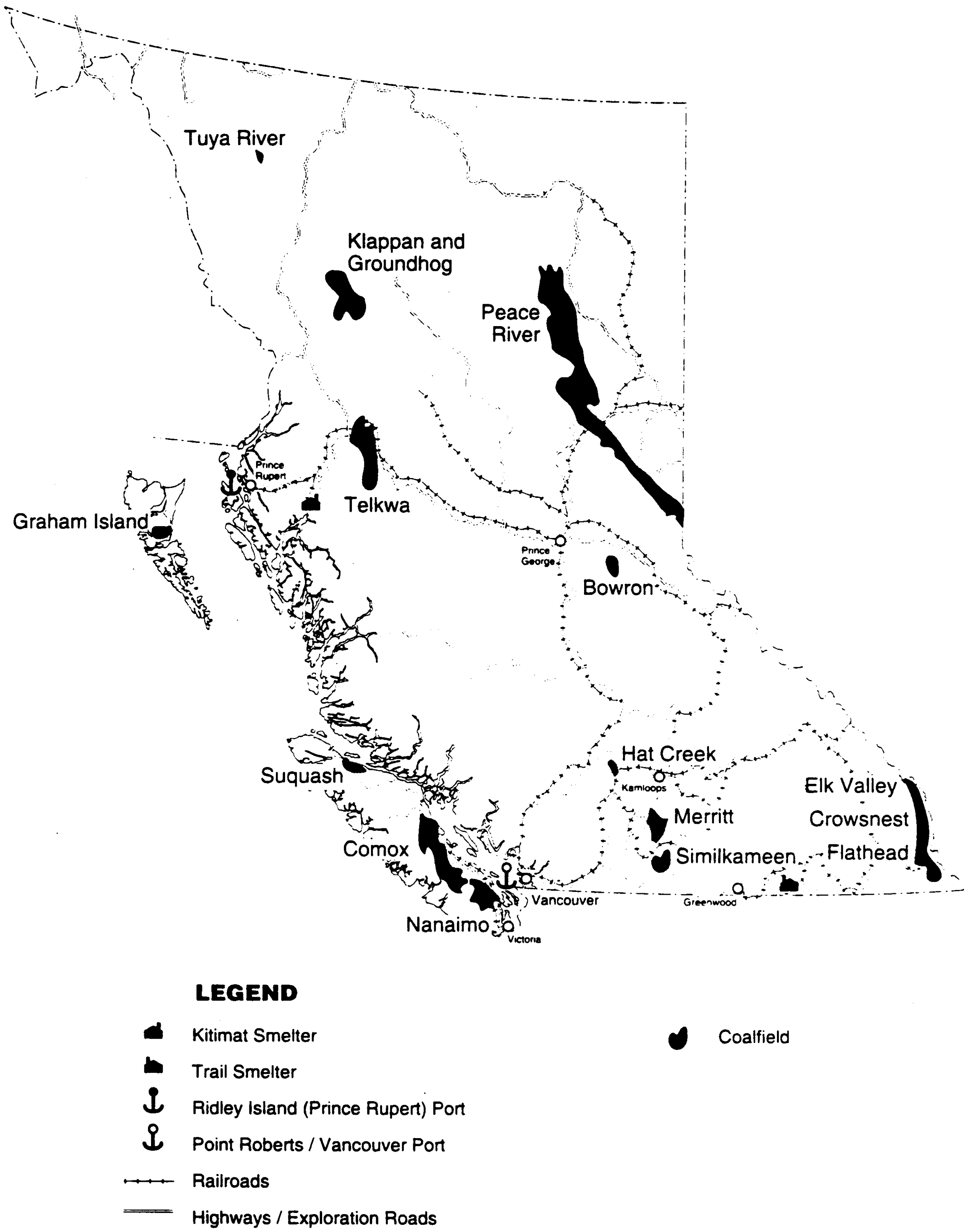


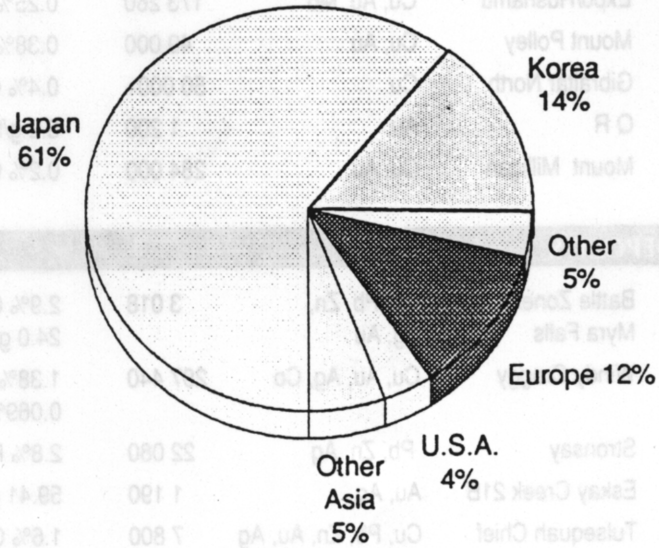

**Figure 6**
**Coalfields in British Columbia**

# B.C. CLEAN COAL SOLD AND USED
# 1980 - 1993

| Year | Metallurgical Quantity t | Metallurgical Value $ | Thermal Quantity t | Thermal Value $ | Total Quantity t | Total Value $ |
|---|---|---|---|---|---|---|
| 1980 | 9 654 000 | 423 128 000 | 1 169 000 | 38 365 000 | 10 824 000 | 461 493 000 |
| 1981 | 10 812 000 | 518 428 000 | 941 000 | 35 844 000 | 11 753 000 | 554 271 000 |
| 1982 | 8 400 000 | 487 005 000 | 2 246 000 | 79 874 000 | 10 646 000 | 566 878 000 |
| 1983 | 9 317 000 | 491 950 000 | 2 163 000 | 63 839 000 | 11 480 000 | 555 789 000 |
| 1984 | 16 302 000 | 895 175 000 | 4 437 000 | 112 344 000 | 20 740 000 | 1 007 520 000 |
| 1985 | 17 767 000 | 899 930 000 | 4 845 000 | 128 387 000 | 22 613 000 | 1 028 317 000 |
| 1986 | 16 690 000 | 828 539 000 | 4 147 000 | 105 875 000 | 20 837 000 | 934 414 000 |
| 1987 | 18 020 000 | 801 967 000 | 4 567 000 | 90 555 000 | 22 587 000 | 892 522 000 |
| 1988 | 21 685 000 | 909 405 000 | 3 128 000 | 69 407 000 | 24 813 000 | 978 812 000 |
| 1989 | 21 945 000 | 908 009 000 | 3 190 000 | 92 589 000 | 25 134 000 | 1 000 598 000 |
| 1990 | 21 346 000 | 896 051 000 | 3 021 000 | 83 806 000 | 24 366 000 | 979 857 000 |
| 1991 | 21 773 000 | 854 784 000 | 3 075 000 | 83 052 000 | 24 848 000 | 937 836 000 |
| 1992 | 15 618 000 | 672 953 000 | 2 476 000 | 76 542 000 | 18 094 000 | 749 495 000 |
| 1993(E) | 17 008 000 | 730 598 000 | 2 256 000 | 52 578 000 | 19 264 000 | 783 176 000 |

(E) = Estimate

## MARKETS FOR METALLURGICAL COAL 1992




## B.C. Metallurgical Coal Sales By Destination

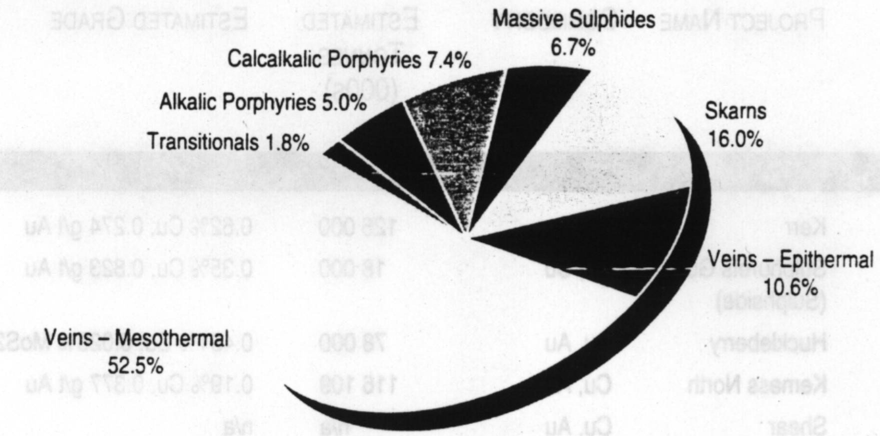
| | Thousand Tonnes | % of Total Sales | | Thousand Tonnes | % of Total Sales |
|---|---|---|---|---|---|
| Japan | 9 376 | 61.1% | Turkey | 68 | 0.4% |
| Korea | 2 185 | 14.2% | Belgium | 54 | 0.4% |
| Taiwan | 660 | 4.3% | Egypt | 46 | 0.3% |
| U.K. | 641 | 4.2% | Canada | 47 | 0.3% |
| U.S.A. | 560 | 3.6% | Pakistan | 44 | 0.3% |
| Portugal | 154 | 1.0% | | | |
| Brazil | 350 | 2.3% | **Total Sales** | 15 353 | 100.0% |
| France | 276 | 1.8% | | | |
| Netherlands | 274 | 1.8% | To Other B.C. Producers | 255 | |
| Spain | 267 | 1.7% | Adjustments/Purchases | (43) | |
| Chile | 95 | 0.6% | **Total Net Sales** | 15 565 | |
| Iran | 95 | 0.6% | | | |
| Italy | 89 | 0.6% | Used at mines | 53 | |
| Denmark | 72 | 0.5% | **Total Sold & Used** | 15 618 | |

| Company Name | Project Name | Commodity | Estimated Tonnes (000s) | Estimated Grade |
|---|---|---|---|---|
| **Porphyry deposits** | | | | |
| Taseko Mines Ltd. | Fish Lake | Cu, Au | 1 080 000 | 0.23% Cu, 0.41 g/t Au |
| El Condor Resources Ltd. | Kemess South | Cu, Au | 207 000 | 0.23% Cu, 0.64 g/t Au |
| St Philips Resources Inc. | | | | |
| Jordex Resources Inc. | Expo/Hushamu | Cu, Au, Mo | 173 260 | 0.25% Cu, 0.31 g/t Au, 0.01% Mo |
| Imperial Metals Corp. | Mount Polley | Cu, Au | 49 000 | 0.38% Cu, 0.55 g/t Au |
| Gibraltar Mines Ltd. | Gibraltar North | Cu | 50 000+ | 0.4% Cu |
| CMP Resources Ltd. | Q R | Au | 1 200 | 5.2 g/t Au |
| Placer Dome Inc. | Mount Milligan | Cu, Au | 284 000 | 0.2% Cu, 0.58 g/t Au |
| **Massive Sulphide deposits** | | | | |
| Westmin Resources Ltd. | Battle Zone/ Myra Falls | Cu, Pb, Zn, Ag, Au | 3 018 | 2.9% Cu, 0.4% Pb, 14.0% Zn, 24.0 g/t Ag, 1.0 g/t Au |
| Geddes Resources Ltd. | Windy Craggy | Cu, Au, Ag, Co | 297 440 | 1.38% Cu, 0.2 g/t Au, 3.83 g/t Ag, 0.069% Co |
| Curragh Resources Ltd | Stronsay | Pb, Zn, Ag | 22 080 | 2.8% Pb, 9.4% Zn, 60 g/t Ag |
| Homestake Canada Ltd. | Eskay Creek 21B | Au, Ag | 1 190 | 59.41 g/t Au, 2659.3 g/t Ag |
| Redfern Resources Ltd. | Tulsequah Chief | Cu, Pb, Zn, Au, Ag | 7 800 | 1.6% Cu, 1.18% Pb, 6.47% Zn, 2.74 g/t Au, 109.72 g/t Ag |
| **Transitional & Vein deposits** | | | | |
| Equity Silver Mines Ltd. | North Waterline Zone | Cu, Au, Ag | 750 | 0.68% Cu, 209 g/t Ag 4.18 g/t Au |
| Cheni Gold Mines Ltd. | Mets | Au | 53.5 | 11.62 g/t Au |
| Golden Rule Resources Ltd. | | | | |
| Manson Creek Resources Ltd. | | | | |
| Canarc Resources Corp. | Polaris-Taku | Au | 2 590 | 14.74 g/t Au |
| Suntac Minerals Corp. | | | | |
| Newhawk Gold Mines Ltd. | Brucejack Lake | Au, Ag | 749.3 | 15.43 g/t Au, 647.2 g/t Ag |
| Granduc Gold Mines Ltd. | (Bruceside) | | (West Zone) | |
| Fairfield Minerals Ltd. | Elk | Au | 308.4 | 22.18 g/t Au, 24.68 g/t Ag |

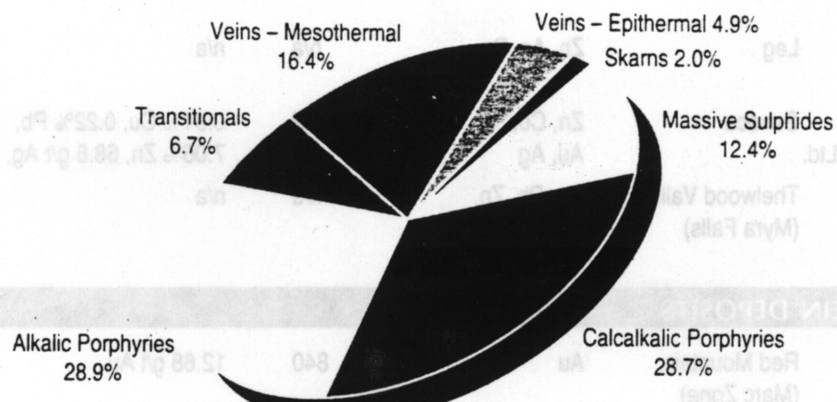
**Table A**
**Advanced Exploration / Development Projects**

| Company Name | Project Name | Commodity | Estimated Tonnes (000s) | Estimated Grade |
|---|---|---|---|---|
| **Porphyry Deposits** | | | | |
| Placer Dome Inc. | Kerr | Cu, Au | 126 000 | 0.62% Cu, 0.274 g/t Au |
| Placer Dome Inc. | Sulphurets Gold (Sulphside) | Au, Cu | 18 000 | 0.35% Cu, 0.823 g/t Au |
| New Canamin Res. Ltd. | Huckleberry | Cu, Au | 78 000 | 0.401% Cu, 0.025% MoS2 |
| El Condor Res. Ltd. | Kemess North | Cu, Au | 116 109 | 0.19% Cu, 0.377 g/t Au |
| Placer Dome Inc. | Shear | Cu, Au | n/a | n/a |
| Yellowack Res. Ltd. | Katie | Cu, Au | n/a | n/a |
| Crew Natural Res. Ltd. | Red Dog | Cu, Au, Mo | 25 000 | 0.35% Cu, 0.44g/t Au, 0.006% Mo |
| **Massive Sulphide Deposits** | | | | |
| Cominco Ltd. | Par | Pb, Zn, Ag, Ba | n/a | n/a |
| Teck Explorations Ltd. Cominco Ltd. | MGM/Bend | Zn, Pb, Ag | n/a | n/a |
| Kokanee Explorations Ltd., Chapleau Res. Ltd., Barkhor Res. Inc. | Fors | Ag, Pb, Zn | n/a | n/a |
| Kokanee Explorations Ltd., Legion Res. Ltd. | Leg | Zn, Ag, Ba | n/a | n/a |
| Minnova Inc. International Curator Res. Ltd. | Seneca | Zn, Cu, Au, Ag | 533 | 0.91% Cu, 0.22% Pb, 7.06% Zn, 68.8 g/t Ag, 1.44 g/t Au |
| Westmin Resources Ltd. | Thelwood Valley (Myra Falls) | Cu, Pb, Zn, Ag, Au | n/a | n/a |
| **Transitional & Vein Deposits** | | | | |
| Lac Minerals Ltd. | Red Mountain (Marc Zone) | Au | 840 | 12.68 g/t Au |
| Gold Fields Canadian Mining Ltd. | Nizi | Au, Ag | n/a | n/a |
| Minnova Inc. | Wolf | Au | n/a | n/a |

## Table B
## Exploration Highlight Projects




**B.C. Lode Gold Production (1890-1990)**
by Deposit Type
Total Production 683.4 Tonnes




**1991 B.C. Lode Gold Reserves**
by Deposit Type
Total Reserves 1813 Tonnes

## Figure 5
## Lode Gold Production and Reserves

## Strategy and Philosophy in Mineral Resources Databases

# OUTLINE:

- Introduction
- Why, How, When, Where, What, Who
- The Mineral Exploration and Development Cycle
- Organization of Earth Science Data
- Master Database - *Data Dictionary*
- System Planning - *System Cycle*
- An Approach to Integrated Data Management
- Summary

**Lecture by:** L. Jones
15 November 1993

**References:** TECDOC Section 4.1, 4.2, Figure 3.
Green, Bill, 1991, Exploration with a Computer.
Tauchid, M.: Mineral Exploration and Development Strategy and Planning, IAEA, Paper presented at Lusaka workshop, May 1993.

## Strategy and Philosophy in Mineral Resources Databases

### REASONING:

### Some Whats:

- **Mineral resources** are unevenly distributed throughout the earth's crust.
- Most countries enjoy some **mineral endowment**.
- Many have a **mining history** dating back hundreds of years.

### Some Whys:

- Few countries have a well-organized, comprehensive and easily accessible **source of historic mining and geological data** relating to the nature and distribution of their mineral resources.
- Such information is the starting point in the search for **new orebodies**.
- Readily **accessible databases** are essential for effective management of the existing resource and invaluable tools in the search for new orebodies.
- Add to the country's **resource base**.
- Stimulates mineral exploration leading to discovery of new **mineral deposits**.
- Development of **new mines**.
- Contributes to the creation of **new wealth** by developers, workforce, and public treasury (profits, wages, and taxes).
- Well maintained databases attracts **investment**.

### Some Hows:

- Effective management of mineral resources requires a **knowledge** of the nature of the resources to be managed, their dimensions, where they are located, their current status, and many other factors.
- Earth Science Databases - **compile and update** this information.
- These databases must be **accessible** to all potential users.
- Organization should develop responsible **resource management policies**.

# The Mineral Exploration and Development Cycle

## PHILOSOPHY OF MINERAL EXPLORATION PROGRAMS:

- Mineral exploration and mine development ventures involve a high level of **financial risk.**
- Information gathered at each stage of a project leads to increased confidence of **discovering and developing** an orebody.
- If the data gathered at each stage of a project is accurate and complete **lower risk factors** are involved.

## STAGES OF MINERAL EXPLORATION PROGRAMS:

- First stage of exploration is the **choice of area,** which is generally based on analysis of available geoscience data from general surveys and previous exploration effort.
- Ready access to this type of information will simplify the task and greatly **increase success**
- Subsequent stages include **geophysical** and **geochemical** surveys, detailed **geological mapping** and **drilling** and **underground work.**
- Costs increase at each stage, as do the spin-off **economic benefits.**
- Information generated must provide the **justification for continuing** to the next stage.
- Final stage - **ore reserves exhausted** and mine closes.
- Portion of the **profits** will be allocated to the search for new orebodies and the exploration and development cycle will be repeated.

## MINERAL EXPLORATION PROGRAM OBSERVATIONS AND STRATEGY:

- Detailed **geological information** will be collected during the life of the operation.
- These data are invaluable in the search for **new orebodies** in the same district and in other areas with similar geological setting.
- Data are often **lost** if the project is abandoned.
- Drill core and logs, assays, geophysical results, geological maps, mine plans and engineering reports may be buried in **private files** or may even be lost or destroyed.
- If the information is stored in a database where it can be readily retrieved and analyzed, it may lead to fresh **insights** and **new ideas** that rekindle interest in the project.
- New geological concepts, availability of new technology, commodity price increases, or improved transportation may **reactivate** old mining areas.
- Easy access to **historical and current geoscientific data,** which is gathered at great expense and sometimes is not reproducible, benefits new investors, which in turn will stimulate and promote mining exploration in an area.

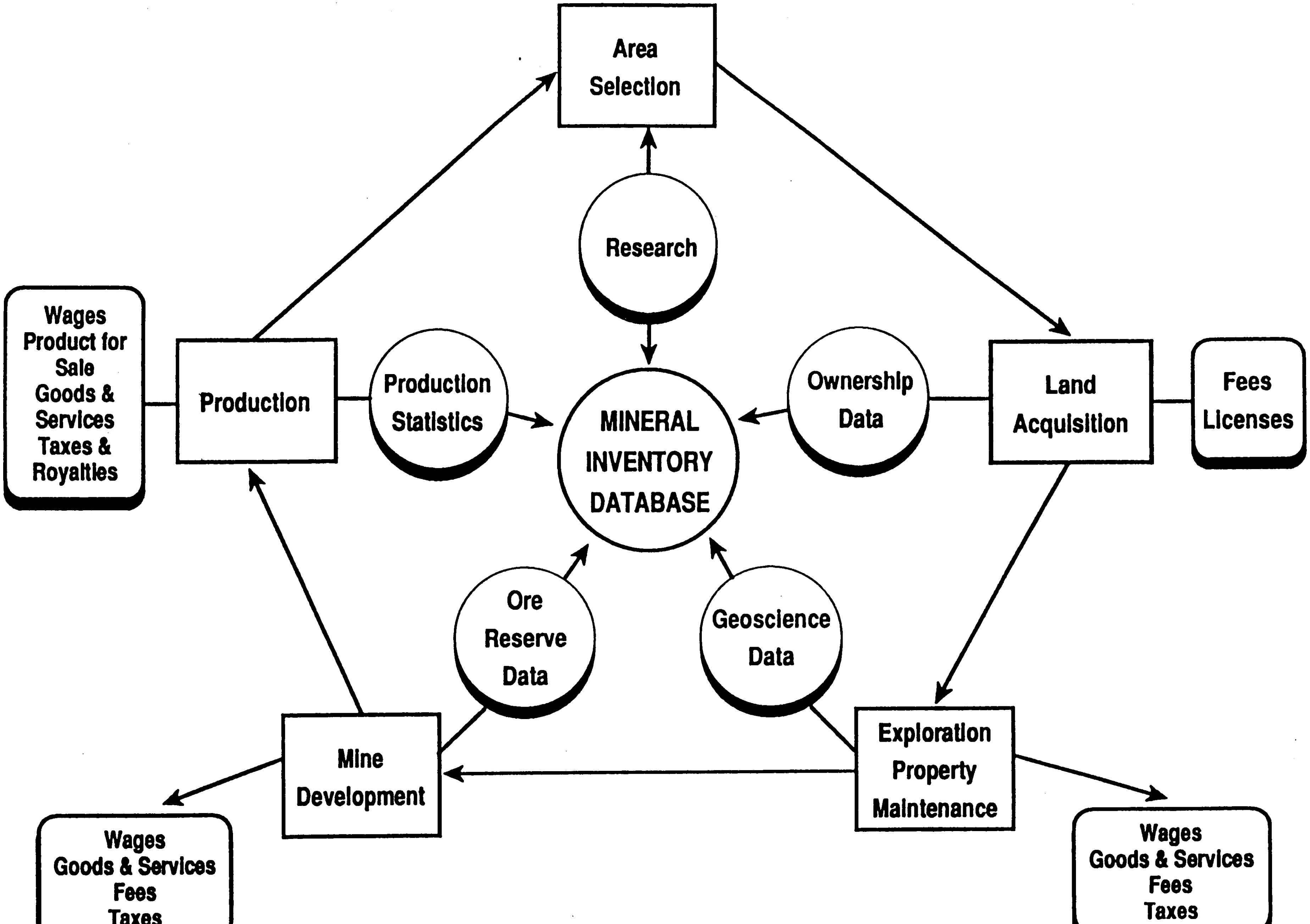
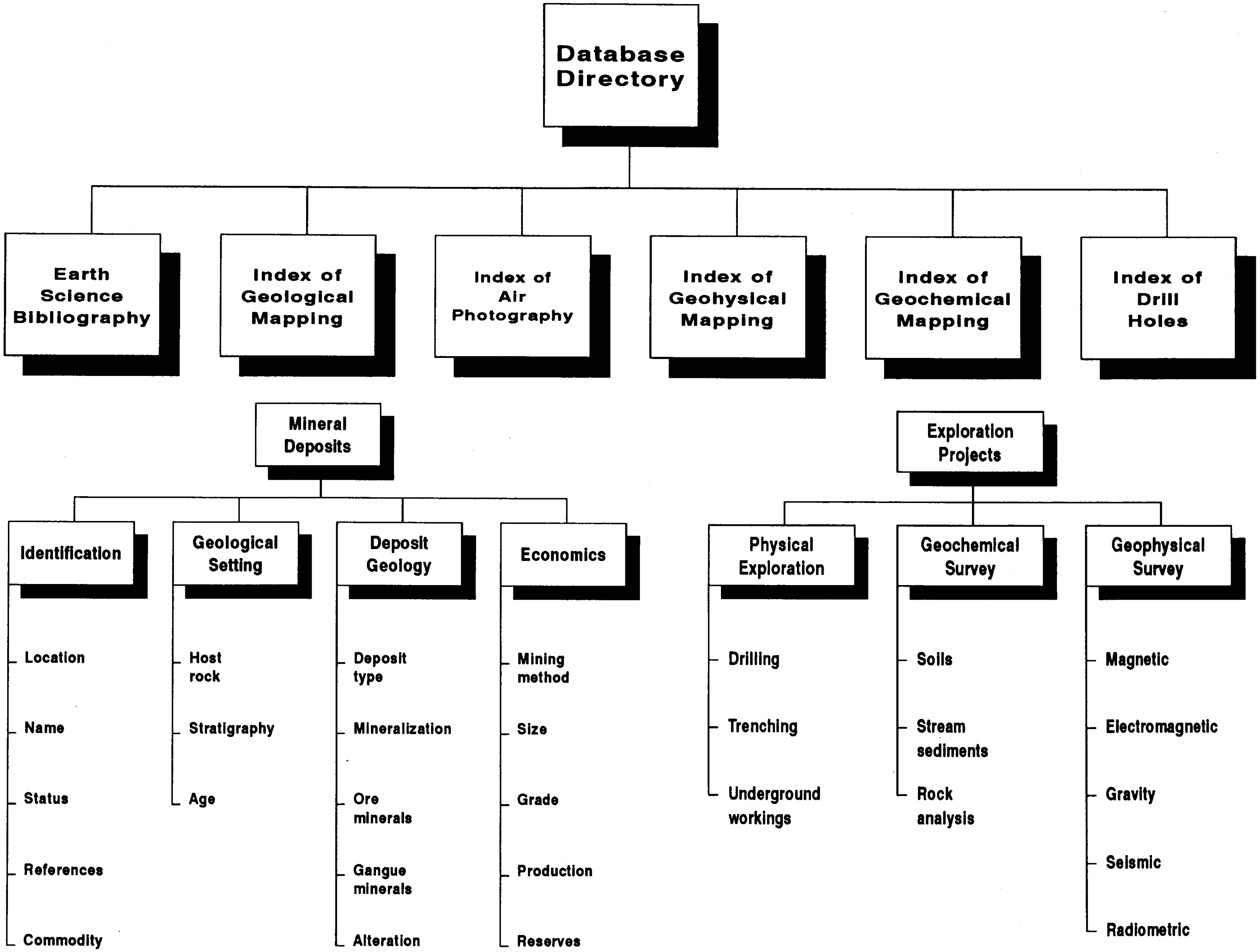

Area
Selection
Research
MINERAL
INVENTORY
DATABASE
Production
Production
Statistics
Wages
Product for
Sale
Goods &
Services
Taxes &
Royalties
Ownership
Data
Land
Acquisition
Fees
Licenses
Ore
Reserve
Data
Geoscience
Data
Mine
Development
Exploration
Property
Maintenance
Wages
Goods & Services
Fees
Taxes
Wages
Goods & Services
Fees
Taxes

Figure 1

# Organization of Earth Science Data

- Information comprising a geoscience information system starts with a repository-type database referred to as the **master database**.
- Database subjects or **themes** describe the handling of earth science information such as bibliographies; mapping indexes (geological, geophysical and geochemical); air photography indexes; and drill hole indexes; mineral deposit information; and exploration information (drill hole, geophysical, geochemical, and field data).
- Selection of appropriate databases and their content are based on the **objectives** of an organization.
- Examples of objectives would be to **collect and store data** on the various themes; provide essential **linkages** to other databases and other levels within the same data theme; facilitate the production of various **reports and maps**; or provide an aid in **planning** future exploration programs.
- Most subject databases follow a **multi-level model**, beginning with the first-level database, which provides a **basic orientation** to the database theme.
- A second- or third-level database provides more **detailed information** on the subject data.

# Organization of Earth Science Data



# INDEX OF GEOSCIENCE MAPPING

## FIRST-LEVEL DATA

- Listing of sources
- Name and address
- Coverage and scales
- Data form

## SECOND-LEVEL DATA

- Rock units
- Field observations
- Sample locations
- Kind of data (geophysical surveys)
- Boundaries of map coverage
- Date

## Table 9 - Example of first-level mineral deposit data.

Structure for database: C:\MINDEP\MINDEP1.DBF
Number of data records: 300
Date of last update: 07/07/91

| FIELD | FIELD NAME | TYPE | WIDTH | DEC | SAMPLE DATA |
|---|---|---|---|---|---|
| 1 | ID_NO | Character | 10 | | TVL-013 |
| 2 | DPST_NM | Character | 30 | | DOMINION REEF |
| 3 | STATUS_C | Character | 4 | | MINE |
| 4 | CMDTY1_C | Character | 2 | | UR |
| 5 | CMDTY2_C | Character | 2 | | AU |
| 6 | CMDTY3_C | Character | 2 | | AG |
| 7 | LAT | Character | 9 | | 26-52-00S |
| 8 | LONG | Character | 10 | | 026-23-00E |
| 9 | DPTYPE_C | Character | 4 | | QPEB |
| 10 | REF1 | Character | 4 | | 0012 |
| 11 | REF2 | Character | 4 | | 0066 |
| 12 | REF3 | Character | 4 | | 0109 |
| 13 | CMNT1_T | Character | 70 | | Quartzite overlying oligomictic quartz-pebble conglomerate. |
| 14 | GEOL_NM | Character | 4 | | LDJ |
| 15 | DATE_IN | Character | 8 | | 070791 |
| ** Total ** | | | 163 | | |

## Table 10 - Example of second-level mineral deposit data.

Structure for database: C:\MINDEP\MINDEP2.DBF
Number of data records: 300
Date of last update: 07/07/91

| FIELD | FIELD NAME | TYPE | WIDTH | DEC | SAMPLE DATA |
|---|---|---|---|---|---|
| 1 | ID_NO | Character | 10 | | TVL-013 |
| 2 | HOST_NM | Character | 30 | | DOMINION |
| 3 | HOST_AGE | Character | 4 | | ARCH |
| 4 | LITH1_C | Character | 4 | | CGLM |
| 5 | LITH2_C | Character | 4 | | QRTZ |
| 6 | LITH3_C | Character | 4 | | |
| 7 | MIN1_C | Character | 4 | | URAN |
| 8 | MIN2_C | Character | 4 | | PYRT |
| 9 | MIN3_C | Character | 4 | | |
| 10 | SETTING | Character | 20 | | BASIN |
| 11 | SIZE | Character | 1 | | |
| 11 | GRADE | Character | 20 | | 200 PPM |
| 12 | CMNT2_T | Character | 70 | | |
| ** Total ** | | | 179 | | |

# DATABASE DIRECTORY

## Name of data set Acronym

- Responsible organization
- Purpose and description
- Keywords

## Location

- Lat. min - Lat. max; Long. min - Long max
- Coverage
- Scales

## Data form

- Positional Accuracy
- Time span
- Data quality and access
- User Base

## Host computer

- Operating system
- Data Structure
- Set size
- "GIS" Software DBMS used
- Output formats and Output media

## Data Custodian/Manager

## Scientific Contact

# System Planning

## SYSTEM CYCLE:

- Establish business objectives and desired output.
- Scope document, user-requirements, fitting analysis (content and system).
- Detailing the proposal, with an action plan and resources required.
- Budgeting and project team selection.
- User-needs analysis and design details.
- Project schedule and detailed implementation plan.
- Develop universal tables, establish regional flexibility.
- Chose application development software and acceptable user-interface.
- Produce a PC-based application.
- System testing and documentation.
- User acceptance and evaluation.
- Marketing, distribution, training and support.

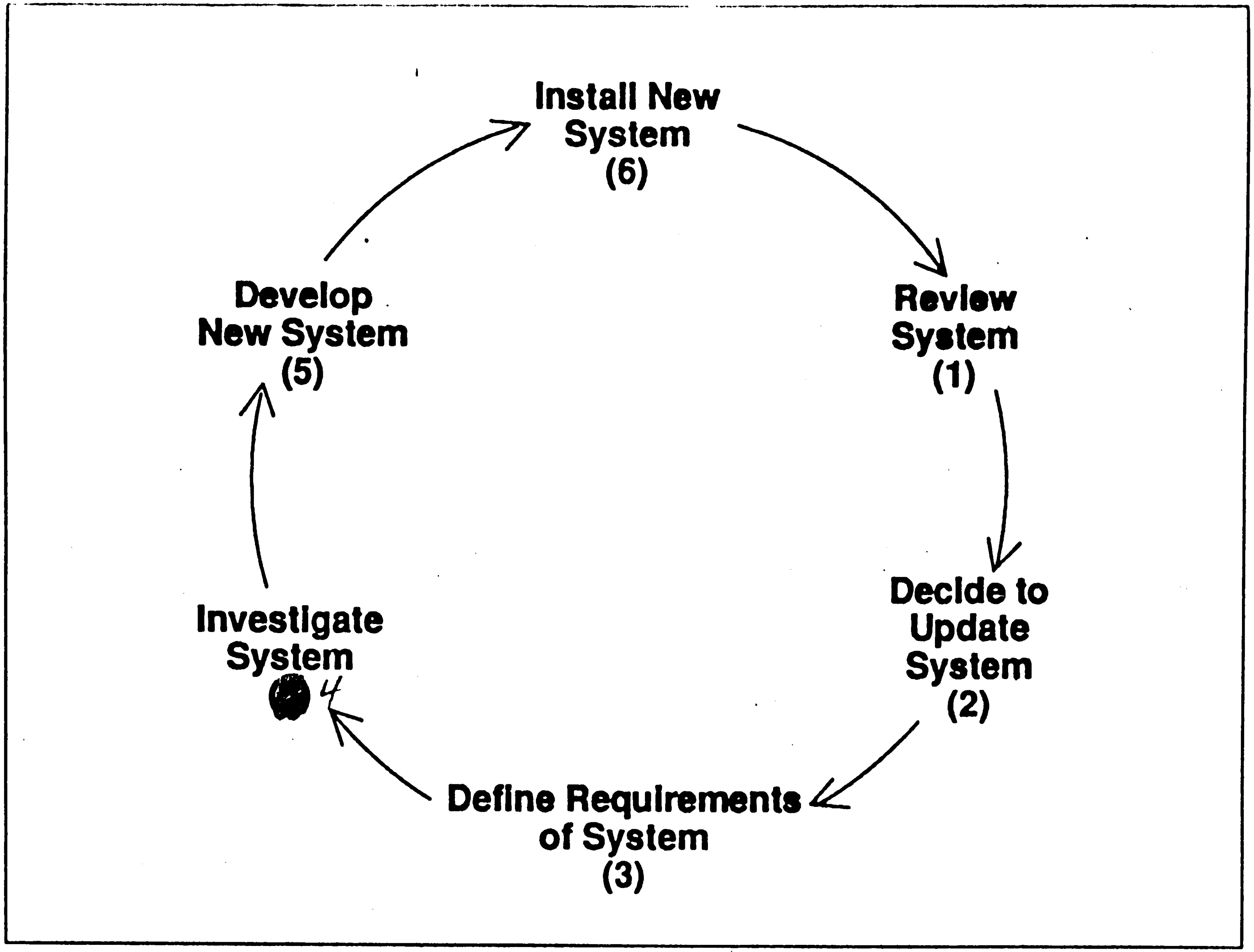



*Figure 4.1 The System Life Cycle*

# CHALLENGE:

- grow with the changes in user-need and technology

  - information strategy
  - minimum cost and effort

# MESSAGES:

- Technology alone cannot solve business problems.
- Need people and business strategy.
- Technology is important, but how it is used is the key to success.

# System Planning

## DATA AND SYSTEM GOALS:

- Quick and easy access to data.
- Detailed, high quality information.
- Data available in a wide variety of forms, such as custom and standard reports, and digital files for incorporation into other programs.
- Systematic management of data elements to improve data integrity and validity.
- An established methodology for the distribution of data.
- Allow the database to grow with increased requirements.
- Efficient and flexible model.
- Establish common data formats and system capabilities.
- Define links to geographical information systems.
- Implement a modern user-interface based on the latest technology.
- Standardize tables and definitions (e.g. commodities and work types).
- A versatile data dictionary will permit customized data content.

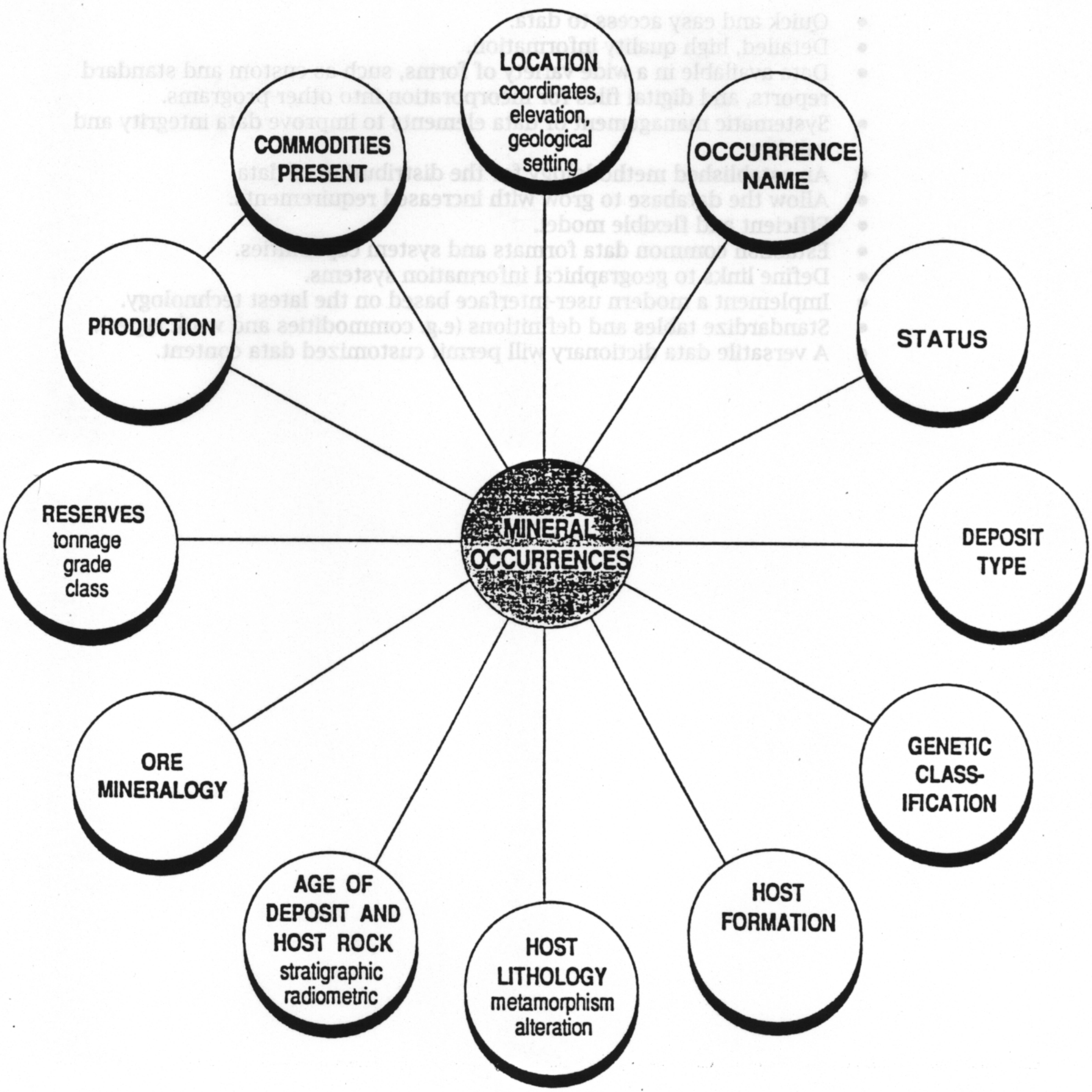

LOCATION coordinates, elevation, geological setting
COMMODITIES PRESENT
OCCURRENCE NAME
PRODUCTION
STATUS
RESERVES tonnage grade class
MINERAL OCCURRENCES
DEPOSIT TYPE
ORE MINERALOGY
GENETIC CLASS-IFICATION
AGE OF DEPOSIT AND HOST ROCK stratigraphic radiometric
HOST LITHOLOGY metamorphism alteration
HOST FORMATION

**Figure 2**

## LIMITATIONS

- *Incomplete or inaccurate reporting*
- *Reporting and recording bias*
- *Data structure knowledge required*
- *Data delivery and updating*
- *Costs & technological barriers*

## SOLUTIONS

- *Research / Interpretation*
- *Ranking / Combining commodities*
- *Educate / Documentation*
- *Planning / Staff support*
- *Technology / Innovations*

GSB

# An Approach to Integrated Data Management

- Challenges
- Data Issues - Data Models
- Technology Management Issues
- Procedure
- Database Components

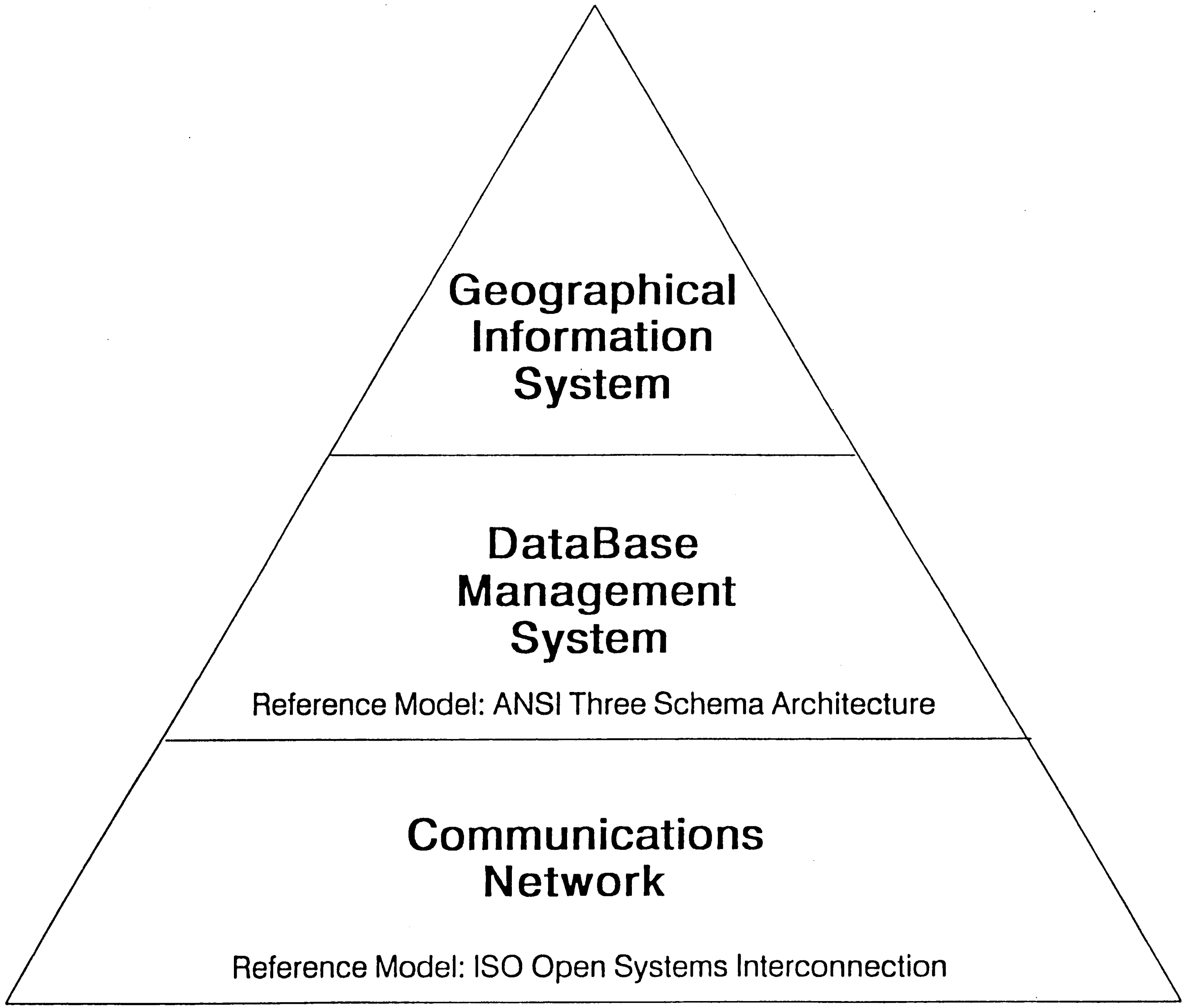



Diagram 1: A proposed Reference Model of Geomatics

# An Approach to Integrated Data Management

## CHALLENGES:

- Successfully integrate the various databases and mapping systems in a way that facilitates exchange of data for broader purposes.
- Maintain information in a manner which promotes data integrity and rapid retrieval.

## DATA ISSUES - DATA MODELS:

- Originally recorded on paper.
- Transferred into digitally based systems.
- Data model must be constructed that provides the organizational layout of the data.
- Must serve the needs of the business application that surrounds the data.
- Many databases evolve in which model construction is minimal.
- Ad hoc database construction which occurred as technology developed.

## TECHNOLOGY MANAGEMENT ISSUES:

- Development and maintenance of data requires human resources.
- Local and central responsibility of systems.
- Database managers and administrators.
- Routine and specialized maintenance - *backups, programming.*
- Inconsistencies, errors, corruption of data, and eventual abandonment of the databases and applications will result.
- Focus on future developments and planned migration strategies.
- Data static if it is collected and managed in a consistent framework.
- Data considered to be dynamic (*changing in its nature, structure, and application*) if collected and evolved over time.
- Requires a strategy that will work towards keeping data relevant and manageable.

## PROCEDURE:

- Establish business case and plan strategy.
- Coordinate implementation with the custodians of the databases.
- Review and recommend, where necessary, upgrading of databases.
- Manage and coordinate the exchange of data.

## DATABASE COMPONENTS:

- Data model
- Administration
- Project staffing
- Documentation
- Database directory

# Guidelines to Database Systems

## OUTLINE:

### Introduction

### Definitions

### Data Models

### Database System Design

### Standards

### Database Administration

### Database Documentation

**Lecture by:** L. Jones
15 November 1993

**References:** TECDOC Section 3

Table 1. Some Common Computer Acronyms.

| *Acronym* | *Term* |
|---|---|
| 4GL | Fourth-Generation Language |
| AI | Artificial Intelligence |
| CAD | Computer-Aided Design |
| CASE | Computer-Aided Systems Engineering |
| CD-ROM | Compact-Disk Read-Only Memory |
| DBMS | Database Management System |
| DOS | Disk Operating System |
| GIS | Geographic Information System |
| GUI | Graphical User Interface |
| kb | Kilobyte, 1 thousand bytes of data |
| LAN | Local Area Network |
| Mb | Megabyte, 1 million bytes of data |
| PC | Personal Computer |
| RAM | Random Access Memory |
| QBE | Query by Example |
| SQL | Structured Query Language |
| WORM | Write-Once Read-Many optical disk drives |

# Definitions

⇒ **database** is an organized set of related data that is drawn together to fit defined needs

⇒ **database management system** (DBMS) consists of a database and a set of programs to access the database. It provides a structured environment that is both convenient and efficient to use in storing, accessing and reporting data

⇒ **database file** contains data with a particular theme

⇒ **record** all the data for a particular entry

⇒ **field** is an item of information within a record

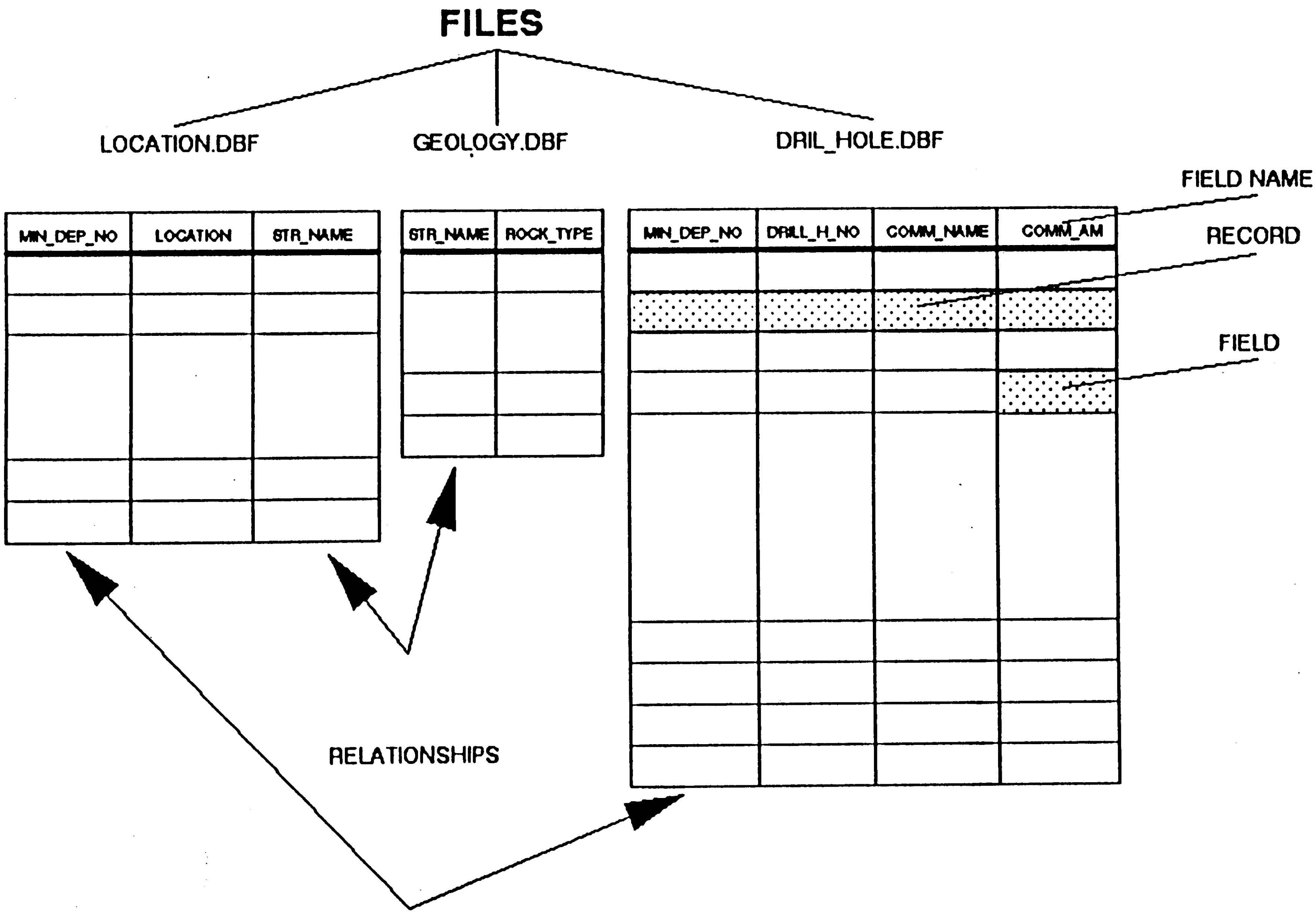
⇒ **database structure** defines a database file

⇒ **database key** uniquely identifies the sites of each record

⇒ **data dictionary** contains details of the structure of the database, definitions of the contents of each field and listings of acceptable entries for fields of explicit content

⇒ **external interface** is defined as the mechanism in which the user captures or enters the data

⇒ **data model** describes data and a set of operations used to manipulate that data


FILES
LOCATION.DBF
GEOLOGY.DBF
DRIL_HOLE.DBF
FIELD NAME
RECORD
FIELD
MIN_DEP_NO
LOCATION
STR_NAME
STR_NAME
ROCK_TYPE
MIN_DEP_NO
DRILL_H_NO
COMM_NAME
COMM_AM
RELATIONSHIPS

# DATABASE DIRECTORY

## Name of data set Acronym

- Responsible organization
- Purpose and description
- Keywords

## Location

- Lat. min - Lat. max; Long. min - Long max
- Coverage
- Scales

## Data form

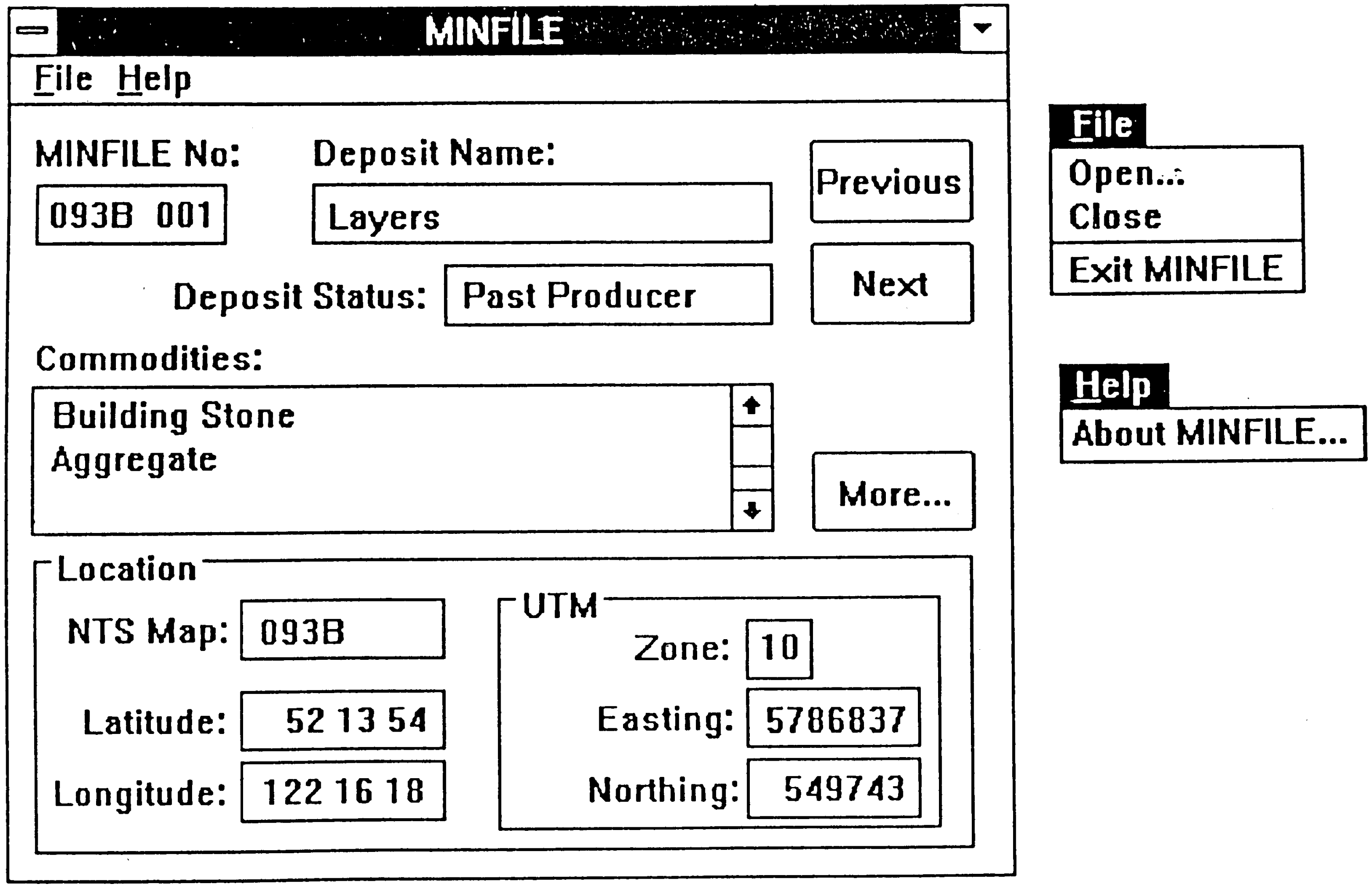
- Positional Accuracy
- Time span
- Data quality and access
- User Base

## Host computer

- Operating system
- Data Structure
- Set size
- "GIS" Software DBMS used
- Output formats and Output media

## Data Custodian/Manager

## Scientific Contact




File: MINF0000.BMP

# DATABASE MODELS

**A notation for describing data and a set of operations used to manipulate that data**

## HIERARCHICAL

- tree-structured diagram
- record replication

## FLAT-FILE

- spreadsheet style
- single table
- simplicity and portability

## RELATIONAL

- data in multiple files
- complex data management
- discrete and manageable units
- flexible; easily modified

## ENTITY-RELATIONSHIP

- entity is a distinct object
- relationship is an association among several entities
- primary key is assigned to each entity
- increased data integrity
- easier future modification
- enhanced performance capabilities

# INDEX OF GEOSCIENCE MAPPING

## FIRST-LEVEL DATA

- Listing of sources
- Name and address
- Coverage and scales
- Data form

## SECOND-LEVEL DATA

- Rock units
- Field observations
- Sample locations
- Kind of data (geophysical surveys)
- Boundaries of map coverage
- Date

# INDEX OF AIR PHOTOGRAPHY

## FIRST-LEVEL DATA

- Listing of sources
- Name and address

## SECOND-LEVEL DATA

- Agency code
- Date of coverage
- Scale of photography
- Focal length of lens
- Type of film
- Cloud cover

# INDEX OF DRILL HOLES

## FIRST-LEVEL DATA

- Listing of sources
- Name and address
- Project, identification number

## SECOND-LEVEL DATA

- Location, bearing
- Inclination
- Total length
- Locations of drill core, log and report

# Format Specification for Regional Geochemical Survey Data

The following describes the data format for recorded field observations and analytical data, with an explanation of the codes for the field observations.

| FIELD | DESCRIPTION | COLUMNS | TYPE | LENGTH | EXAMPLE |
|---|---|---|---|---|---|
| 01 | NTS Map-Sheet | 001-006 | A | 6 | 104N16 |
| 02 | ID (Year,Crew,Number) | 007-012 | N | 6 | 841102 |
| 03 | UTM Zone | 013-014 | N | 2 | 10 |
| 04 | UTM East (Metres) | 015-020 | N | 6 | 544654 |
| 05 | UTM North (Metres) | 021-027 | N | 7 | 5911939 |
| 06 | Elevation (Metres) | 028-031 | N | 4 | 1500 |
| 07 | Sample Material | 032 | N | 1 | 8 |
| 08 | Replicate Status | 033-034 | N | 2 | 10 |
| 09 | Formation | 035-038 | A | 4 | lJBv |
| 10 | Rock Type | 039-042 | A | 4 | GRNT |
| 11 | Age | 043-044 | N | 2 | 64 |
| 12 | Source of Water | 045 | N | 1 | 2 |
| 13 | Stream Order | 046 | N | 1 | 1 |
| 14 | Stream Type | 047 | N | 1 | 2 |
| 15 | Physiography | 048 | N | 1 | 3 |
| 16 | Drainage Pattern | 049 | N | 1 | 2 |
| 17 | Contamination | 050 | N | 1 | 3 |
| 18 | Stream Width (metres) | 051-054 | N | 4 (1) | 10.5 |
| 19 | Stream Depth (cm) | 055-57 | N | 3 | 220 |
| 20 | Stream Flow Rate | 058 | N | 1 | 1 |
| 21 | Water Colour | 059 | N | 1 | 3 |
| 22 | Bank Type | 060 | N | 1 | 3 |
| 23 | Bank Precipitate | 061 | N | 1 | 2 |
| 24 | Sediment Composition | 062-064 | N | 3 | 111 |
| 25 | Sediment Colour | 065 | N | 1 | 5 |
| 26 | Sediment Precipitate | 066 | N | 1 | 2 |
| 27 | Channel Bed Type | 067 | N | 1 | 3 |
| 28 | Channel Pattern | 068 | N | 1 | 4 |
| 29 | Moss-mat Position | 069-071 | N | 3 (1) | 2.5 |
| 30 | Moss-mat Colour | 072 | N | 1 | 2 |
| 31 | Moss-mat Health | 073 | N | 1 | 1 |
| 32 | Moss-mat Host | 074 | N | 1 | 3 |
| 33 | Thickness of Moss-mat | 075 | N | 1 | 10 |
| 34 | Blanks | 076-080 | N | 5 | ? |
| 34 | pH of stream waters | 081-085 | N | 5 (1) | 7.0 |
| 35 | Uranium in waters (ppb) | 086-090 | N | 5 (2) | 0.12 |
| 36 | Fluorine in waters(ppb) | 091-095 | N | 5 | 34 |
| 37 | Zinc (ppm) | 096-100 | N | 5 | 47 |
| 38 | Copper (ppm) | 101-105 | N | 5 | 79 |
| 39 | Lead (ppm) | 106-110 | N | 5 | 12 |
| 40 | Nickel (ppm) | 111-115 | N | 5 | 26 |
| 41 | Cobalt (ppm) | 116-120 | N | 5 | 73 |

# NORMALIZATION

**To divide data into logical groupings in separate data files.**

## Example of unnormalized and normalized data structures

**Unnormalized** (single database file)

| |
|---|
| MINERAL DEPOSIT NUMBER<br>LOCATION<br>STRATIGRAPHIC NAME<br>ROCK TYPE<br>DRILL HOLE NO<br>COMMODITY NAME<br>COMMODITY AMOUNT |

**Normalized** (three database files)

| |
|---|
| MINERAL DEPOSIT NUMBER<br>LOCATION<br>STRATIGRAPHIC NAME |

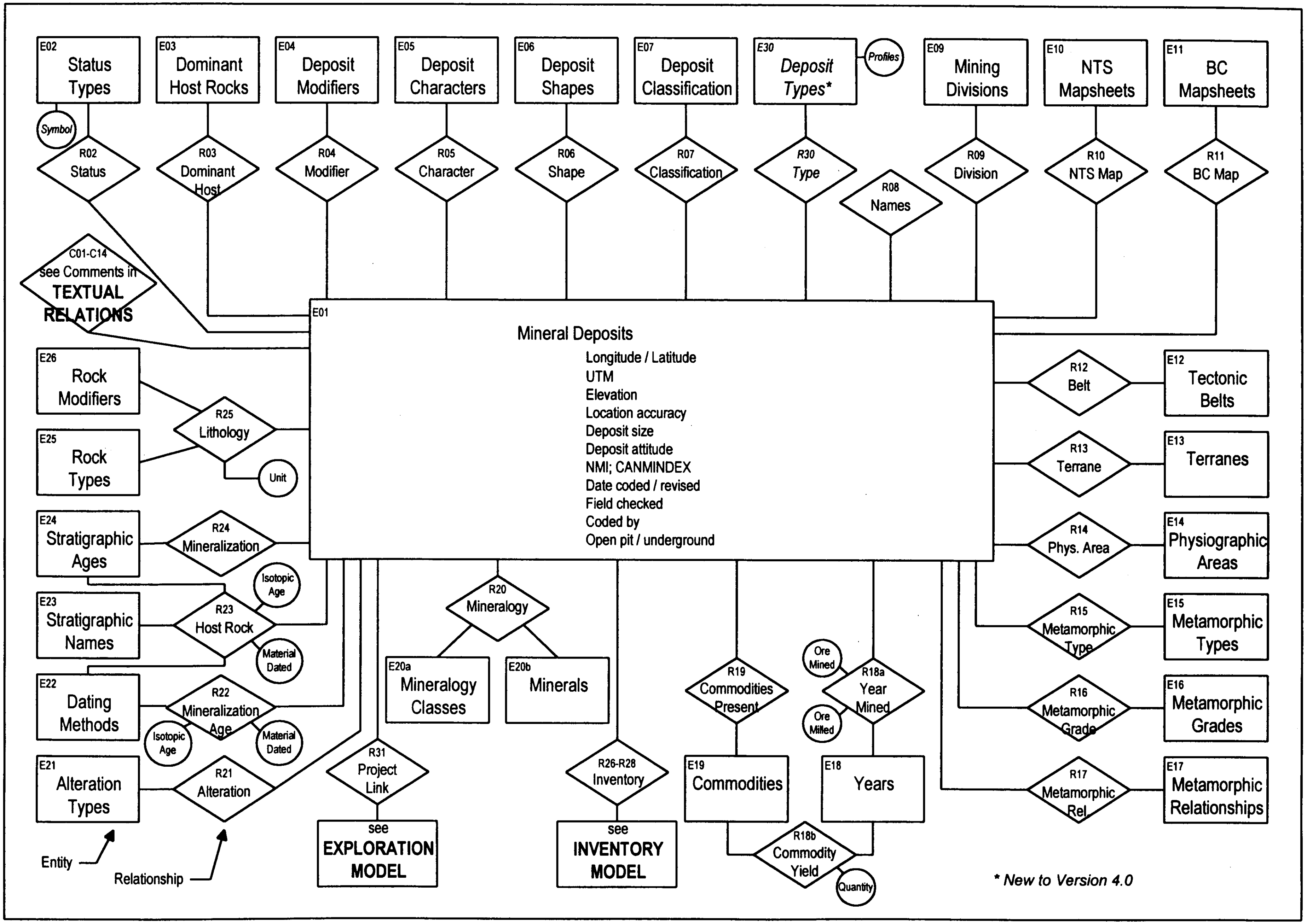
| |
|---|
| STRATIGRAPHIC NAME<br>ROCK TYPE |

| |
|---|
| MINERAL DEPOSIT NUMBER<br>DRILL HOLE NO<br>COMMODITY NAME<br>COMMODITY AMOUNT |

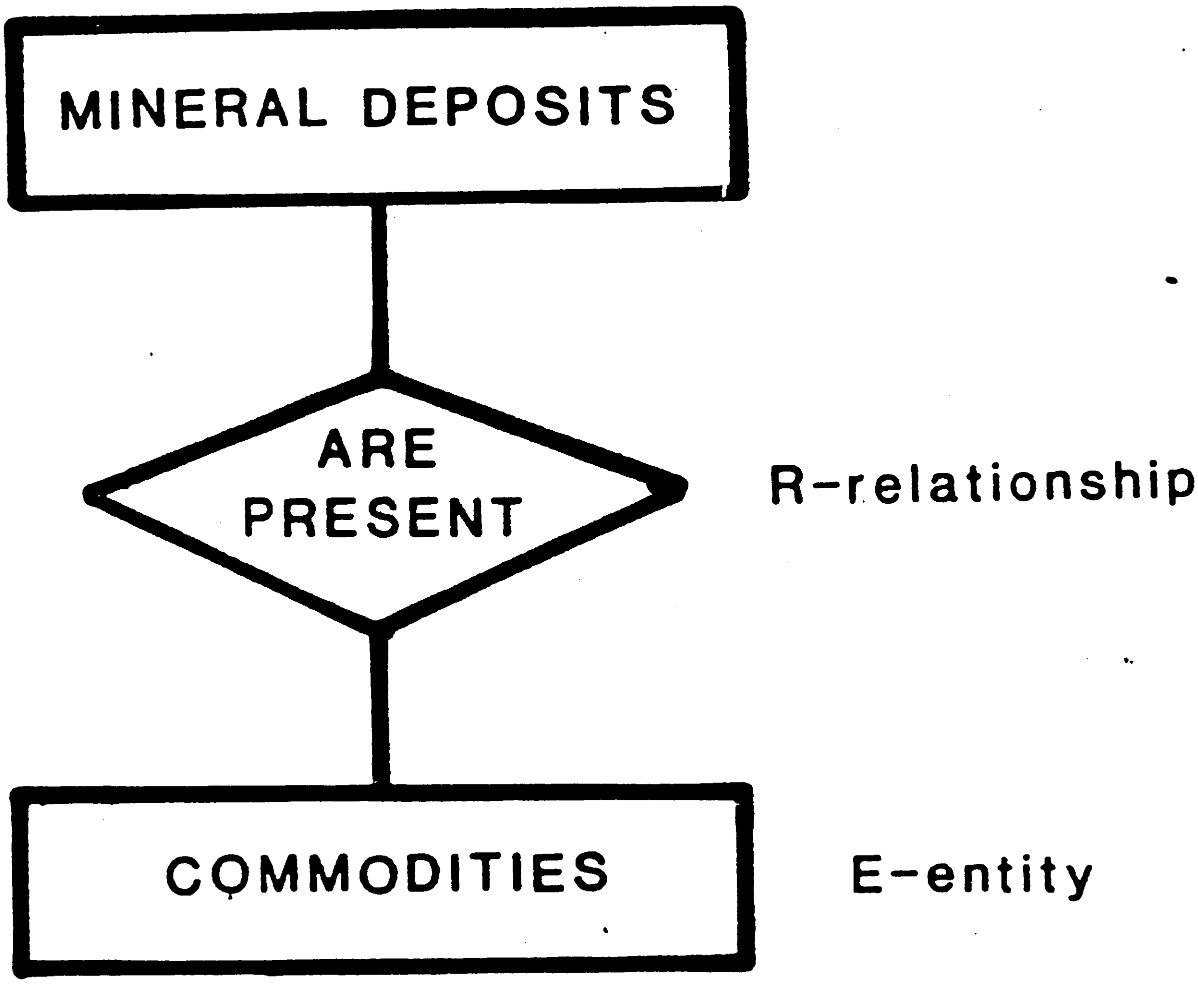
## Offers:

- **easy future modification**
- **efficient performance**
- **data integrity**
- **minimize redundancy**

# MINFILE ENTITY/RELATIONSHIP DATA MODEL



PART of 'E-R' MODEL



# CODE TABLE EXAMPLES

## COMMODITY CODES

| | |
|---|---|
| Copper | CU |

## MINERAL CODES

| | |
|---|---|
| Azurite | AZRT |

## ROCK CODES

| | |
|---|---|
| Gabbro | GBBR |

## ALTERATION CODE

| | |
|---|---|
| Sericitic | SERI |

BC Energy, Mines and Petroleum Resources
GEOLOGICAL SURVEY BRANCH

# MINFILE

NEW ☐ REVISION ☒ MODIFIED ☐ DELETE ☐

## IDENTIFICATION

MINFILE NO. 093L 053 NAT'L MINERAL INV. NO. 093L3 Mo1
CANMINDEX NO.

NAME(S) 1. LUCKY SHIP
2.
3.
4.

STATUS: ☐ SHOWing ☐ PROSpect ☒ DEveloped PRospect [O] [U] PRODucer [O] [U] PAst PRoducer

LOCATION:
NTS MAP: 093L03W
BC MAP:
MINING DIVISION: OMIN Omenica
UTM ZONE: 9 NORTHING: 5987098 EASTING: 599776
LATITUDE: ° ' " LONGITUDE: ° ' "
ELEVATION: 1082 (metres)
LOCATION CERTAINTY: ☒ within 500 m [2] within 1 km [3] within 5 km
Comment on Identity: Centre of mineralized zone (Minister of Mines Annual Report 1965, Figure 13).

## MINERAL OCCURRENCE

COMMODITIES: Mo
MINERALOGY:
SIGNIFICANT Minerals: MLBD CLCP SPLR GLEN
Comment: Minor chalcopyrite, sphalerite and galena are reported in separate localities.
ASSOCIATED Minerals: QRTZ
Comment:
ALTERATION Minerals: PYRT CARB KSPA TALC
Comment:
ALTERATION Type: SILI PYRT CARB KSPA TALC

DEPOSIT CHARACTER: 02
[01] Vein ☒ Stockwork [03] Breccia [04] Pipe [05] Unconsolidated
[06] Podiform [07] Layered [08] Stratabound [09] Stratiform [10] Concordant
[11] Discordant [12] Massive [13] Disseminated [..] Unknown

DEPOSIT CLASSIFICATION: 09
[01] Replacement [02] Magmatic [03] Volcanogenic [04] Sedimentary [05] Syngenetic
[06] Epigenetic [07] Hydrothermal [08] Residual ☒ Porphyry [10] Igneous-contact
[11] Skarn [12] Pegmatite [13] Placer [14] Precipitate [15] Exhalative
[16] Diatreme [17] Epithermal [18] Mesothermal [19] Fossil Fuel [20] Metamorphic
[..] Unknown

AGE OF MINERALIZATION: 124 Eocene ISOTOPIC AGE:
MATERIAL DATED: DATING METHOD:
SHAPE OF DEPOSIT: [1] Regular [2] Tabular [3] Cylindrical [4] Bladed [5] Irregular
SHAPE MODIFIER: [1] Folded [2] Faulted [3] Fractured [4] Sheared [5] Other
DEPOSIT DIMENSION: X X (metres)

ATTITUDE: STRIKE/DIP TREND/PLUNGE
Comment:

DATE CODED: Y M D CODED BY FIELD CHECKED ☐ YES ☐ NO
Y 88 M 08 D 14 REVISED BY LLD ☐ YES ☒ NO

HB-936

# Database System Design

⇒ **Base on an organization's** business objectives, **functions and processes, and its** available resources.

⇒ **Conduct a** system study **to help identify** requirements for users **and implement a process to achieve efficient access to, and manipulation of, data.**

⇒ **Use a** data classification hierarchy **to described data according to subject area and group.**

⇒ **Good** design techniques **will include data modeling, data flow diagrams and normalization.**

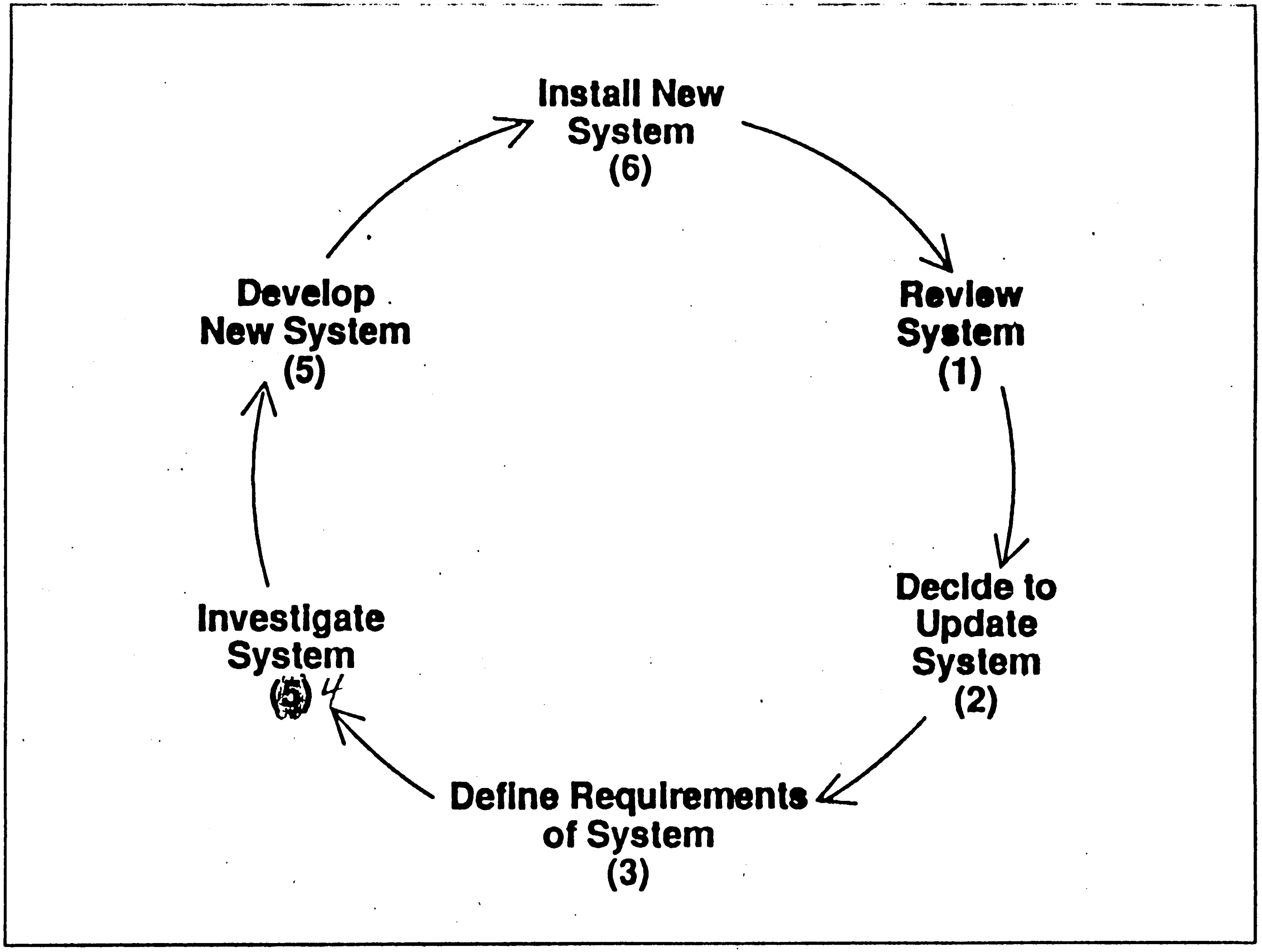



*Figure 4.1 The System Life Cycle*

# TECHNOLOGY STUDY

## Table of Contents

Ministry of Energy, Mines and Petroleum Resources
MINFILE/District Geology Subsystem (MINFILE/DG)

| REQUEST FOR PROPOSAL | Part B - Requirements Section |
|---|---|

## Table of Contents

# Table of Contents

# FIT ANALYSIS REPORT

## Table of Contents

# FIT ANALYSIS REPORT

## Table of Contents (Cont.)

# MINFILE PRELIMINARY DESIGN DOCUMENT

## Table of Contents

**1. Identification**

```
DENT4010                         MINFILE / pc                      04/27/90
                                  Data Entry                          13:12
               Ministry of Energy, Mines and Petroleum Resources
```

```
                           —— Identification ——

MINFILE No.   : XXXXXXXXX             Names: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
NMI No.       : XXXXXXXXXXXXXXXXXX                     Mining Method
Status        : XXXXXXXXXXXXXXXXXXXX          Open Pit: X   Underground: X
                          ——— Location ———
NTS Maps      : XXXXXXX               Mining Divisions     : XXXXXXXXXXXXXX
BC Maps       : XXXXXXX               UTM Zone             : XX
Latitude      :  XX XX XX             Northing             : XXXXXXX
Longitude     : XXX XX XX             Easting              : XXXXXX
Elevation     : XXXX metres           Location Certainty   : XXXXXXXXXXXX
                          ——— Comments ———
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Date Coded    : XX/XX/XX            Coded by   : XXXX      Field Checked: X
Date Revised  : XX/XX/XX            Revised by: XXXX       Field Checked: X

                                                      | Deposits : XXXXXX
```

**2. Mineral Occurrence**

```
DENT4020                         MINFILE / pc                      04/27/90
                                  Data Entry                          13:20
               Ministry of Energy, Mines and Petroleum Resources
```

```
                          - Mineral Occurrence -

MINFILE No.    : XXXXXXXXX             Name : XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Commodities    : XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
MINERALS                                DEPOSIT
Significant    : XXXXXXXXXXXXXXXXXXXX   Characteristics: XXXXXXXXXXXXXXXXXXXX
Associated     : XXXXXXXXXXXXXXXXXXXX   Classifications: XXXXXXXXXXXXXXX
Alteration     : XXXXXXXXXXXXXXXXXXXX   Shape          : XXXXXXXXXXXX
Alterat'n Type: XXXXXXXXXXXX            Modifiers      : XXXXXXXXXXXXXXX
                                        Dimension      : XXXXxXXXXxXXXX metres
AGE                                     Strike/Dip     : XXX/XXX
Mineralization: XXXXXXXXXXXXXXXXXXXX    Trend/Plunge   : XXX/XX
Isotopic      : XXXXXXXXXXXXXXXXXXXX
Material Dated: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX Method: XXXXXXXXXXXXXXXXXXX
COMMENTS: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

                                                      | Deposits: XXXXXX
```

# MINFILE DETAILED DESIGN DOCUMENT

## Table of Contents

# MINFILE IMPLEMENTATION PLAN

## Table of Contents

# PROJECT CHANGE REQUEST

| | |
|---|---|
| Customer Name: ______________________________ | Request #: ________________ |
| Project Number: ________________________ | Project Manager: ________________ |
| Project Code: ______________________________________ | Date: ________________ |
| Change Requested: ________________________ | Requested By: ________________ |
| Reason for Change: | |
| Cost Amount: | Prepared By: ________________ |
| Ramifications: | |
| Approved (A) / Rejected (R): __________________ | |
| Customer Signature: ____________________ | Company Signature: ______________ |
| Name: __________________________________ | Name: ____________________________ |
| Signature: ______________________________ | Signature: ________________________ |
| Date: ___________________________________ | Date: _____________________________ |

# Conventions and Standards

## GENERAL

⇒ Acquisitions for business objectives

## HARDWARE AND SOFTWARE

⇒ IBM-compatible PC

⇒ Store data in ASCII (American Standard Communication Information Interchange) format.

⇒ Lotus 1-2-3 (.WK1) and dBASE (.DBF) formats are recommended.

# COMPUTER HARDWARE AND SOFTWARE GENERAL

- **Custom development** of programs is expensive.
- Recommend purchase of **existing application packages**, such as spreadsheets, word processors, database systems, statistical packages and GIS programs is.
- Concentrate on the **integration and implementation** of these applications.
- Benefits include **improved functionality and reduced costs** for maintenance and support of custom-built software.
- Establish **business objectives** before selecting computing environment.
- **Evaluate software requirements** first, before hardware selection, to avoid incompatibilities.
- Consider availability of **support and local expertise**; **training** requirements; **standards** compliance; and the **size and growth** requirements of the database.

# Hardware

- **IBM-compatible PC** systems (80486 processor) recommended.
- 640-kilobyte random access memory (**RAM**), with at least four megabytes of extended memory.
- Large **hard disk** (200 megabytes).
- Parallel port for a printer; two serial ports for plotter and digitizer.
- **VGA** graphics system.
- Peripheral devices: laser printer; digitizer (capable of sending data as an **ASCII** string); plotter (**HPGL**).
- **Mass storage** devices for large data sets and system backup.
- **UPS** (uninterrupted power supply) recommended in areas of erratic power supply.

# Software

- Operating systems: **DOS and MS Windows.**
- Word-processing systems: capable of working in, or exporting a simple **ASCII** file (ASCII characters 33-127), without control characters.
- Spreadsheet format: **Lotus 1-2-3** (.WK1) format.
- Database management systems (DBMS): .DBF format of **dBASE** has become a *de facto* standard.
- Other **supporting software** packages: report writers; file compression utilities.
- **Custom development**: if funds are available; may make the organization's work process more efficient; documentation of the developed product is very important.

# DATABASE ADMINISTRATION

**Objective to maintain**
**a standard, structured and secure database.**

## CONCERNS

| | |
|---|---|
| **Data acquisition** | - collecting, managing and modifying data |
| **Data integrity** | - detect errors; provide logic and range checks |
| **Data currency** | - data values are reconfirmed or updated within an appropriate time period |
| **Data access control** | - granting of permission for the creation, retrieval, use, modification and disposal of data. |
| **Data custodianship** | - designation of a functional responsibility for the creation, integrity and maintenance of data |
| **Data links** | - interchange with diverse applications and needs |

dBASE View: C:\...dg\notices.dbf 63 / 1,587

| Prop_1_dsc | Recrn_area | Mining_div | Nts | Lat | Long |
|---|---|---|---|---|---|
| | N | ALBERNI | 92E\15W | 04960 | 12690 |
| | N | NANAIMO | 92L/12W | 50 4130 | 1274550 |
| 194 | N | | | | |
| | N | Victoria | | | |
| 200 | N | | | | |
| | N | Victoria | 92C.058 | 48 35 | 12429 |
| 207 | N | Victoria | P92B/12W | | |
| 210 | N | New Westminster | | | |
| | N | Nanaimo | 92F\1,2,7, | 49 15 | 12430 |
| | N | Vancouver | 92K-11W | 50 31 | 25 245 |
| | N | Vancouver | 92k/15e,w | 05055 | 12445 |
| 221 | N | | | | |
| | N | Nanaimo | 92F/9E | 49 0 | 12434 |
| | N | | 92F/7,10 | 49 30 | 12453 |
| | N | Nanaimo | 982L17W | 50 25 | 12047 |
| | N | Nanaimo | 92L/7W | 12645 | 50 15 |
| 232 | N | Nanaimo | | | |
| 237 | N | Nanaimo | | | |
| 241 | N | | | | |
| 246 | N | | | | |

## DATABASE LIMITS
### AND SOLUTIONS...

*PROBLEM:*

Data structure knowledge is required for proper interpretation of data

*SOLUTION:*

Education of users and accurate documentation

GSB

## DATABASE LIMITS
### AND SOLUTIONS...

*PROBLEM:*

Data delivery and updating involves tremendous amount of time

*SOLUTION:*

Project planning and staff support

GSB

# DATABASE PROJECT STAFFING

## QUALIFICATIONS

1. Understanding of computerized database concepts, model and design.

2. Understanding of geoscience data acquisition, data elements and their relationships.

3. Ability to design computerized databases using widely available database management systems.

4. Ability to access and to retrieve the data in the database in order to transfer the data to other application programs to gain additional capabilities (statistical packages, GIS and others).

# DATABASE DOCUMENTATION

**Important for instruction and reference by users and subsequent program developers.**

## COMPONENTS OF DOCUMENT PLANNING

- user-needs analysis
- purpose, scope and contents of documentation
- document specification
- work plan
- organization (menu hierarchy, topic or function)

## TYPES OF DOCUMENTS

- training documents (user manuals, tutorials and quick reference cards
- reference documents (technical programmer notes)
- marketing documents (descriptive brochures)

# Mineral Deposit Databases

## OUTLINE:

### Introduction

### Data Codes, Structure and Elements

### USGS Example

### MINFILE Example

- What is MINFILE
- Brief History
- Data Model
- User Examples
- MINFILE/pc
- Products and Distribution

### Summary

**Lecture by:** L. Jones
15 November 1993

**References:** TECDOC Section 4.4, Annex 6.4

Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

GEOLOGICAL SURVEY
PAPER 78-26

# Computer-based files on mineral deposits: Guidelines and recommended standards for data content

**A report by the Mineral Deposits Working Committee, National Advisory Committee on Research in the Geological Sciences**

R.V. Longe, Chairman, C.F. Burk, Jr., J. Dugas, K.A. Ewing,
S.A. Ferguson, K.L. Gunn, E.V. Jackson, A.M. Kelly,
A.D. Oliver, P.G. Sutterlin and G.D. Williams

1978

**List of Tables of Values given in this report**

| | Name | Type of list | Usage | Applicable data groups |
|---|---|---|---|---|
| 1 | Development status | Closed | Strongly recommended | 3.3.3 |
| 2 | Reference points | Open | Optional | 3.3.5<br>3.3.6 |
| 3 | Provinces and Territories of Canada | Closed | Strongly recommended | 3.3.8 |
| 4 | Types of development | Open | Strongly recommended | 3.4.5 |
| 5 | Geological types | Closed | Strongly recommended | 3.5.1 |
| 6 | Categories of geologic-stratigraphic units | Open | Strongly recommended | 3.5.2 |
| 7 | Stratigraphic age codes | Closed | Optional | 3.5.2<br>3.5.3<br>3.5.7 |
| 8 | Relationship of geologic-stratigraphic unit to deposit | Closed | Optional | 3.5.2<br>3.5.3 |
| 9 | Rock types | Closed | "Primary category" strongly recommended; remainder optional | 3.5.3 |
| 10 | Mineral names | Open | Optional | 3.4.6<br>3.5.4 |
| 11 | Shapes | Closed | Strongly recommended | 3.5.5 |
| 12 | Shape modifiers | Open | Optional | 3.5.5 |
| 13 | Geometric relationship to environment | Closed | Optional | 3.5.5 |
| 14 | Types of documents | Closed | Optional | 3.3.5 3.5.3<br>3.4.1 3.5.7<br>3.4.2 3.6.1<br>3.4.3 |
| 15 | Map types | Open | Optional | 3.3.5<br>3.6.1 |

Increasing hierarchical level ↑

| Natural structure | Conceptual data structure | Physical data structure | Electronic data structure |
|---|---|---|---|
| | Data file | Data file | Data file |
| Entity | Entity record (general term)<br><br>Deposit record (this report) | Entity record | Collection of related logical records |
| | Data group | Data group | Logical record |
| | Data item | Data item | Data item |

TABLE 1. Schematic relationship between natural, conceptual, physical and electronic data structures. This report focuses on conceptual data structures.

# Mineral Deposit Databases

## GENERAL

- A mineral deposit database is an **organized inventory** of data related to mineral occurrences.
- A **relational data model** is functional, flexible and expandable.
- Use in a **multi-level** approach.
- Use **standard codes**.
- **Rank multiple entries**, such as the commodity, mineralogy and lithology fields, in decreasing order of importance.

# Multi-Level Approach

## FIRST-LEVEL DATA ELEMENTS:

- Deposit identification number
- Deposit name
- Commodities or minerals present
- Point location, map area
- Administrative jurisdiction
- Geologic setting
- Current status or stage of development
- Deposit type
- Commodity economics
- Brief geological descriptions
- Primary references
- Name of the collector and date of input

*these are the recommended minimum data elements*

# Example of first-level mineral deposit data.

Structure for database: C:\MINDEP\MINDEP1.DBF
Number of data records: 300
Date of last update: 07/07/91

| FIELD | FIELD NAME | TYPE | WIDTHDEC | SAMPLE DATA |
|---|---|---|---|---|
| 1 | ID_NO | Character | 10 | TVL-013 |
| 2 | DPST_NM | Character | 30 | DOMINION REEF |
| 3 | STATUS_C | Character | 4 | MINE |
| 4 | CMDTY1_C | Character | 2 | UR |
| 5 | CMDTY2_C | Character | 2 | AU |
| 6 | CMDTY3_C | Character | 2 | AG |
| 7 | LAT | Character | 9 | 26-52-00S |
| 8 | LONG | Character | 10 | 026-23-00E |
| 9 | DPTYPE_C | Character | 4 | QPEB |
| 10 | REF1 | Character | 4 | 0012 |
| 11 | REF2 | Character | 4 | 0066 |
| 12 | REF3 | Character | 4 | 0109 |
| 13 | CMNT1_T | Character | 70 | Quartzite overlying oligomictic quartz-pebble congl. |
| 14 | GEOL_NM | Character | 4 | LDJ |
| 15 | DATE_IN | Character | 8 | 070791 |
| ** Total ** | | | 163 | |

# Multi-Level Approach

## SECOND-LEVEL DATA ELEMENTS:

- Host rocks in terms of name, age, lithology and relationship to the economic minerals
- Size of deposit
- Regional structural-tectonic setting
- Economic, gangue and alteration minerals
- Reserves

# Example of second-level mineral deposit data.

Structure for database: C:\MINDEP\MINDEP2.DBF
Number of data records: 300
Date of last update: 07/07/91

| FIELD | FIELD NAME | TYPE | WIDTH | DEC | SAMPLE DATA |
|---|---|---|---|---|---|
| 1 | ID_NO | Character | 10 | | TVL-013 |
| 2 | HOST_NM | Character | 30 | | DOMINION |
| 3 | HOST_AGE | Character | 4 | | ARCH |
| 4 | LITH1_C | Character | 4 | | CGLM |
| 5 | LITH2_C | Character | 4 | | QRTZ |
| 6 | LITH3_C | Character | 4 | | |
| 7 | MIN1_C | Character | 4 | | URAN |
| 8 | MIN2_C | Character | 4 | | PYRT |
| 9 | MIN3_C | Character | 4 | | |
| 10 | SETTING | Character | 20 | | BASIN |
| 11 | SIZE | Character | 1 | | |
| 11 | GRADE | Character | 20 | | 200 PPM |
| 12 | CMNT2_T | Character | 70 | | |
| ** Total ** | | | 179 | | |

# Multi-Level Approach

## THIRD-LEVEL DATA ELEMENTS:

- Elevation & location accuracy
- Alteration type
- Deposit details
- Metamorphic type and grade
- Stratigraphic name and age
- Isotopic age, material dated and dating method
- Ore reserve category, year of calculation, quantity, grade and reference
- Year of production, ore mined, ore milled, quantity and reference

# Example of third-level mineral deposit data.

| Field | Length | Content |
|---|---|---|
| ELEV | 4 | Elevation in metres |
| LOC_ACC | 1 | Deposit location accuracy (1=500 m, 2=1 km, 3=5 km) |
| ADMINJUR | 4 | Administrative jurisdiction (province, territory or district) |
| ALTER_C | 4 | Alteration type code |
| DEPCHR_C | 4 | Deposit character code |
| DEPCLA_C | 4 | Deposit classification code |
| DEPSIZEL | 4 | Deposit length |
| DEPSIZEB | 4 | Deposit breadth |
| DEPSIZEW | 4 | Deposit width |
| DIP | 3 | Deposit dip |
| STRIKE | 3 | Deposit strike |
| PLUNGE | 6 | Deposit plunge |
| DEPSHA_C | 1 | Deposit shape type code (1=regular, 2=tabular, etc) |
| META_T_C | 1 | Metamorphic type code (1=contact, 2=regional) |
| META_G_C | 2 | Metamorphic grade code |
| STNAME_C | 6 | Stratigraphic name code |
| ST_AGE_C | 3 | Stratigraphic age code |
| ISOAGE | 20 | Isotopic age |
| MATERIAL | 30 | Material dated |
| DATMET_C | 2 | Dating method code |
| RESCAT_C | 2 | Ore reserve category code (IN=indicated, etc) |
| RESYEAR | 4 | Year of calculation or publication |
| RESQUAN | 12 | Quantity in metric tonnes |
| RESCO_C | 2 | Recoverable commodity code |
| RESGRADE | 9 | Grade of commodity |
| RESREF_T | 70 | Reserves reference |
| PRODYEAR | 4 | Year of production |
| MINED | 12 | Ore mined |
| MILLED | 12 | Ore milled |
| PRODCO_C | 2 | Produced commodity code |
| PRODQUAN | 12 | Quantity produced |
| PRODRF_T | 66 | Production reference |

# Mineral Deposit Databases

## DATA CODES (ENTITIES OR TABLES)

- Keep the database **small.**
- **Reduce errors** on input.
- Help to **speed up queries** on the database.
- Provide the user with **classification guidelines** and choices.
- May be **easily redefined,** modified or expanded.
- Chose codes with **meaning and flexibility**.
- Use **standard codes** based on controlled vocabularies and global frequencies, such as commodities, rocks, mineral names and stratigraphic units.

# MINFILE CODING FORM

## SUMMARY

### MINERALOGY

| COMMON MINERALS | CODE |
|---|---|
| **ECONOMIC** | |
| Chalcopyrite | CLCP |
| Galena | GLEN |
| Sphalerite | SPLR |
| Arsenopyrite | ARPR |
| Pyrite | PYRT |
| Pyrrhotite | PYTT |
| Molybdenite | MLBD |
| Scheelite | SCLT |
| Tetrahedrite | TRDR |
| Barite | BRIT |
| Fluorite | FLRT |
| **GANGUE** | |
| Barite | BRIT |
| Fluorite | FLRT |
| Limestone | LMES |
| Quartz | QRTZ |
| Biotite | BOIT |
| Dolomite | DOLM |
| Feldspar | FLDP |
| Calcite | CLCT |
| **ALTERATION** | |
| Montmorillonite | MMRL |
| Alunite | ALUN |
| Kaolinite | KLNT |
| Sericite | SRCT |
| Clay | CLAY |
| Chlorite | CLRT |
| Pyrite | PYRT |
| Epidote | EPDT |
| Dolomite | DOLM |
| Serpentine | SRPN |
| Tourmaline | TRML |
| Biotite | BOIT |
| Feidspar | FLDP |

### ALTERATION

| ALTERATION TYPE *(Assemblages)* | CODE |
|---|---|
| Argillic | AGLC |
| Propylitic | PPLC |
| Silicic | SLCC |
| Greisen | GRSN |
| Skarn | SKRN |
| Saussuritic | SSTC |
| Carbonate | CRBN |
| Potassic | PTSC |

# Code table example

**FILE NAME: STATUS_C**

| CODE | DESCRIPTION | EXPLANATION |
| --- | --- | --- |
| SHOW | Showing | A showing or occurrence with identified mineralization. |
| PROS | Prospect | A showing with development and unknown resources. |
| DEPR | Developed prospect | A prospect pending an economic evaluation. |
| ECDP | Economic deposit | A developed prospect with recoverable ore. |
| MINE | Active mine | A producing mine. |
| MINR | Inactive mine | An inactive mine with resources remaining. |
| MIND | Depleted mine | A mined-out or depleted ore deposit. |

```
SRCH1070                        MINFILE / pc
                                   Search
           Ministry of Energy, Mines and Petroleum Resources
```

```
                         Deposit Character Search

     01 Vein                 06 Podiform          11 Discordant
     02 Stockwork            07 Layered           12 Massive
     03 Breccia              08 Stratabound       13 Disseminated
     04 Pipe                 09 Stratiform        14 Shear
     05 Unconsolidated       10 Concordant        ** Unknown

  All of:             and      and      and      and       must be present

                                 AND

  At least 1 of:       or       or       or       or       must be present

   Complete the above Boolean expression ...         | Deposits :  11144
```

```
SRCH1080                        MINFILE / pc
                                   Search
           Ministry of Energy, Mines and Petroleum Resources
```

```
                      Deposit Classification Search
 01 Replacement                                             17 Epithermal
 02 Magmatic           07 Hydrothermal      12 Pegmatite    18 Mesothermal
 03 Volcanogenic       08 Residual          13 Placer       19 Fossil Fuel
 04 Sedimentary        09 Porphyry          14 Evaporite    20 Metamorphic
 05 Syngenetic         10 Igneous-contact   15 Exhalative   21 Industrial Min.
 06 Epigenetic         11 Skarn             16 Diatreme     ** Unknown

 All of:              and      and      and      and       must be present

                                 AND

  At least 1 of:       or       or       or       or       must be present

   Complete the above Boolean expression ...         | Deposits :  11144
```

# STRATIGRAPHIC AGE CODES

| Era | Period | Epoch | Code |
|---|---|---|---|
| 1 Cenozoic | 0 | 0 | 100 |
| | 1 Quaternary | 0 | 110 |
| | | 1 Recent | 111 |
| | | 2 Pleistocene | 112 |
| | | 9 Pliocene-Pleistocene | 119 |
| | 2 Tertiary | 0 | 120 |
| | | 1 Pliocene | 121 |
| | | 2 Miocene | 122 |
| | | 3 Oligocene | 123 |
| | | 4 Eocene | 124 |
| | | 5 Paleocene | 125 |
| | | 9 Cretaceous-Tertiary | 129 |
| | Mesozoic-Cenozoic | | 199 |
| 2 Mesozoic | | 0 | 200 |
| | 1 Cretaceous | 0 | 210 |
| | | 1 Upper | 211 |
| | | 4 Middle | 214 |
| | | 7 Lower | 217 |
| | | 9 Jurassic-Cretaceous | 219 |
| | 2 Jurassic | 0 | 220 |
| | | 1 Upper | 221 |
| | | 4 Middle | 224 |
| | | 7 Lower | 227 |
| | | 9 Triassic-Jurassic | 229 |
| | 3 Triassic | 0 | 230 |
| | | 1 Upper | 231 |
| | | 4 Middle | 234 |
| | | 7 Lower | 237 |
| | | 9 Permian-Triassic | 239 |
| | Paleozoic-Mesozoic | | 299 |
| 3 Paleozoic | 0 | 0 | 300 |
| | Upper Paleozoic | | 301 |
| | 1 Permian | 0 | 310 |
| | | 1 Upper | 311 |
| | | 4 Middle | 314 |
| | | 7 Lower | 317 |
| | | 9 Pennsylvan.-Permian | 319 |
| | 2 Pennsylvanian | 0 | 320 |
| | | 1 Upper | 321 |
| | | 4 Middle | 324 |
| | | 7 Lower | 327 |
| | | 9 Carboniferous | 329 |
| | 3 Mississippian | 0 | 330 |
| | | 1 Upper | 331 |
| | | 4 Middle | 334 |
| | | 7 Lower | 337 |
| | | 9 Devonian-Mississipp. | 339 |
| | 4 Devonian | 0 | 340 |
| | | 1 Upper | 341 |

# STRATIGRAPHIC AGE CODES

| Era | Period | Epoch | Code |
|---|---|---|---|
| | | 4 Middle | 344 |
| | | 7 Lower | 347 |
| | | 9 Silurian-Devonian | 349 |
| | 5 Silurian | 0 | 350 |
| | | 1 Upper | 351 |
| | | 4 Middle | 354 |
| | | 7 Lower | 357 |
| | | 9 Ordovician-Silurian | 359 |
| | 6 Ordovician | 0 | 360 |
| | | 1 Upper | 361 |
| | | 4 Middle | 364 |
| | | 7 Lower | 367 |
| | | 9 Cambrian-Ordovician | 369 |
| | 7 Cambrian | 0 | 370 |
| | | 1 Upper | 371 |
| | | 4 Middle | 374 |
| | | 7 Lower | 377 |
| | | 9 Proterozoic-Cambrian | 379 |
| | Proterozoic-Paleoz. | | 399 |
| 4 Proterozoic | 0 | 0 | 400 |
| | 1 Upper | 0 | 410 |
| | 2 Hadrynian | 0 | 420 |
| | 4 Middle | 0 | 440 |
| | 5 Helikian | 0 | 450 |
| | 7 Lower | 0 | 470 |
| | 8 Aphebian | 0 | 480 |
| 5 Archean | 0 | 0 | 500 |
| | 1 Upper | 0 | 510 |
| | 4 Middle | 0 | 540 |
| | 7 Lower | 0 | 570 |
| UNKNOWN | | | *** |

# DEPOSIT TYPES

## Geological Survey Branch Mineral Deposit Profiles

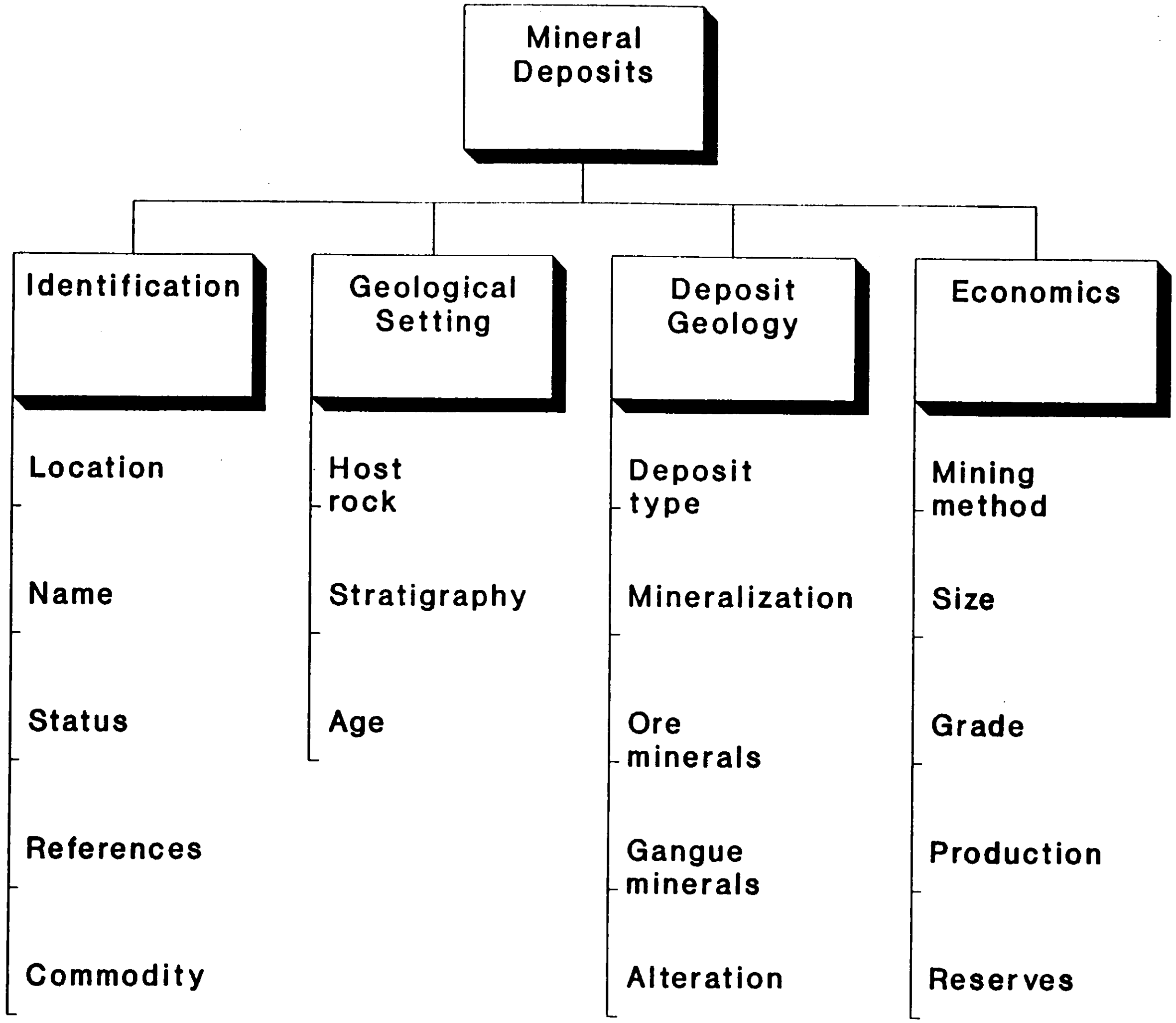
| Code | Description | Synonym | USGS | B.C. Example | Global Example |
|---|---|---|---|---|---|
| A | ORGANIC | | | | |
| A01 | Peat | | -- | Fraser Delta, North Coast | Ontario, New Brunswick |
| A02 | Lignite | Brown coal | -- | Hat Creek, Skonun Point (Graham Island) | Coal River (Sask.), Texas |
| A03 | Sub-bituminous coal | Thermal coal, Black lignite | -- | Hat Creek, Quinsam | Highvale (Alberta) |
| A04 | Bituminous coal | Coking coal, Soft coal | -- | Quintette, Bullmoose, Greenhills | Gregg River (Alberta) |
| A05 | Anthracite coal | Hard coal, Stone coal | -- | Mt Klappan, Queen Charlottes | Pennsylvannia |
| B | RESIDUAL/SURFICIAL | | | | |
| B01 | Laterite Fe | Gossan Fe; enriched iron formation | -- | | Glenravel (IRLD), Oregon, Araxa (BRZL) |
| B02 | Laterite Ni | | 38a | | Riddle (Oregon) |
| B03 | Laterite-Saprolite Au | Eluvial placers | 38g | | Boddington, Mt. Gibson (Australia), Akaiwang (Guyana) |
| B04 | Bauxite Al | Lateritic bauxite | 38b | Florence (Sooke) | Brazil, Queensland, Pocos de Caldas (Brazil), Salem hills (Oregon) |
| B05 | Residual kaolin | Primary Kaolin | 38h* | Lang Bay, Sumas Mountain | Germany, North Carolina, Idaho |
| B06 | Fireclay | Refractory shale | 38i* | Sumas mountain, Quinsam coal | Alabama, Georgia, Missouri |
| B07 | Bog Fe, Mn, U, Cu, Au | | -- | Whipsaw Ck, Limonite Creek, Quatsino Iron? | |
| B08 | Surficial U | "Calcrete U" | -- | Prairie Flats | Trois Rivieres (Que.), Flodelle Creek (Wash.) |
| B09 | Karst-hosted Fe, Al, Pb-Zn | | -- | | Transvaal, Sardinia (Pb-Zn), Jamaica (Al), Marquesaedo (Fe, SPAN) |
| B10 | "Terra Rossa" Au-Ag | Residual Au; Precious metal gossans | -- | Villalta | Rio Tinto (Spain) |
| B11 | Marl | | | Cheam Lake (Chiliwack) | |
| B12 | Sand and Gravel | | | | |
| C | PLACER | | | | |
| C01 | Surficial placers | Placer U-Au-PGE-Sn-diamond-magnetite-garnet, gems | 39a | Fraser River, Quesnel River, Graham island | North Saskatchewan River, Nome (Alaska) |
| C02 | Buried channel placers | | 39a | Williams Creek, Otter Creek, Bullion Mine | Livingston Ck (Yukon), Valdez Creek (Alaska) |
| C03 | Marine placers | Off-shore heavy mineral sediments | 39f*? | Middlebank (n. end Van. Is.) | Australia (NSW, Queensland) |
| C04 | Paleoplacer U-Au-PGE-Sn-diamond-Ti-mag-gar-zir | | 39c,d,e | | Elliot Lake, Blind R., Wittwatersrand, Jacobina |
| D | CONTINENTAL SEDIMENTS & VOLCANICS | | | | |
| D01 | Zeolites in tuffs of open hydrologic systems | Open-System Zeolites | 25oa | Princeton basin | Death Valley (Calif.), Naples (Italy), John Day Form. (Oregon) |
| D02 | Zeolites in saline, alkaline-lake deposits | Closed Basin Zeolites | 25ob | | Bowie (Ariz.), Lake Magadi (Kenya) |
| D03 | Volcanic redbed copper | Basaltic Cu | 23 | Sustut | Keewenaw (Mich.), Copper Mine (NWT) |
| D04 | Basal U | Sandstone U | -- | Blizzard, Tyee | Sherwood (Wash.) |
| D05 | Sandstone U | Roll front U, Tabular U | 30c | | Colorado Plateau, Grants (New Mexico) |
| D06 | Volcanic-hosted U | "Epithermal U" Volcanogenic U | 25f | Rexspar, Bullion (Birch Island) | Marysvale (Utah), Aurora (Oregon) |
| D07 | Olympic Dam type Fe (Cu-U-Au) | El Romero Type | 29b | | Olympic Dam (Australia), Wernecke Breecia's (Yukon) |
| E | SEDIMENT-HOSTED | | | | |
| E01 | Almaden Hg | | 27b | | Almaden (Spain), Santa Barbara (Peru) |
| E02 | Kipushi Cu-Pb-Zn | Carbonate-hosted Cu-Pb-Zn | 32c | | Tsumeb (Nambia), Kipushi (Zaire), Ruby Creek (Alaska) |
| E03 | Carlin-Type Sediment-hosted Au-Ag | Carbonate-hosted Au-Ag | 26a,19c | | Carlin (Nevada), Getchell (Nevada), Cortez (Nevada) |
| E04 | Sediment-hosted Cu | Sandstone Cu, Sediment-hosted stratiform Cu | 30b | Sage Creek | Kupfershiefer (Germany & Poland), White Pine (Mich.), Boleo (Mex) |
| E05 | Sandstone Pb | | 30a | ? Tamarack | Laisvall (Sweden), Largentiere (France), George Lake (Sask.) |

| Code | Description | Synonym | USGS | B.C. Example | Global Example |
|---|---|---|---|---|---|
| E06 | Bentonite | Volcanic Clay, Soap Clay | 28e?* | Princeton, Quilchena | Wyoming, Alberta, Rodalquilar (SPAN) |
| E07 | Sedimentary kaolin | | 31k* | | |
| E08 | Carbonate-hosted talc | Dolomite-hosted talc | 18?i* | Red Mountain, Silver Dollar | Treasure Mountain (Mont.), Trimacous ( France), henderson (Ont.) |
| E09 | Sparry magnesite | Veitsch-type, carbonate-hosted magnesite | 18?i* | Mt. Burssilof, Marysville | Europe |
| E10 | Mississippi Valley type barite | | - - | Muncho Lake | Legill? Ck, 110 Ck, Sulphur Ck |
| E11 | Mississippi Valley type fluorite | | 32d* | Lower Liard | Gem?,Tan? |
| E12 | Mississippi Valley Type Pb-Zn | Carbonate-hosted Pb-Zn, Appalachian Zn | 32a/32b | Robb Lake, Monarch | Vibumum Trend (Missouri), Pine Point, Polaris (NWT) |
| E13 | Kootenay Arc Type Pb-Zn | | | | |
| E14 | SEDEX Zn-Pb-Ag-S | Sullivan massive sulphide | 31a | Sullivan, Cirque, Driftpile | Mount Isa (Australia), Faro, Grum (yukon) |
| E15 | Blackbird massive sulphide Cu-Co | Sediment-hosted Cu-Co massive sulphide | 24d | | Blackbird, Sheep Creek (Montana) |
| E16 | Sediment-hosted Ni | | - - | | Nick (Yukon), China |
| E17 | Sediment-hosted barite | Bedded barite | 31b | Kwadacha | Tea (Yukon), Magcobar (Ireland) |
| F | CHEMICAL SEDIMENT | | | | |
| F01 | Sedimentary Mn | | 34b | | Molongo (MXCO), Atasu (Kazakhstan), Kalahari (SAFR) |
| F02 | Bedded gypsum/anhydrite | Marine evaporite gypsum | 35ae | Lussier River, Windermere | Paris Basin (France), Appalachian Basins (New York, Penn.) |
| F03 | Gypsum-hosted sulphur | Frasch sulphur | - - | Trutch area | Texas, Louisiana, Poland, Coronation (Alberta) |
| F04 | Bedded celestite | | 35aa* | Kitsault Lake | Lake Enon (Nova Scotia), Mexico, Germany |
| F05 | Palygorskite | Attapulgite | 34e* | "Mountain Leather" (Cassiar) | Metalline Falls, Wash. |
| F06 | Lacustrine diatomite | Diatomaceous earth, kieselguhr | 31s | | Juntura and Otis Basins (Oregon), Lake Myvatn (Iceland) |
| F07 | Phosphate, upwelling type | | 34c | Femie synclinorium | Phosphoric Formation (Idaho), Meskala (Morocco) |
| F08 | Phosphate, warm-current type | | 34d | none | Athabaska Basin (Sask.), Florida |
| F09 | Playas (hydromagnesite, sodium carb. lake brines) | | 35ba,bm(T) | | |
| F10 | Superior Type Iron Formation | | 34a | Falcon? | Mesabi Ranges (Minnesota), Minas Gervas (Brazil) |
| G | MARINE VOLCANIC ASSOCIATION | | | | |
| G01 | Algoma Fe | | 28b | | Vermillion Iron Formation (Minn.), Helen Mine (Ont.) |
| G02 | Volcanogenic Mn | combine with rhodonite | 24c | | Olympic Mtns.(Washington), Nicoya (Costa Rica) |
| G03 | Volcanogenic anhydrite/gypsum | | - - | Britannia, Falkland | |
| G04 | Besshi massive sulphide Zn-Cu-Pb | Kieslager | 24b | Goldstream, Windy Craggy | Besshi (Japan), Greens Creek (Alaska) |
| G05 | Cyprus massive sulphide Cu | | 24a | Anyox, Chu Chua | Cyprus, Oman |
| G06 | Noranda/Kuroko massive sulphide Cu-Pb-Zn | Noranda Cu-Pb-Zn massive sulphide | 28a | Britannia, Kutcho Creek, Myra Falls | Noranda (Quebec), Kuroko (Japan) |
| H | EPITHERMAL | | | | |
| H01 | Travertine | tufa? | 35d* | | |
| H02 | Hot spring Hg | | 27a | Ucluelet? | Sulphur Bank (California), Steamboat Springs (Nev.) |
| H03 | Hot spring Au-Ag | | 25a | Cinola | McLaughlin (Calif.), Round Mountain (Nev.) |
| H04 | Epithermal Au-Ag; high sulphidation | Acid-sulphate epithermal, Nansatsu-type | 25d | Taseko Property, Expo | El Indio (Chile), Nansatsu (Japan) |
| H05 | Epithermal Au-Ag; low sulphidation | Adularia-sericite epithermal | 25b/25c | Lawyers, Blackdome, Silbak Premier | Creede (Colorado), Comstock (Nevada), Sado (Japan) |
| H06 | Epithermal Mn | | 25g | | Talamantes (Mexico), Gloryana (New Mexico) |
| H07 | Rhyolite-hosted Sn and Sn-Ag veins | | 25h, 20b | D Zone Cassiar | Black Range (New Mex.), Potosi (Bolivia), Ashio (Japan) |
| H08 | Alkalic-hosted Au-Ag-Te-F veins | "epithermal", sub-volcanic | 22b | | Emperor (Fiji), Zortman-Landusky (Mont.), Cripple Creek (Colorado) |
| H09 | Hydrothermal clays | kaolin, alunite, siliceous cap, pyrophyllite | 25lb* | Monteith Bay, Pemberton Hills | (Comwall (England)?) |
| I | VEIN / BRECCIA | | | | |

| Code | Description | Synonym | USGS | B.C. Example | Global Example |
|---|---|---|---|---|---|
| I01 | Gold-quartz veins | Mesothermal, Motherlode, Saddle Reefs | 36a | Bralome, Erickson, Atlin | Motherlode (Calif.), Alaska-Juneau (Alaska), Red Lake (Ont.) |
| I02 | Subvolcanic shear hosted gold | | -- | Scottie, Snip, Johnny Mountain, Baker?, Rossland | |
| I03 | Turbidite-hosted gold veins | Meguma Type | 36a | Frasergold | Ballarat, Australia; Meguma (Nova Scotia) |
| I04 | Iron formation-hosted gold | | 36b | 900 Zone Debbie? | Homestake (South Dakota) |
| I05 | Polymetallic veins Ag-Pb-Zn | | 22c | Silver Queen, Beaverdell | Keno Hill (Yukon) |
| I06 | Cu-Ag Quartz Vein | | ? | Davis Keys?, Churchill Copper | Nikolai Mine, Kathleen-Margaret (Alaska) |
| I08 | Silica-Hg carbonate | New Almaden? | 27c | Pinchi, Bralome Takla | Red Devil? (Alaska) |
| I09 | Stibnite veins and disseminations | Simple and Disseminated Sb Deposits | 27d,27e | Minto, Congress, Snowbird | Jerritt Canyon (Nevada), Bolivia |
| I10 | Vein barite | | 27e | Parson | Del Rio District (Tenn.), Jebel Ighoud (Morocco) |
| I11 | Barite-fluorite veins | | 26c* | Rock Candy | Mongolian flourite belt |
| I12 | W veins | "Porphyry W" | 15a | | Pasto Bueno (Peru), Carrock Fell (Great Brit.) |
| I13 | Sn veins and griesens | | 15b | | Cornwall (GRBR), Lost River (Alaska) |
| I14 | Volcanic-hosted magnetite apatite | | 25i | Magnet? | |
| I15 | Uranium veins | | -- | Little Gem? | Uranium City, Schwartzwalder (Colorado) |
| I16 | Felsic plutonic U | | | Coryell intrusions, Surprise Lake | Roy Creek, Bokan Mountain (Alaska), Massif Central (France) |
| I17 | Silica veins | | -- | Gypo vein | |
| I17 | Unconfomity U-Au-Ni | Vein-like type U | 37a | | Key Lake, Cigar Lake (Sask.), Jubiluka (Australia), The Midnight (Wash.) |
| J | REPLACEMENT | | | | |
| J01 | Polymetallic manto Ag,Pb,Zn (Au) | Polymetallic replacement deposits | 19a | Bluebell, Midway, | East Tintic (USUT), Manto (MXCO), Drum Mountain (USUT), Butler mountain, Sa Dena Hess |
| J02 | Sn manto and stockwork | "Replacement Sn" | 14c | | Renison Bell (Tasmania) |
| J03 | Mn veins and replacements | "Replacement Mn" | 19b | | Lake Valley (New Mexico), Phillipsburg (Montana) |
| K | SKARN | | | | |
| K01 | Cu skarn | | 18a,b | Craigmont, Phoenix | Mines Gaspe Area (Que.), Carr Fork (Yukon) |
| K02 | Zn-Pb skarn | | 18c | Piedmont, Contact | San Antonio (Mexico), Ban Ban (Australia) |
| K03 | Fe skarn | | 18d | Tasu, Jessie, Merry Widow, HPH | Shinyama (Japan), Cornwall (Penn.) |
| K04 | Au skarn | | -- | Nickel Plate | Fortitude, McCoy (Nevada), Buckhorn Mountain (Wash.) |
| K05 | W skarn | | 14a | Emerald Tungsten, Dimac | Cantung, Mactung (yukon), Pine Creek (Calif.) |
| K06 | Sn skarn | | 14b | Daybreak | Lost River (Alaska), JC (Yukon) |
| K07 | Mo skarn | | -- | Coxey, Novelty | Little Boulder Creek (Idaho), Mt. Tennyson (Australia) |
| K08 | Garnet skarn | | -- | Crystal Peak, Argonaut | |
| K09 | Wollastonite skarn | | 18g | Sechelt | Fox Knoll (USNY) |
| L | PORPHYRY | | | | |
| L01 | Subvolcanic Cu-Ag-Au (As-Sb) | Enargite Au, Transitional Au-Ag | 22a/25e | Equity Silver, Thorn? | Lepanto (Philipines), Resck (Hungary), Kori Kollo (Bolivia) |
| L02 | Porphyry-Related Au | Granitoid Au, Porphyry Au | 20d | Snowfields? | Marte, Lobo (Chile), Fort Knox (Alaska) |
| L03 | Alkalic Porphyry Cu-Au | | -- | Afton, Mt. Polley, Copper Mountain, Galore Creek | Ok Tedi (PNG), Tai Parit (Phillipines) |
| L04 | Porphyry Cu+/-Mo+/-Au | | 17 | Highland Valley, Gibraltar | Chuquicamata, La Escondida (Chile) |
| L05 | Porphyry Mo | | 21b | Endako, Kitsault, Glacier Gulch | Quartz Hill (Alaska) |
| L06 | Porphyry Sn | "Subvolcanic Tin" | 20a | | Llallagua (Bolivia), Potato Hills (Yukon) |
| L07 | Porphyry W | | 21c* | Boya | Mount Pleasant (Nova Scotia), Logtung (Yukon) |
| M | ULTRAMAFIC/MAFIC-HOSTED | | | | |
| M01 | Basaltic subvolcanic Cu-Ni-PGE | | 5a/5b | | Noril'sk, Duluth |
| M02 | Gabbroid Ni-Cu-PGE | | 7a | Giant Mascot | Lynn Lake, Kluane Province, Yukon, Noril'sk-Talnakh |
| M03 | Podiform chromite | Major/minor | 8a/8b | | (Turkey/Oregon) |

| Code | Description | Synonym | USGS | B.C. Example | Global Example |
|---|---|---|---|---|---|
| M04 | Anorthosite (ilmenite) | | | | |
| M05 | Zoned ultramafic Fe-Ti-V/PGE/Cr/Cu-Ni | Alaskan Type Fe-Ti-V/PGE/Cr/Cu-Ni | 9 | Tulameen | Duke Island |
| M06 | Asbestos | Serpentinite-hosted asbestos | 8d | Cassiar | Thetford |
| M07 | Serpentinite-hosted magnesite-talc | | 8f* | Nahatlatch River | |
| M08 | Vermiculite | | | | |
| N | ALKALIC ASSOCIATION | | | | |
| N01 | Carbonatites | Carbonatite deposits - Phosphate,Th, REE | 10 | Aley, Deep Purple?, Mount Grace tuff | Palabora (South AFrica), Oka (Quebec), Mountain Pass (California) |
| N02 | Kimberlite-hosted diamond | Diamond pipes | 12 | Cross | Kimberley, Orapa, Premier |
| N03 | Lamproite-hosted diamond | Lamproite-hosted diamond | 12 | Golden, Ospika | Australia, British Columbia |
| O | PEGMATITE | | | | |
| O01 | Pegmatite, family LCT | Zoned pegmatite, Lithium-Cesium-Tantalium | 13a*,b* | Firestorm, Kimberley | Tanko (Canada), Blackhills (South Dakota), Greenbushes (Australia) |
| O02 | REE pegmatite, family NYF | Niobium-Ytrium-Fluorine | - - | | South Platte District (Colorado), Bancroft (Ont.) |
| O03 | Granitic pegmatite, muscovite class | Mica-bearing pegmatite | 13f* | | Nomaqualand (SAFR) |
| O04 | Simple quartz-feldspar pegmatites | Barren pegmatite, Ceramic pegmatite | | Lumby, Hellroaring Creek, Oliver | Black Hills, Otjiwarongo (Nambia) |
| P | METAMORPHIC-HOSTED | | | | |
| P01 | Andalusite hornfels | | - - | Frenchman Cap, Leech River | Transval (South Africa), Brittany (France) |
| P02 | Kyanite family | | - - | Leech River | Pella (SAFR), Hillsboro (North Carolina), NARCO (Quebec) |
| P03 | Microcrystalline graphite | | - - | | Raton (New Mexico), Sonora (Mexico) |
| P04 | Crystalline flake graphite | "Lump and chip graphite" | | AA | Lac Knife (Que) |
| P05 | Vein graphite | | | | Calumet, Clot (Que), Bogala (Sri Lanka) |
| P06 | Corundum in aluminous metasediments | | | | Gallatin & Madison Counties (Montana) |
| Q | GEMS AND SEMI-PRECIOUS STONES | | | | |
| Q01 | Jade | | - - | Cry lake, Ogden Mountain | |
| Q02 | Rhodonite | | - - | | |
| Q03 | Agate | | - - | | |
| Q04 | Amethyst | | - - | | |
| Q05 | Jasper | | - - | | |
| Q06 | Columbia-type emerald deposits | | 31c | | Chivari and Mazo districts (Columbia) |
| Q07 | Schist-hosted emerald deposits | | - - | | |
| Q08 | Opal | Australian-type | - - | | Southeast Queensland, Coober Peedy (Australia) |
| Q09 | Ruby & Sapphire | | - - | | |
| R | INDUSTRIAL ROCKS | | | | |
| R01 | Cement shale | | - - | | |
| R02 | Expanding shale | | - - | | Wabamun shales (Alberta) |
| R03 | Dimension stone - granite | | - - | | Riviere a Pierre (Que), Black Hills (South Dakota) |
| R04 | Dimension stone - marble | | - - | | Vermont, Alabama, Georgia |
| R05 | Dimension stone - andesite | | - - | | |
| R06 | Dimension stone - sandstone | | 30d* | | |
| R07 | Silica sandstone | High Silica Quartzite | 30e* | Moberley | |
| R08 | Flagstone | | - - | | Yorkshire (GRBR) |
| R09 | Limestone | | - - | Texada Island, Victoria | |
| R10 | Dolomite | | - - | | |
| R11 | Volcanic ash - pumice | | - - | | |
| R12 | Perlite | | - - | Blackdome | |
| R13 | Nepheline syenite | | - - | Trident Mountain | Blue Mountain |
| R14 | Alaskite | | | | Feldspar Corp., N.? Carolina |
| R15 | Crushed rock | | | | |

# ORGANIZATION OF MINERAL DEPOSIT DATA



# Mineral Deposit Databases

## USES

- An inexpensive **research** tool by industry, academic researchers and government.
- Selection of areas for **exploration or research** projects.
- Assists in the analysis of the **distribution** of geology, metallogeny and mineral deposits.
- Mineral deposit distribution plots help select prospective areas for **mineral potential.**
- **Land-use planning** and **mineral resource management.**
- Data may be integrated into geographical information systems (**GIS**).

# Mineral Deposit Databases

## USGS EXAMPLE:

MRDS - Mineral Resource Data System Contents

- **Record Number and Type**
- **Information Source**
- **Reporter and Affiliation, and Entry Date**
- **Site Type, Name and Synonyms**
- **Country, State, County and District/Area**
- **Primary Quadrangle and Scale**
- **Latitude And Longitude**
- **Commodities**
- **Production**
- **Deposit Type and Code**
- **Host Rock Name and Lithology**
- **Host Rock and Mineralization Age**
- **Tectonic Setting**
- **Associated Igneous Rock and Age**
- **Ore Minerals and Controls**
- **Non-Ore Mineralogy**
- **Deposit Description**
- **Comments**
- **Key Words**
- **References**

# MRDS - MINERAL RESOURCE DATA SYSTEM

### Reference

TAYLOR, Richard B., SELNER, Gary I. and JOHNSON, Bruce, R., GS MRDS - A System Based on the Data Fields Used in the National MRDS System but Using dBASE III and a Microcomputer (IBM PC or Compatible) for Organizing Data on Mineral Resource Occurrences and Providing Tabular and Graphic Output, *U.S. Geological Survey*, Open File Report 86-450A, Program Disk 86-450B, (1986).

### Database Structure (mrds.dbf)

| Field | Field name | Type | Width |
|---|---|---|---|
| 1 | WF_NUMBER | Character | 5 |
| 2 | MRDS_NO | Character | 7 |
| 3 | CMR_NO | Character | 7 |
| 4 | REC_TYPE | Character | 2 |
| 5 | ENTRY_DATE | Date | 8 |
| 6 | INFO_SRCE | Character | 1 |
| 7 | REPORTER | Character | 25 |
| 8 | REPORT_AFF | Character | 20 |
| 9 | SITE_NAME | Character | 40 |
| 10 | SYNONYMS | Character | 68 |
| 11 | SITE_TYPE | Character | 1 |
| 12 | DIST_AREA | Character | 40 |
| 13 | COUNTY | Character | 40 |
| 14 | STATE | Character | 2 |
| 15 | COUNTRY | Character | 2 |
| 16 | QUAD_2DEG | Character | 25 |
| 17 | PRIME_QUAD | Character | 25 |
| 18 | SCALE | Character | 7 |
| 19 | LATITUDE | Character | 13 |
| 20 | LONGITUDE | Character | 14 |
| 21 | COMMODITYS | Character | 68 |
| 22 | PRODUCTION | Character | 1 |
| 23 | PROD_INFO | Memo | 10 |
| 24 | DEPOS_TYPE | Character | 68 |
| 25 | DEPOS_CODE | Character | 24 |
| 26 | HR_LITH | Character | 40 |
| 27 | FORM_HR | Character | 25 |
| 28 | AGE_HR | Character | 15 |
| 29 | AGE_MINER | Character | 15 |
| 30 | TECTON_SET | Character | 68 |
| 31 | AS_IG_LITH | Character | 68 |
| 32 | AGE_AS_IG | Character | 15 |
| 33 | ORE_MINER | Character | 68 |
| 34 | N_ORE_MIN | Memo | 10 |
| 35 | ORE_CNTRLS | Memo | 10 |
| 36 | DEPOS_DESC | Memo | 10 |
| 37 | COMMENTS | Memo | 10 |
| 38 | KEY_WORDS | Character | 68 |
| 39 | NOTES | Memo | 10 |
| 40 | REF_1 | Numeric | 3 |
| 41 | REF_2 | Numeric | 3 |
| 42 | REF_3 | Numeric | 3 |
| 43 | REF_4 | Numeric | 3 |
| 44 | REF_5 | Numeric | 3 |

## MRDS - MINERAL RESOURCE DATA SYSTEM

### Database Descriptions of Fields

- or what goes into each blank in the form -

RECORD NUMBER: The entry in this required field is generated automatically by the computer. Each record in a file is numbered starting with one; the working file numbers continuously increase in order of entry. (This number belongs to the computer - the PC - it does not go to the national MRDS system.)

WORKING FILE NUMBER (WF_NUMBER): The entry in this field is for the convenience of the compiler of the database; any number can be used (1-99999); it is best used as a sequential entry when several different MRDS databases are being Compiled. It is not a required field. (This number belongs to the compiler.)

MRDS NUMBER (MRDS_NO): Enter the MRDS number if one has been assigned to the deposit; otherwise, leave blank. (This number belongs to the national MRDS system.)

CMR NUMBER (CMR_NO): Enter the CMR record number if one has been assigned to the deposit; otherwise, leave blank. (This number belongs to CMR - it does not go to the national MRDS system.)

RECORD TYPE (REC_TYPE): This is a two character code describing the type of record. The first character is an S if the record contains site specific information (describes a single mine, prospect, etc.). The first character is an A if the record contains information describing an area (a mineralized area, mining district, etc.). The second character is an M for metallic deposits, an N for nonmetallic deposits, or a B for deposits that contain both metallic and non-metallic commodities. (Only the M, N, or B goes to the national MRDS system.)

| | |
|---|---|
| S site | M metallic |
| A area | N nonmetallic |
| | B both metallic and nonmetallic |

ENTRY DATE (ENTRY_DATE): The date the data is entered into the database. Enter two digits for month (06), two for date (03), and two for year (85). Change date after editing only for substantive changes, especially if new information has been added.

INFORMATION SOURCE (INFO_SRCE): A one character code used to describe the primary type of information which was used to create the record. The codes are:

| | |
|---|---|
| 1 | Published literature |
| 2 | Unpublished report, memo, file, etc. |
| 3 | Field observation |
| 4 | MRDS |
| 5 | Personal communication |

REPORTER (REPORTER): Enter the name (preferably last name, first name, middle initial) of the person responsible for the contents of the record. If an assistant is doing the actual data entry, he or she should enter his supervisor's name in this field. The purpose of this field is to provide users with a contact for further information about this particular record.

REPORTER AFFILIATION (REPORT_AFF): Enter the name of the organization for which the reporter works. Organization names may be abbreviated if the abbreviation is unique and easily recognizable (USGS, BLM, etc.).

SITE TYPE (SITE_NAME): Enter the most well known, or most recent name of the deposit, occurrence, district, or area. If the name is unknown, enter as unidentified occurrence. This is a required field.

SYNONYMS (SYNONYMS): Enter other names by which the site has been known. If more than one name is entered, separate names with commas. For district or area records, names of important mines in the district should be entered here.

SITE TYPE (SITE_TYPE): Enter type of site or area being described by this record as a one character code from the following list:

| | |
|---|---|
| M Mine | This field does not go to the |
| P Prospect | national MRDS system. |
| C Claim | |
| O Occurrence | H Drill hole |
| A Mineralized area | |
| D Mining district | |

DISTRICT/AREA (DIST_AREA): Enter the best known or most recent name of the mining district or mineralized area which contains the site being described, or the name of the district or area for an area record.

COUNTY (COUNTY): Enter in full the county name in which the deposit is located. If the deposit is located in more than one county, separate the names with commas. Do not enter the word "county" as part of the name.

STATES (STATE): Enter the two character, U.S. Postal Service abbreviation for the name of the state in which the deposit is located. If a district or area is located in more than one state, enter the code for the state in which most of the area is located.

COUNTRY (COUNTRY): Enter the name, or abbreviation for the name (eg. US) of the country in which the deposit is located.

2 DEGREE QUADRANGLE (QUAD_2DE): Enter the name of the lo x 2o quadrangle in which the deposit is located. In the case of district or area records, enter the name of the lo x 2o quadrangle in which most of the district or area is located. Do not enter the word "quadrangle" as part of the name.

PRIMARY QUADRANGLE (PRIME_QUAD): Enter the name of the quadrangle used to determine the accurate coordinates of the site location, or the boundary of the mining district or area. Normally, this will be the name of a 1:24,000 or 1:62,500 scale quadrangle. Do not enter the word "quadrangle" as part of the name.

SCALE (SCALE): Enter the denominator of the fractional scale of the primary quadrangle (24000, not 1:24,000).

LATITUDE (LATITUDE): Enter the latitude of the site being described to the nearest second. The format is: dd mm ssN
dd = degrees mm = minutes ss = seconds
Normally, this information is obtained by digitizing from the primary quadrangle named above. This is a required field.

LONGITUDE (LONGITUDE): Enter the longitude of the site being described to the nearest second. The format is: ddd mm ssW. Normally, this information is obtained by digitizing from the primary quadrangle named above. This is a required field.

COMMODITIES (COMMODITYS): Enter a list separated by commas of the known commodities at the site being described. Use the correct chemical symbols for elements (Au, Ag, Pb, etc.) and short descriptive "codes" for other minerals and materials. The list below is that of the national MRDS system; please use it, as it will facilitate search, and feed directly into the main system. If possible, list the commodities in decreasing order of importance.

## Commodity Codes

| | | |
|---|---|---|
| ALM | | Alum |
| AL1 | | Bauxite |
| AL2 | | Aluminum (from other sources) |
| AL3 | | Alunite |
| AMB | | Amber |
| GYP | | Anhydride, gypsum |
| ASB | | Asbestos |
| VOL | | Ash, volcanic |
| BRI | | Brines, saline materials |
| MG | | Brucite as well as magnesium |
| CAR | | Carbonates |
| CER | | Cement rock, natural |
| CLY | | Clay, general |
| | CLI | Bentonite |
| | CL2 | Fuller's earth |
| | CL3 | Kaolin (includes high alumina clay) |
| | CL4 | Ball clay |
| | CL5 | Fire clay (refractory) |
| | CL6 | Bloating materials (clay, shale, etc,) |
| | CL7 | Brick clay (common) |
| COR | | Corundum |
| DIA | | Diamond |
| DIT | | Diatomite |
| DOL | | Dolomite, general |
| | DOLI | Ultra pure dolomite, CaCO3 + MgCO3 >97 % |
| | DOL2 | High magnesian dolomite; 97% > CaCO3 MgCO3 >95% |
| EMY | | Emery |
| EVA | | Evaporates, see also brine, halite |
| FLD | | Feldspar |
| GAR | | Garnet |
| GEM | | Gem stones |
| GLA | | Glauconite |
| GRF | | Graphite |
| GYP | | Gypsum, anhydride |
| HAL | | Halite |
| HAG | | Heavy aggregate |
| KYN | | Kyanite, sillimanite, andalusite, dumortierite |
| LAT | | Laterite |
| LST | | Limestone, general |
| | LSTI | Limestone, CaCO3 >97 % |
| | LST2 | Limestone, 97 % > CaCO3 >95 % |
| LWA | | Light weight aggregate |
| MGS | | Magnesite |
| MBL | | Marble |
| MIC | | Mica, general |
| | MICI | Sheet mica |
| | MIC2 | Scrap mica |
| | MIC3 | Flake mica |
| MPG | | Mineral pigments |
| MON | | Monazite |
| OLV | | Olivine |
| P | | Phosphorus or phosphate |
| PEA | | Peat |
| PER | | Perlite |
| PGM | | Platinum group metals |
| PUM | | Pumice |
| PYR | | Pyrite |
| | PYRI | Pyrrhotite |
| PYF | | Pyrophyllite |
| QTZ | | Quartz |
| REE | | Rare earth elements |
| REF | | Refractory materials |
| BRI | | Salines, brines |
| SAP | | Saprolite |
| SIL | | Silica |
| TLC | | Talc, serpentine, soapstone |
| VRM | | Vermiculite |
| WOL | | Wollastonite |
| ZEO | | Zeolites |

PRODUCTION (PRODUCTION): A one character field which indicates whether production has been known to occur. Codes are as follows:

| | |
|---|---|
| Y | known production |
| N | known to have not produced |
| ? | production history unknown |

PRODUCTION INFORMATION (PROD_INFO): Enter into this text field information about the production history of the deposit, if any. Include known dates of production, commodities produced, and data on tonnage and/or grade of ore produced.

DEPOSIT TYPE (DEPOS_TYPE): Enter a concise label, or labels that you would attach to the type of deposit being described by this record (epithermal vein, massive sulfide, Mississippi Valley, placer, etc.).

DEPOSIT TYPE CODE (DEPOS_CODE): Enter the code number from the following list which best describes the deposit. If several deposit types are present, enter the code numbers describing them in order of importance; separate these code numbers with commas. These code numbers provide a structured entry to facilitate sorting by deposit type. This entry will not be transmitted to the main MRDS file.

## Deposit type code

```
10.     Placer deposits
  10.2        Modern
     10.21        Alluvial
     10.22        Marine, including beach, strand line
  10.4        Fossil
     10.41        Alluvial
     10.42        Marine, including beach, strand line
     10.47        Quartz-Pebble conglomerate (Au, U, Th, Rand)
12.     Residual deposits
  12.2        Resistate (mechanical)
     12.22        barite (Missouri)
  12.4        Chemical (concentrations, alteration minerals)
     12.42        clays
     12.44        bauxite
     12.46        iron (including "bog iron, manganese',)
     12.48        vermiculite
     12.49        nickel (Riddle, OR)
14.     Supergene base and precious metals
20.     Organic-rich sedimentary deposits
  20.2        peat
  20.6        shale (metal-rich)
     20.62        metal-rich black shale
22.     Syngenetic sedimentary deposits
  22.2        clays
     22.25        lithium clays
  22.3        shales (bloating, light-weight aggregate)
  22.4        carbonate rocks
     22.42        limestone
     22.44        dolomite
     22.46        nahcolite
  22.6        phosphorite
  22.8        evaporite
     22.82        gypsum-anhydride-sulfur
     22.84        saline minerals
     22.86        saline brines
24.     Iron formation
26.     Sedimentary manganese
  26.2        bedded (Kalahari field)
  26.4        nodules
28.     Sedimentary (bedded) barite
30.     Syngenetic massive (and disseminated) sulfides
  30.2        Sedimentary (Rammelsberg)
  30.4        Iron formation, sulfide bearing
  30.6        Volcanic-hosted
     30.61        Ophiolite assemblage (Cyprus)
     30.63        Felsic to intermediate (Kuroko)
  30.8        Metamorphosed syngenetic sulfide deposits
     30.81        Zn-Cu (Sedalia type)
     30.83        W-Cu (Firefly type)
36.     Diagenetic sedimentary deposits
  36.2        clays
  36.4        zeolites
     36.42        saline lake (closed system)
     36.44        altered tuffs (open system)
  36.6        fluorite (Rome, OR)
```

```
        36.8        metals in sedimentary rocks
40.   Epigenetic sedimentary-hosted deposits
        40.2        sandstone-hosted metals
           40.22       sandstone uranium, vanadium, silver
           40.24       sandstone-hosted "Mississippi Valley" (Laisvall, Sweden)
        40.4        sandstone, shale-hosted metals
           40.42       copper (Kupferschiefer)
           40.44       molybdenum (SD Badlands)
        40.6        carbonate-hosted metals
           40.62       "Mississippi Valley', base metals, cobalt
           40.64       Dolomitic Cu-Co (Zaire Cu)
50.   Geothermal energy
        50.2        Steam
        50.4        Hot water (only)
52.   Hot spring deposits
        52.1        carbonates (travertine)
        52.2        clays
           52.3        metals
           52.33       sedimentary rock-hosted
           52.35       volcanic-hosted
55.   Hydrothermal (volcanic-subvolcanic)
        55.1        veins
        55.2        stockworks
        55.3        breccia pipes
        55.4        mantos
        55.5        disseminated
           55.55       volcanic Cu (Keeweenaw, MI)
        55.6        unconformity-vein (uranium)
57.   Contact metamorphic
        57.1        Cu (Pb-Zn-Au-Ag-Mo, Carr Fork, UT)
        57.2        Zn-Pb (Ag-Cu-W, Ban Ban, Australia)
        57.5        W (Mo-Zn-Cu, Pine Creek, CA)
        57.6        Sn (W-F-Be, Lost River, Ak)
        57.7        Fe (Cu-Co-Au, Daiguiri, Cuba)
        57.8        Nonmetallics
           57.81       magnesite (magnesite, brucite, Gabbs, NV)
           57.83       marble
58.   Porphyry
        58.1        Cu
        58.3        Cu-Mo (Au)
        58.4        Au
        58.5        Mo (W)
        58.7        Sn
59.   Greisen
        59.1        disseminated
        59.3        veins
        59.5        pegmatite-greisen veins
60.   Volcanic-plutonic rocks
        60.1        pumice and perlite
66.   Magmatic segregations, granitic plutons
        66.1        pegmatites
67.   Magmatic segregations, mafic-ultramafic plutons
        67.1        sulfide (immiscible melts)
           67.11       podlike (Sudbury)
           67.13       layered, interstitial (Bushfeldt Pt)
        67.3        cumulates
           67.31       stratiform chromitite
           67.32       disseminated chromite
           67.34       Podiform
        67.6        intrusive
           67.61       magnetite, chromite, ilmenite
        67.7        extrusive
           67.71       magnetite (lava)
68.   Magmatic differentiates, undersaturated plutons (syenite-ultramafic complexes)
        68.5        intrusive
           68.51       carbonatite
        68.7        extrusive
           68.71       carbonate (lava)
69.   Kimberlite pipes (diamond pipes)
        69.1        alnoite (diamond-bearing, Kimberly, Australia)
70.   Meta-ultramafic
        70.1        asbestos
        70.3        serpentine
75.   Regional metamorphic
        75.2        aluminosilicate minerals
        75.3        marble
```

| | |
|---|---|
| 75.7 | graphite |
| 75.8 | talc |

Commodities that should not be entered in MRDS file:

Oil and gas Sand and gravel (common aggregates) Dimension stone Coal

HOST ROCK LITHOLOGY (HR_LITH): Enter a concise description of the lithology of the rock which forms the principal host for the deposit.

HOST ROCK NAME (FORM_HR): Enter the formal name of the unit which forms the principal host for the deposit.

HOST ROCK AGE (AGE_HR): Enter the abbreviation for the most specific geologic age of the rock which forms the principal host for the deposit. A range of ages may be entered separated by a hyphen (Cret-Tert).

| | | | |
|---|---|---|---|
| Cen | Cenozoic | Pal | Paleozoic |
| Quat | Quaternary | Perm | Permian |
| Holo | Holocene | Penn | Pennsylvanian |
| Pleis | Pleistocene | Carb | Carboniferous |
| Tert | Tertiary | Miss | Mississippian |
| Neo | Neogene | Dev | Devonian |
| Paleog | Paleogene | Sil | Silurian |
| Plio | Pliocene | Ord | Ordovician |
| Mio | Miocene | Camb | Cambrian |
| Oligo | Oligocene | Prec | Precambrian |
| Eo | Eocene | Prot | Proterozoic |
| Paleo | Paleocene | Arch | Archean |
| Mes | Mesozoic | E | Early |
| Cret | Cretaceous | M | Middle |
| Jur | Jurassic | L | Late |
| Tri | Triassic | | |

MINERALIZATION AGE (AGE_MINER): Enter the abbreviation for the most specific geologic age of the mineralization of the deposit. Use the same abbreviations used for the age of the host rock. A range of ages may be entered separated by a hyphen (Cret-Tert). If the mineralization has been dated radiometrically, include that information in the "Deposit Description" field.

TECTONIC SETTING (TECTON_SET): Enter a brief description of the tectonic setting of the site or area at the time the deposit was formed.

ASSOCIATED IGNEOUS ROCK (AS_IG_LITH): Enter a brief description of any igneous rock genetically associated with the mineralization. Include the formal name, if any, and the lithology.

ASSOCIATED IGNEOUS ROCK AGE (AGE_AS_IG): Enter the abbreviation for the most specific geologic age of the genetically associated igneous rock. Use the same abbreviations used for the age of the host rock. A range of ages may be entered separated by a hyphen (Cret-Tert). If the associated igneous rock has been dated radiometrically, include that information in the "Deposit Description" field.

ORE MINERALS (ORE_MINER): Enter the complete name of all ore minerals known to occur at the site being described. If possible, list in decreasing order of importance.

NON-ORE MINERALOGY (N_ORE_MIN): Enter into this text field a complete (as possible), but brief description of the alteration, gangue, and other non-ore mineralogy associated with the mineralization at this site.

ORE CONTROLS (ORE_CNTRLS): Enter into this text field a description of the factors controlling mineralization, including structural, stratigraphic, chemical, or any other type of control.

DEPOSIT DESCRIPTION (DEPOS_DESC): Enter into this text field a general description of the deposit being described. Also include any other information concerning this deposit or area that does not seem to fit in another field.

COMMENTS (COMMENTS): This is a general purpose text field which can be used for information which does not fit any other field. This is a good place to put speculations (as opposed to facts entered into other fields) concerning deposit origin, etc.

KEY WORDS (KEY_WORDS): This is a key word field available for free use; it will not be transferred to MRDS or to the CMR file.

NOTES (NOTES): This is a memo field available for notes, comments, that are not to be transferred to MRDS or to the CMR file.

REFERENCES (REF_1..._5): Five numeric reference fields are furnished. Each reference should be entered into the Reference file, numbered in order of entry. These references must be in standard Survey format, and must be complete. Each reference will be assigned a number and be entered only once. A number from the reference file should be entered into the numeric reference field of the MRDS file. Up to five references may be entered into a single deposit record, one in each field.

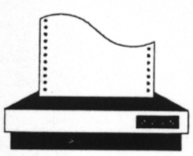
# MINFILE AT A GLANCE

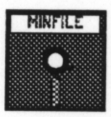
## DATABASE

Total occurrences: 11 368 records
Size of database: 68 Mb
Area covered (B.C.): 950,000 square kilometres
Map areas (1:250K scale): ~90 Maps
Data format: 69 entity-relational ASCII files
Per cent data released: 75%

## PRODUCT OUTPUT

Mineral location maps: 1:250,000; 1:100,000 scales
Data diskettes (1.2 Mb): 1 for each map area
MINFILE/pc program: Data Entry-Search-Report
Paper printouts: Indexes and complete reports
Open Files: Commodity reports
Major deposits






## CLIENTS

Users of MINFILE/pc: 536 clients
Mailing list for MINFILE: 950 clients
Types of clients: Governments, Industry, Public
List of interested clients: Canada, U.S.A., Australia, New Zealand, England, Europe, China, Japan, Vietnam, Africa


January 1994

# Summary of B.C. MINFILE

## OVERVIEW OF MINFILE:

- MINFILE is the British Columbia Geological Survey's mineral inventory database management system.
- Contains information on over 11 000 metallic, industrial mineral and coal occurrences (showings to major producing mines).
- MINFILE/pc, a menu-driven data-entry, search and report program for IBM-compatible microcomputers, accesses the database.
- Data elements are organized with a set of codes (entities), within a relational database design (entity-relationship model).
- The MINFILE system helps provide solutions in mineral exploration, land-use planning and mineral resource management.
- MINFILE information may be used in other programs such as word processors, plotted using computer-aided mapping systems, and integrated with conventional geographical information systems.
- The database contains 69 files, with 96 fields and 84 data elements.
- 86 maps (1:250,000 or 1:100,000 scale) cover 950 000 square kilometres.

## MINFILE DATA:

- Location
- Commodity
- Mineralogy and alteration
- Geological setting
- Lithology and host-rock name and age
- Deposit class and character
- Assays, reserves and production, and reserves
- Textual geological description (capsule geology)
- Bibliography, citing information sources for the occurrence

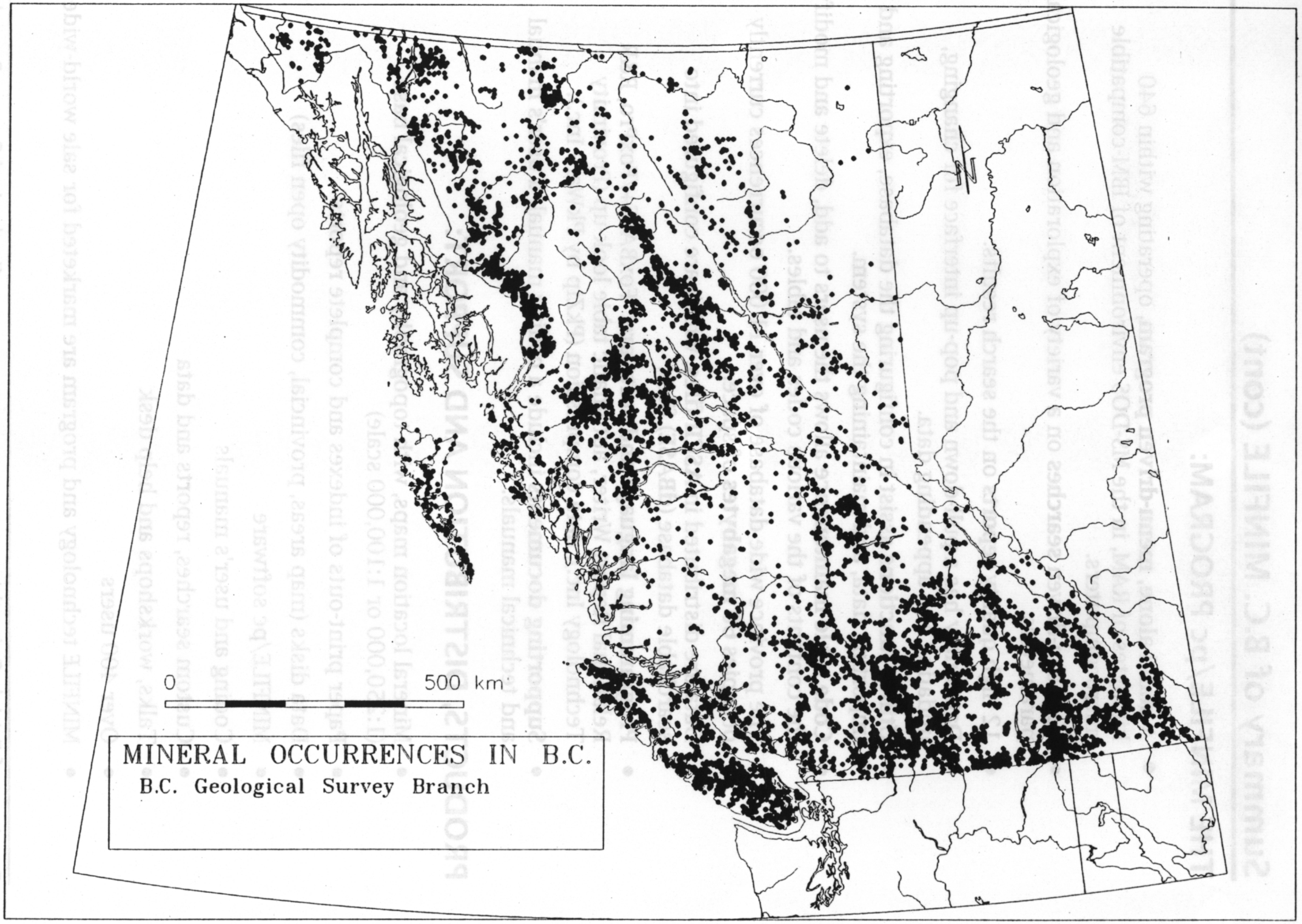
# Summary of B.C. MINFILE (cont)

## THE MINFILE/pc PROGRAM:

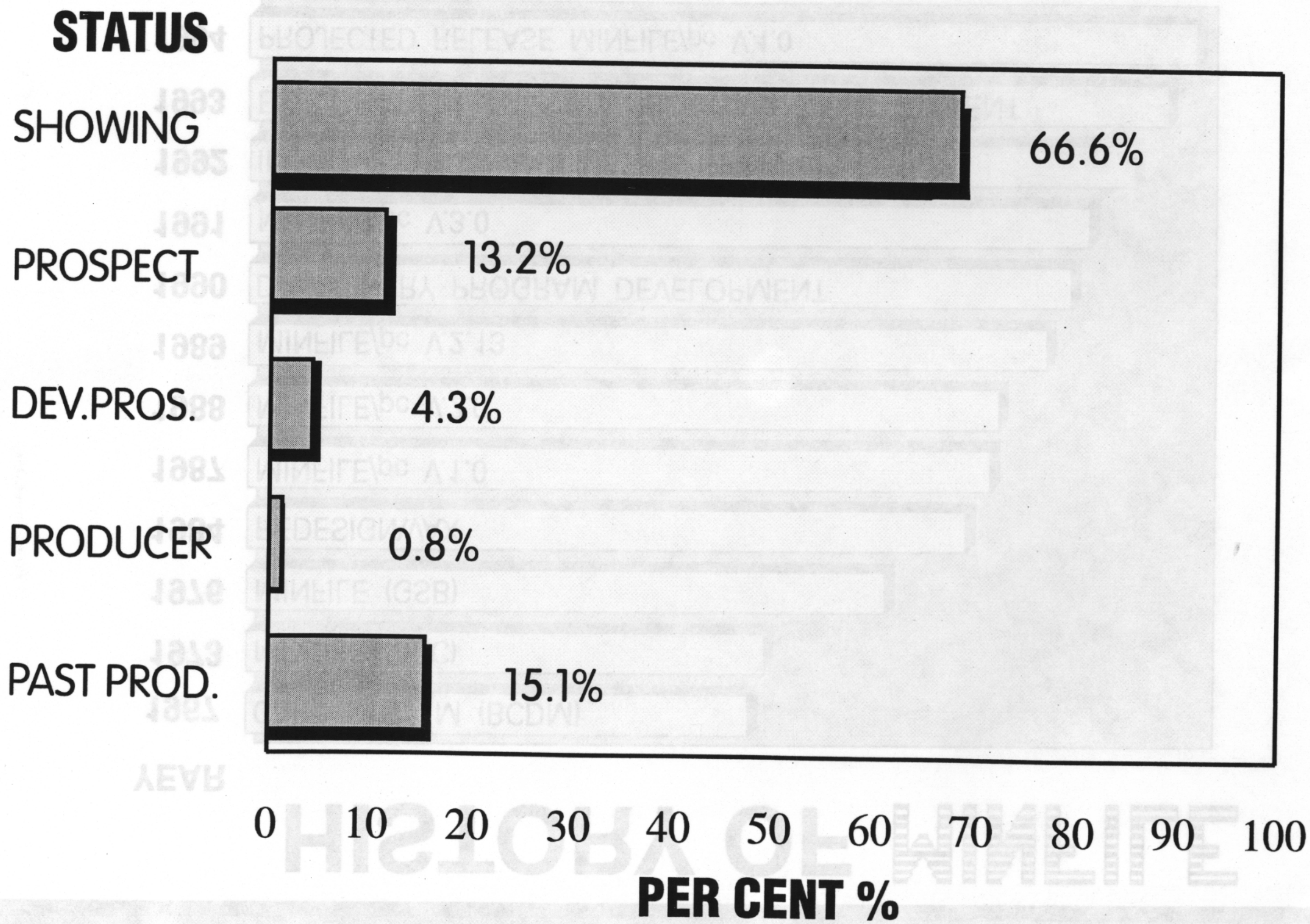
- A **stand-alone, menu-driven program**, operating within 640 kilobytes of RAM, in the MS-DOS environment of IBM-compatible microcomputers.
- 12 menu-driven **searches** on a variety of exploration and geological parameters.
- 12 high quality **reports** on the search results.
- **Data-entry** has a pull-down and pop-up interface for changing, updating and appending data.
- **Utility functions** assist in configuring the database, exporting and importing data, and maintaining the system.
- **Code table maintenance** allows the users to add, delete and modify the contents of the various codes and tables.
- The province wide database of over 11 000 occurrences currently occupies **60 megabytes** of space.
- Data are distributed in **ASCII files**, which are configured into searchable database (**dBASE**) files.
- **Programming language and software**: FoxBASE+/FoxPro, R&R Relational Report Writer, automatic table look-up (Proximity Technology Inc.), data compression (PkZip by PkWare Inc.).
- **Supporting documents** include a coding manual, a user's manual and technical manuals.

## PRODUCTS, DISTRIBUTION AND SUPPORT:

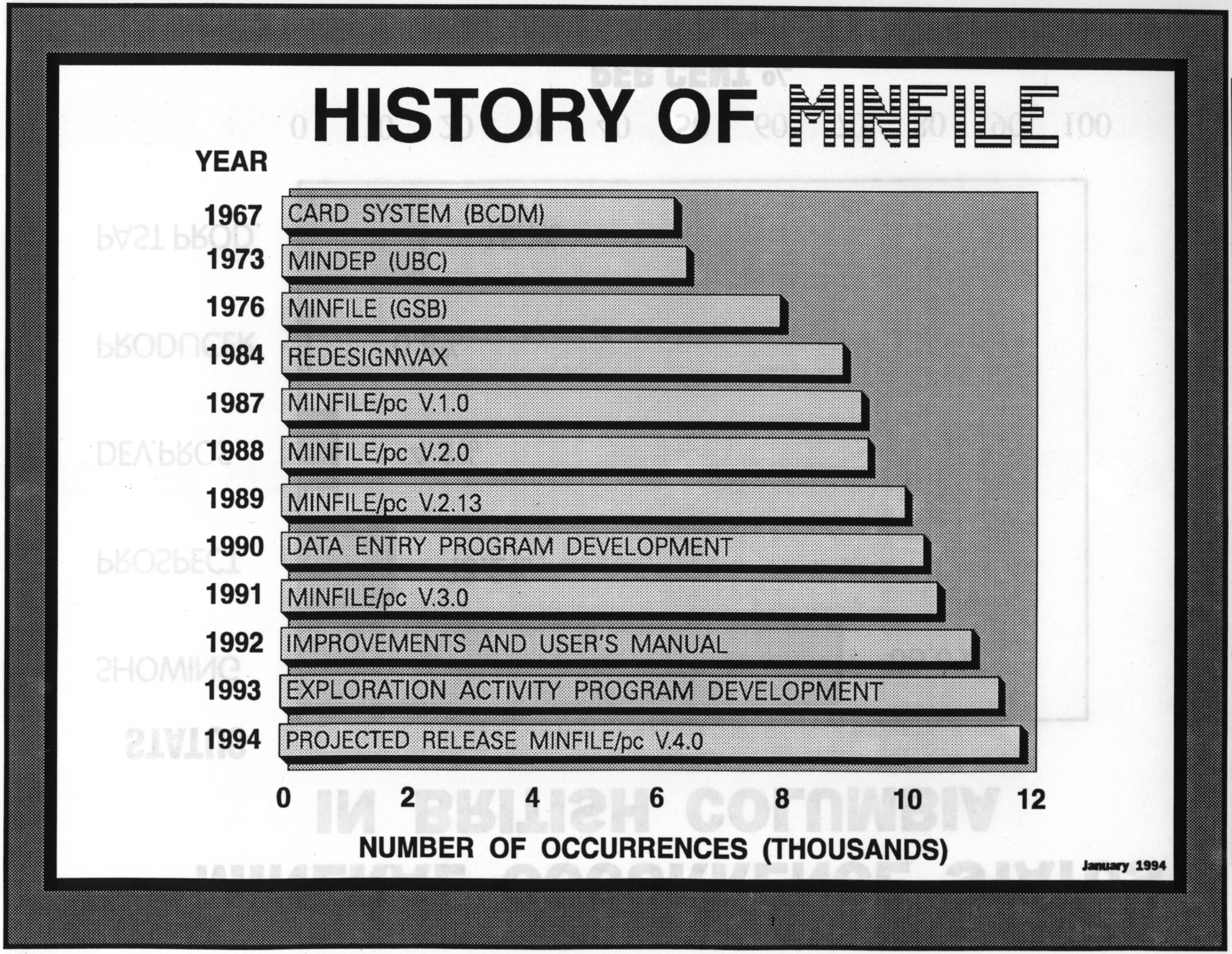
- Mineral location maps, with topography and geological base (1:250,000 or 1:100,000 scale)
- Paper print-outs of indexes and complete reports
- Data disks (map areas, provincial, commodity open files)
- MINFILE/pc software
- Coding and user's manuals
- Custom searches, reports and data
- Talks, workshops and help desk
- Over 400 users
- MINFILE technology and program are marketed for sale world-wide


MINERAL OCCURRENCES IN B.C.
B.C. Geological Survey Branch
0
500 km

# MINERAL OCCURRENCE STATUS IN BRITISH COLUMBIA




GSB 01/94


HISTORY OF MINFILE
YEAR
1967
CARD SYSTEM (BCDM)
1973
MINDEP (UBC)
1976
MINFILE (GSB)
1984
REDESIGN\VAX
1987
MINFILE/pc V.1.0
1988
MINFILE/pc V.2.0
1989
MINFILE/pc V.2.13
1990
DATA ENTRY PROGRAM DEVELOPMENT
1991
MINFILE/pc V.3.0
1992
IMPROVEMENTS AND USER'S MANUAL
1993
EXPLORATION ACTIVITY PROGRAM DEVELOPMENT
1994
PROJECTED RELEASE MINFILE/pc V.4.0
0
2
4
6
8
10
12
NUMBER OF OCCURRENCES (THOUSANDS)
January 1994

N.T.S: 104B/1W

Deposit No: 21

U.T.M: 

METALS: Cu, Ag, Fe, As, Co, Au

Lat - Long.: 56°12.9' 130°20.7'

PROPERTY: Granduc Mine

References: BC MI #3302 Granduc

MMAR 1931, p 47; 1953, p 82; 1954, pp 80-82; 1955, pp 14-16; 1956, "

pp 15-17; 1957, p 6; 1958, p 6; 1960, p 6; 1961, p 8; 1962, p 8;

1964, p 18; 1965, pp 44-48; 1966, p 38; 1967, pp 31-34; 1968, p 46;

1969, p 54

BC Prelim. Map of Granduc Area, 1956

As Repts 89; 90; 328; 340

NMI 104B/1 Cu 1 Granduc (Leduc) (Edna May)

MRB Corp Files: "The Granby Mining Co. Ltd.";

"Granduc Mines, Ltd."; "Granduc Operating Co."

Western Miner & Oil Review, Aug. 1953, p 42

(OVER)

Project 290

104B/1W 21

Norman, G.W.H., "Faults and Folds Across Cordilleran Trends at the Headwaters of Leduc River, Northern B.C.," Petrologic Studies, Buddington Volume, the G.S.A., 1962

GEM 1970, p. 68-73; 1971, p. 34-5

Norman, G.W.H. & McCue, J., "1966 Relations of Ores to Fold Patterns at Granduc, B. C." C.I.M.M. Special Volume No. 8

MINERAL DEPOSIT INVENTORY

Map No. 104B-21 Property No. 3302

Metal ☒ Industrial Mineral ☐ Placer ☐ Coal ☐ Lapidary ☐

Name: Granduc Mine

Claim ______ Owner ______
Operator ______ Year(s) ______

Claim ______ Owner ______
Operator ______ Year(s) ______

Claim ______ Owner ______
Operator ______ Year(s) ______

Location: N.T.S. 104B/1W Lat. 56°13.0' Long. 130°20.8' U.T.M. ______
M.D. Skeena In park ______ E. & N. ☐ El. ______
Loc. plot. ______ Source ______ Prec. 1

Status: Producer ☒ Dev. Prospect ☐ Prospect ☐ Showing ☐

Production: Tons 6,491,898 Grade: Au 23,243 oz Ag 1,476,742 oz Cu 153,422,613 Pb -- Zn --
Others ______ Year(s) 1970 to 1973
Reserves; Tons 32,951,000 Grade 1.64% Cu Year 1973
Tons ______ Grade ______ Year ______
Tons ______ Grade ______ Year ______

Development: Surface ______
Underground 40,146'
Drilling 68,273'
Surveys: Geol. ______ Geophys. ______ Geochem. ______

References: M.M.A.R. 1931-47, 1953-82, 1956-15, 1961-8, 1962-8, 1964-18, 1965-44, 1966-38, 1967-31, 1968-46
______ Expl. Form 1974
G.E.M. 1969-54, 1970-66,73, 1971-34, 1972-514, 1973-497, 1974-532
As. Rpt.: L.C. ______ Prosp. ______ D.D. ______ Other ______
Geol. ______ Geophys. 3739 Geochem. ______
Geol. and maps Preliminary Map Granduc - 1956, NMI.Cul-

Summary description mineralized shear zones in metaseds.

Attitude of deposit: Strike ______ Dip ______ Azimuth ______ Plunge ______
Size: Length ______ Width ______ Depth ______

Minerals Chalcopyrite, pyrite, pyrrhotite, magnetite, galena, sphalerite, arsenopyrite
Economic minerals ______
Assays ______

Remarks ______

Recorded by gg 4/71 Revised by ______ Lib. Res. Comp. ______

BRITISH COLUMBIA DEPARTMENT OF MINES AND PETROLEUM RESOURCES

Product(s) Cu,Ag,Fe,Au,Co
Map No. 104B-21
Property No. 3302

## HOST ROCK

**DOMINANT HOST ROCK:** [1] Sedimentary; [X] Plutonic; [3] Volcanic; [4] Metasedimentary; [5] Metaplutonic; [6] Metavolcanic; [7] Metamorphic

**FORMAL HOST:**

1. Group: 289 Hazelton — Formation: ** undefined
   Strat-Age: 227 Lower Jurassic — Isotopic Age:
   Dating Method: — Material Dated:
2. Group: — Formation:
   Strat-Age: — Isotopic Age:
   Dating Method: — Material Dated:

**INFORMAL HOST:**

1. Igneous/Metamorphic/Other: — Name: 257 Nanika Intrusion
   Strat-Age: 124 Eocene — Isotopic Age: 49.9 Ma +/- 2.3 Ma
   * Dating Method: 07 K-Ar — Material Dated: Whole rock (biotite hornfels)
2. Igneous/Metamorphic/Other: — Name:
   Strat-Age: — Isotopic Age:
   Dating Method: — Material Dated:

**Comment on Host Rock:** Age date from Bulletin 64, page 89.

**ROCK TYPE/LITHOLOGY:**

| MODIFIER CODE(S) | | | ROCK CODE | ROCK NAME |
|---|---|---|---|---|
| RYLT | | | PRPR | Rhyolite porphyry |
| | | | BRCC | Breccia |
| QRTZ | MNZN | | PRPR | Quartz monzonite porphyry |
| BOIT | | | HRFL | Biotite hornfels |
| | | | GRWK | Greywacke |
| | | | ARGL | Argillite |

## GEOLOGICAL SETTING

**TECTONIC BELT:** [IN] INsular; [CC] Coast Crystalline; [X] InterMontane; [OM] OMineca; [EA] EAstern

**TERRANE:** 1. CPC Plutonic Rocks 2. ST Stikinia

**PHYSIOGRAPHIC AREA:** NCPT Nechako Plateau

**METAMORPHISM:**

TYPE: [X] Contact; [2] Regional

RELATIONSHIP: [1] Pre-Mineralization; [2] Syn-Mineralization; [3] Post-Mineralization

**GRADE:** [ZL] Zeolite; [GS] Greenschist; [AM] Amphibolite; [X] Hornfels; [GL] Granulite; [BS] Blueschist; [EC] Eclogite; [AN] Anthracite; [SA] Semi-Anthracite; [LV] Low Vol. Bituminous; [MV] Med. Vol. Bituminous; [HV] Hi Vol. Bituminous; [SB] Sub Bituminous; [LI] Lignite

**Geological Setting Comment:**

## CAPSULE GEOLOGY

Molybdenum mineralization occurs within a rhyolite plug, 600 by 900 metres in diameter, which intrudes hornfelsic clastic rocks with intercalated greywackes and argillites of the Lower Jurassic Hazelton Group. The porphyry plug is part of the Eocene Nanika Intrusions and has been dated at 49.9 +/- 2.3 million years. This rhyolite porphyry plug consists of four phases including two porphyries and two breccias. The porphyry forming the major part of the plug is a white aphanitic rock with sparse phenocrysts of quartz and feldspar. This phase intrudes an earlier breccia in which fragments of the porphyry occur along with fragments of country rock. The porphyry is intruded by a second breccia composed mainly of porphyry fragments and a small (about 245 metres in diameter) plug of quartz monzonite porphyry.

Mineralization is concentrated in a stockwork of quartz veins and fractures. The molybdenite mineralization is contained within a silicified zone and better grades occur in a zone immediately peripheral to the contact of the younger porphyry plug. Minor chalcopyrite, sphalerite and galena are reported to occur in separate localities.

Silicification is the most intense type of alteration but carbonate, pyrite and talcose alteration with potassic metasomatism also occur.

The Lucky Ship deposit is reported to host 13.6 million tonnes of ore grading 0.17 per cent molybdenite (Map 65).

## WORK HISTORY

| YEAR FROM | YEAR TO | WORK TYPE | AMOUNT (m/km/ha/No.) | COMMENT (Owner/Operator/Results) |
|---|---|---|---|---|
| | 1957 | STAK | 15 claims | Owned by Matthew Sam and B. McRae |
| | | TREN | 62 metres | |
| 1963 | 1964 | PHYS | | 109 claims owned by Southwest Potash Corp |
| | | GEOL | 61 line-km. | 42 claims optioned to Plateau Metals Ltd. |
| | | GEOC | 61 line-km. | Work done under the direction of T.J.R. |
| | | DIAD | 1312 metres | Godfrey of Southwest Potash Corp. |
| 1965 | 1967 | STAK | 81 claims | Amax Exploration Inc., restaked 81 |
| | | PHYS | | claims and optioned property from both |
| | | GEOC | | Southwest Potash Corp. and Plateau |
| | | IPOL | | Metals Ltd. |
| | | MAGG | | In 1965 Plateau Metals Ltd. reported |
| | | DIAD | 8439 metres | 13.6 million tonnes of 0.17 % $MoS_2$. |
| | | TREN | | |
| | 1968 | STRI | | Work done by Plateau Metals Ltd. |
| | | DIAD | 2 holes, 828 m. | |
| | | GEOL | | |

```
 DEPOSIT        SCREEN        EDIT        PRINT       HELP
DENT4010      ┌──────────────────────┐E / pc                        30/05/94
              │ Identification       │ata Entry                        16:54
              │ Mineral occurrence   │s and Petroleum Resources
              │ Host rock            │
              │ Geological setting   │
              │ Reserves             │cation——
              │ Production           │
MINFILE No.  :│ Capsule geology      │ Names: ESKAY CREEK
NMI No.      :│ Bibliography         │                 Mining Method
Status       :│ Notes                │          Open Pit:     Underground: X
              │ Exploration Activity │ion ————
NTS Maps     :│ Work History         │ Mining Divisions      : Skeena
BC Maps      :└──────────────────────┘ UTM Zone              : 09
Latitude     :  56 38 00               Northing              : 6277299
Longitude    : 130 27 00               Easting               : 411052
Elevation    : 1600 metres             Location Certainty    : Within 500 m
                           ———— Comments ————
21 zone, approximately 84 kilometres north-northwest of Stewart and 4

Date Coded   : 24/07/85             Coded by  : GSB      Field Checked: N
Date Revised : 15/11/91             Revised by: GO       Field Checked: Y

                                                   Deposits :  11369
```

```
 DEPOSIT        SCREEN        EDIT        PRINT       HELP
DENT4020                    ┌─────────┐ / pc                      30/05/94
                            │ Append  │ta Entry                      16:54
              Ministry of En│ Revise  │ and Petroleum Resources
                            ├─────────┤
                            │ Browse  │
                           —│ Delete  │currence——
                            │ Move    │
MINFILE No.    : 104B  008  │ Insert  │Name : ESKAY CREEK
                           —├─────────┤
Commodities    : Gold       │ Submit  │EPOSIT
MINERALS                    │ Undo    │haracteristics: Stratabound
Significant    : Sphalerite ├─────────┤lassifications: Volcanogenic
Associated     :            │ Options │ypes:
Alteration     : Chlorite   │ Compare │hape           : Tabular
Alterat'n Type: Chloritic   └─────────┘odifiers       : Faulted
                                      Dimension       : 1400x250 x5    metres
AGE                                   Strike/Dip      :    /
Mineralization: Lower Jurassic        Trend/Plunge    :    /
Isotopic       :
Material Dated: Galena                      Method: Lead/Lead
COMMENTS: 21 zone; 5 to 45 metres thick.  Age date of mineralization from

                                                   Deposits :  11369
```

```
SCREEN          DEPOSIT          EDIT      HELP       PRINT
                                 MINFILE / pc                    23/05/90
 Identification                  Data Entry                         13:58
 Mineral Occurrence  y of Energy, Mines and Petroleum Resources
 Host Rock
 Geological Setting
 Reserves                     ── Identification ──
 Production
 Capsule Geology     021                Names: GRANDUC
 Bibliography        Cu1                          Mining Method
 Work History        roducer                  Open Pit:    Underground: X
 Exit to Main Menu            ──── Location ────
                     W                  Mining Divisions      : Skeena
BC Maps         :                       UTM Zone              : 09
Latitude        :  56 12 41             Northing              : 6230200
Longitude       : 130 20 35             Easting               : 416700
Elevation       : 0975 metres           Location Certainty    : Within 500 m
                              ──── Comments ────
Mine location.

Date Coded    : 24/07/85             Coded by   : GSB       Field Checked: N
Date Revised  : 25/07/88             Revised by: LDJ        Field Checked: N

                                                  | Deposits :  1
```

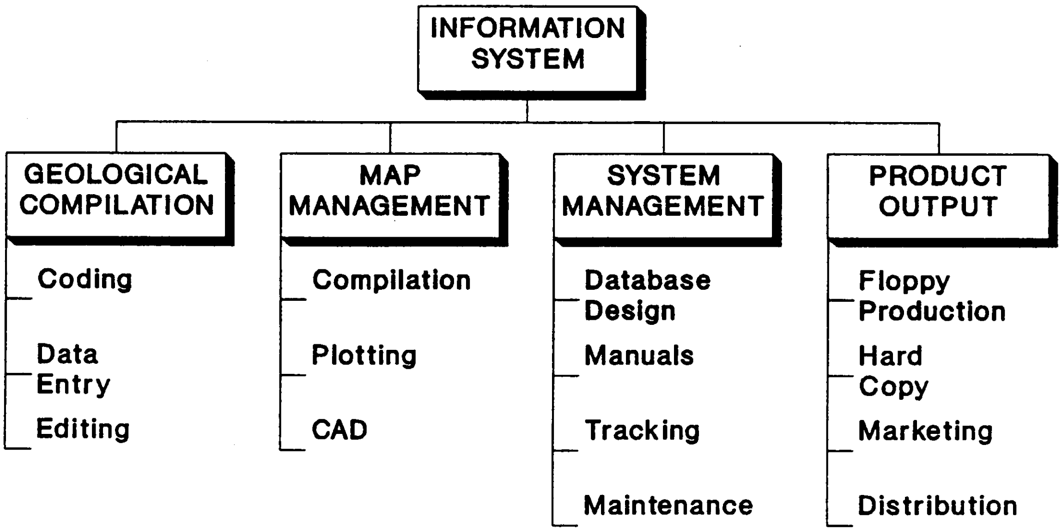
```
DENT4020                       MINFILE / pc                        23/05/90
                               Data Entry                             14:33
                Ministry of Energy, Mines and Petroleum Resources     REVISE

                           Tourmaline
                           Torbernite
MINFILE No.     : 104B  021  Topaz                C
                           Tonalite
Commodities     :          Thorite
MINERALS          Epidote  Turgite
Significant     :          Tenorite               s: Massive
Associated      :  tour    Thorianite             s: Syngenetic
Alteration      :          Bournonite              : Regular
Alterat'n Type:    Graphite  Wurtzite              : Folded
                           Thorogummite            : 1200x760 x240  metres
AGE                        Staurolite              :    /
Mineralization: Unknown    Telluride               :    /
Isotopic        :
Material Dated:                              Method: Unknown
COMMENTS: These massive sulphide deposits likely represent deformed syngene

Press PGDN or ↓ to see remainder of list         | Deposits :  75
```

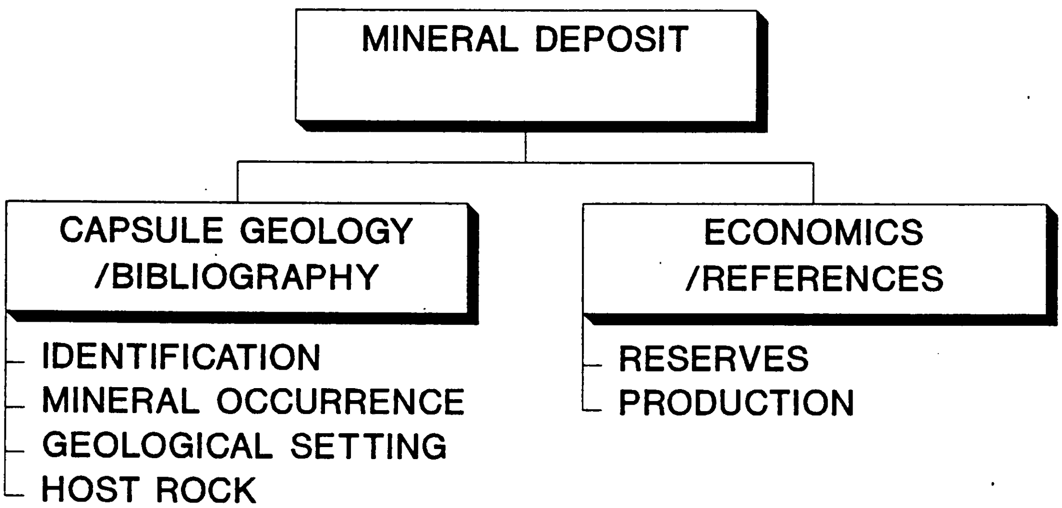
**Sample Data Entry Screens and Proximity Help System**

# MINFILE




GSB

# MINFILE MODEL




GSB

## LIMITATIONS

- *Incomplete or inaccurate reporting*
- *Reporting and recording bias*
- *Data structure knowledge required*
- *Data delivery and updating*
- *Costs & technological barriers*

## SOLUTIONS

- *Research / Interpretation*
- *Ranking / Combining commodities*
- *Educate / Documentation*
- *Planning / Staff support*
- *Technology / Innovations*

GSB

# DATA CAPTURE

- Company Reports
- Provincial Annual Reports, Bulletins
- Federal Papers, Memoirs, Bulletins
- University Theses
- Press Releases
- Scientific Journals

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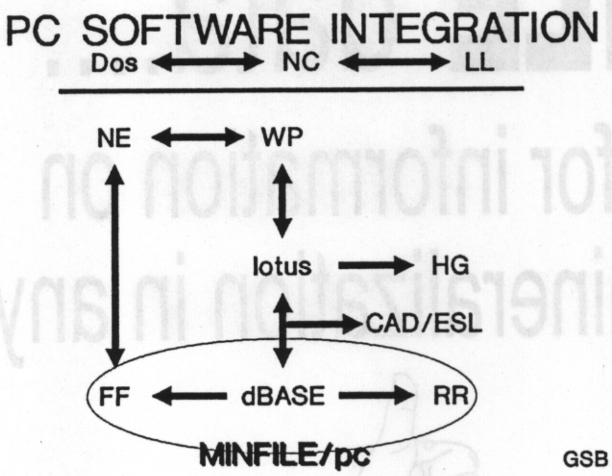
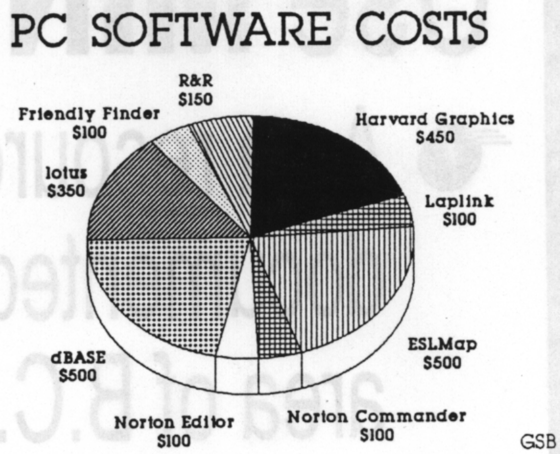


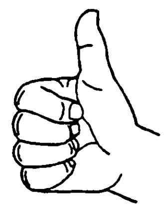

# SOFTWARE APPLICATIONS

| Program | Use | Examples |
|---|---|---|
| dBASE/FoxBASE | Relational Database | Mineral Inventory |
| R&R | Reports | Master Report |
| Friendly Finder | Query (TSR) | Codes |
| lotus | Spreadsheet | Budget/Stats |
| | Flat File | Projects |
| Harvard Graphics | Charts | Slides/Overhead |
| | | Graphs |
| Norton Editor/Word | Word Processor | Capsule Geology |
| Norton Commander | Dos Shell | File Organizer |
| Mobius/Kermit | Vax-PC Link | Downloads |
| Laplink | PC-PC Link | Data Transfer |
| AUTOCAD/ESLMap | Drafting/Plotting | Mineral Maps |

GSB

# Use **MINFILE** data....

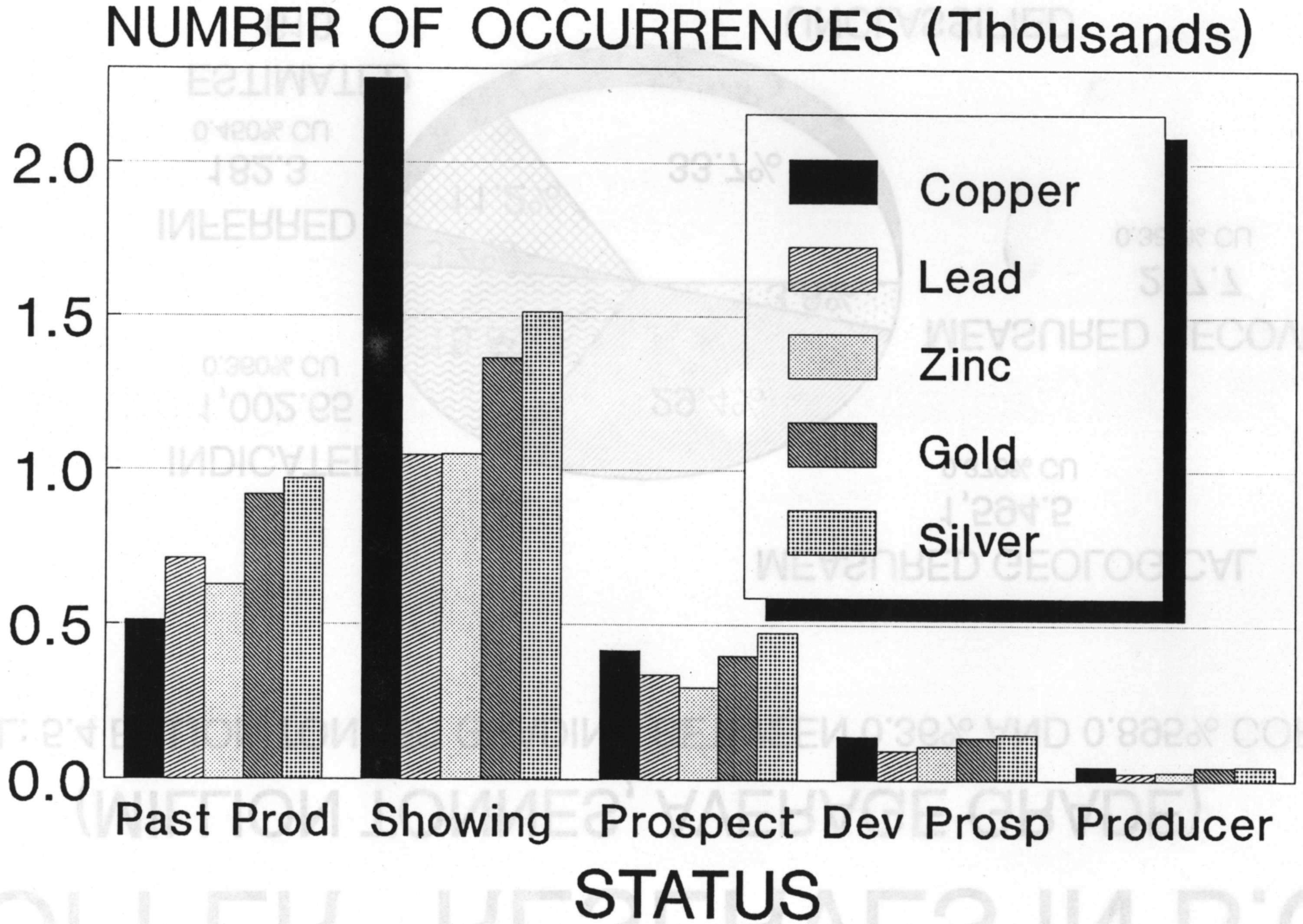
1. As a resource for information on documented mineralization in any area of B.C.



2. To develop exploration strategies
3. For geoscience research
4. To evaluate the resource potential of an area

5. For land-use planning
6. For "Desk-top Prospecting"

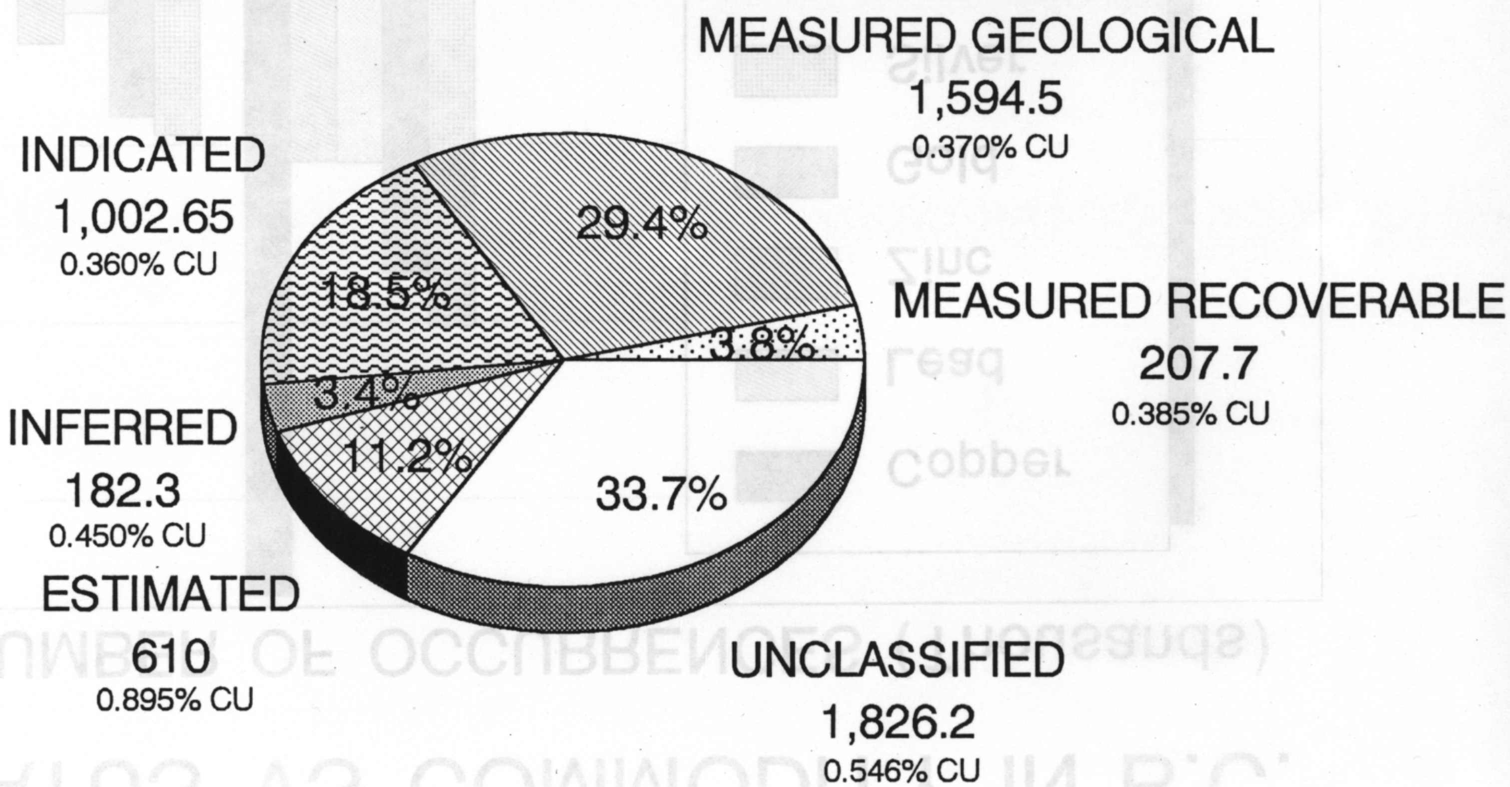
# STATUS VS COMMODITY IN B.C.



# COPPER *RESERVES IN B.C.

## (MILLION TONNES, AVERAGE GRADE)

TOTAL: 5.4 BILLION TONNES GRADING BETWEEN 0.36% AND 0.895% COPPER




*BASED ON 44 DEPOSITS WITH RESERVES => 20 MT, 0.2% CU

MINFILE OCT. 1991

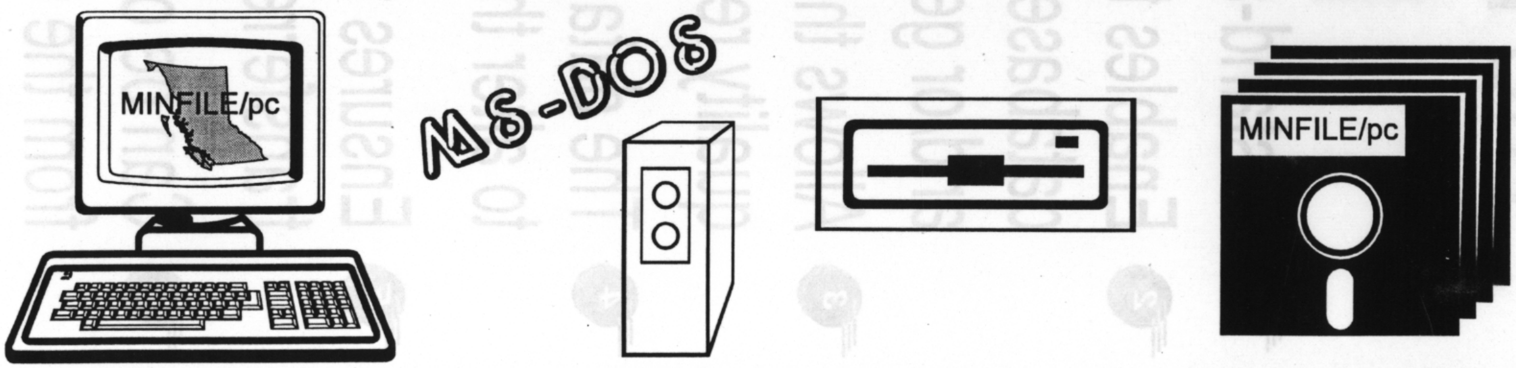
# The **MINFILE/pc** program...

1. Is stand-alone on a personal computer
2. Enables the user to search the MINFILE database on a variety of exploration and/or geological parameters
3. Allows the user to produce high quality reports on the search results
4. The data entry module allows the user to alter the data in the MINFILE database
5. Ensures that data can be easily transferred between computers
6. Can be obtained free of charge from the Geological Survey Branch, MINFILE project

# MINFILE/pc Version 3.0

## Requirements

- IBM-PC or compatible computer
- DOS Version 3.X or higher
- 640 Kilobytes of RAM
- 1.2 Mb, 5.25 inch floppy drive
- Disk space: 2 Mb for the program, 8 Mb per 1000 occurrences data



```
MENU1000                        MINFILE / pc
                                   Search
              Ministry of Energy, Mines and Petroleum Resources
```

```
                              Search database

    * Location ..................  1   Deposit character ...........  7

      Commodity .................  2   Deposit classification ......  8

      Status ....................  3   Lithology ...................  9

      MINFILE Number/Name .......  4   Formal/informal host ........ 10

      Mineralogy ................  5   Deposits with production .... 11

      Host rock, mineral age ....  6   Deposits with reserves ...... 12

                                 Choice 4
---------------------------------------------------------------------------
   * Location search is recommended first.             | Deposits :  75
```

## 2. Location

```
SRCH1010                        MINFILE / pc
                                   Search
              Ministry of Energy, Mines and Petroleum Resources
```

```
                              Location search
                             Degrees / Minutes       Degrees / Minutes
                                   From                     To
      Latitude                      /                        /
      Longitude                     /                        /
---------------------------------------------------------------------------
                                   From                     To
      UTM Northing
      UTM Easting
      UTM Zone
---------------------------------------------------------------------------
      NTS Map Sheet              104B
      BC  Map Sheet
      Mining Division                         Tectonic Belt
      Physiographic Region                    Terrane

---------------------------------------------------------------------------
   Choose ONE search ONLY                              | Deposits :  75
```

```
MENU2000                      MINFILE / pc
                           Report Generation
             Ministry of Energy, Mines and Petroleum Resources

                                Reports

    Master ....................... 01   MINFILE Number Index......... 06
    Production ................... 02   Primary Name Index .......... 07
    Capsule Geology/Bibliography   03   Primary Commodity Index ..... 08
    Map Legend ................... 04   NTS Map Index ............... 09
    Map Commodity Index .......... 44   Alphabetical Index .......... 10
    Data Dictionary Control ...... 05   Commodity Index ............. 11

                                Devices

    Screen ............ S   Printer .......... P   File .............. F

                   Report    Device    Modify settings

Select device and report                          | Deposits :  10675
```

```
SRCH1020                      MINFILE / pc
                                 Search
             Ministry of Energy, Mines and Petroleum Resources

                            Commodity Search
      Primary Commodity:    or    or    or    or    must be present

      All of:               and   and   and   and   must be present
                                     AND
    * At least 1 of:        or    or    or    or    must be present
                                     AND
      None of:              or    or    or    or    must be present

  * This search is the quickest!                  | Deposits :  10675
```

RUN DATE: 06/02/94
RUN TIME: 11:02:42

MINFILE / pc
MASTER REPORT
GEOLOGICAL SURVEY BRANCH - MINERAL RESOURCES DIVISION
MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES

PAGE: 1
REPORT: RGEN0100

MINFILE NUMBER: **092F 330** NATIONAL MINERAL INVENTORY: 092F12 Zn4

NAME(S): **MYRA FALLS (H-W)**, H-W, H-W MINE,
MYRA FALLS

STATUS: Producer Underground MINING DIVISION: Alberni
NTS MAP: 092F12E UTM ZONE: 10
LATITUDE: 49 34 24 NORTHING: 5494198
LONGITUDE: 125 35 25 EASTING: 312728
ELEVATION: 0326 Metres
LOCATION ACCURACY: Within 500M
COMMENTS: Centre of H-W zone is located 2 kilometres west of the south end of Buttle Lake (Western Miner, May 1983).

COMMODITIES: Copper Zinc Lead Gold Silver
Cadmium

MINERALS
SIGNIFICANT: Chalcopyrite Sphalerite Galena Pyrite Tennantite
Bornite Pyrrhotite Barite
ALTERATION: Sericite Quartz Pyrite
ALTERATION TYPE: Sericitic Silicific'n Pyrite
MINERALIZATION AGE: Upper Devonian
ISOTOPIC AGE: 370 Ma DATING METHOD: Rubidium/Strontium MATERIAL DATED: Whole rock

DEPOSIT
CHARACTER: Stratiform Massive
CLASSIFICATION: Exhalative Volcanogenic Syngenetic
SHAPE: Tabular
COMMENTS: Age date from Juras, 1987, page 109 (Ph.D. Thesis).

HOST ROCK
DOMINANT HOST ROCK: Volcanic

| STRATIGRAPHIC AGE | GROUP | FORMATION | IGNEOUS/METAMORPHIC/OTHER |
|---|---|---|---|
| Upper Devonian | Sicker | Myra | |
| ISOTOPIC AGE: | 370 Ma | | |
| DATING METHOD: | Rubidium/Strontium | | |
| MATERIAL DATED: | Whole rock | | |
| Upper Devonian | Sicker | Price | |
| Jurassic | | | Island Plutonic Suite |
| ISOTOPIC AGE: | 166 Ma +/- 8 Ma | | |
| DATING METHOD: | Potassium/Argon | | |
| MATERIAL DATED: | Biotite | | |
| Tertiary | | | Mount Washington Intrus. Suite |
| ISOTOPIC AGE: | 39 Ma | | |
| DATING METHOD: | Potassium/Argon | | |
| MATERIAL DATED: | Biotite | | |

LITHOLOGY: Pyroclastic Rock
Argillite
Andesitic Flow
Breccia
Quartz Feldspar Rhyolite Tuff
Pillow Basalt
Feldspar Pyroxene Andesite Flow
Granitic Dike
Dacite
Rhyolite

HOST ROCK COMMENTS: Age dates from Geological Survey of Canada Paper 72-44 and Juras, 1987. Sicker Group possibly as young as Pennsylvanian.

GEOLOGICAL SETTING
TECTONIC BELT: Insular PHYSIOGRAPHIC AREA: Vancouver Island Ranges
TERRANE: Wrangell Plutonic Rocks
METAMORPHIC TYPE: Regional RELATIONSHIP: GRADE: Greenschist
COMMENTS: Located in the Buttle Lake uplift.

INVENTORY

ORE ZONE: GAP

CATEGORY: Measured YEAR: 1993
QUANTITY: 634400 Tonnes

| COMMODITY | GRADE | |
|---|---|---|
| Gold | 3.2000 | Grams per tonne |
| Silver | 151.5000 | Grams per tonne |
| Copper | 1.8000 | Per cent |
| Lead | 1.1000 | Per cent |
| Zinc | 13.3000 | Per cent |

COMMENTS: Proven and probable geological reserves.
REFERENCE: George Cross News Letter No. 30 (February 12), 1993.

ORE ZONE: H-W

CATEGORY: Measured YEAR: 1993
QUANTITY: 8955100 Tonnes

| COMMODITY | GRADE | |
|---|---|---|
| Silver | 39.6000 | Grams per tonne |
| Gold | 2.2000 | Grams per tonne |
| Copper | 1.7000 | Per cent |
| Lead | 0.4000 | Per cent |
| Zinc | 4.3000 | Per cent |

COMMENTS: Proven and possible geological reserves.
REFERENCE: George Cross News Letter No. 30 (February 12), 1993.

ORE ZONE: BATTLE

CATEGORY: Measured YEAR: 1993
QUANTITY: 2013700 Tonnes

| COMMODITY | GRADE | |
|---|---|---|
| Gold | 1.1000 | Grams per tonne |
| Silver | 24.2000 | Grams per tonne |
| Copper | 2.6000 | Per cent |
| Lead | 0.5000 | Per cent |
| Zinc | 12.7000 | Per cent |

COMMENTS: Proven and probable geological reserves.
REFERENCE: George Cross News Letter No. 30 (February 12), 1993.

ORE ZONE: TOTAL

CATEGORY: Measured YEAR: 1993
QUANTITY: 12516100 Tonnes

| COMMODITY | GRADE | |
|---|---|---|
| Gold | 2.1000 | Grams per tonne |
| Silver | 45.6000 | Grams per tonne |
| Copper | 1.9000 | Per cent |
| Lead | 0.5000 | Per cent |
| Zinc | 6.3000 | Per cent |

COMMENTS: Total proven and probable geological reserves of the H-W, Lynx, Price, Gap, Battle, Extension (W37), Trumpeter and 6 Level deposits.
REFERENCE: George Cross News Letter No. 30 (February 12), 1993.

CAPSULE GEOLOGY

The H-W volcanogenic massive sulphide deposit occurs within the southern part of the Buttle Lake uplift. This discreet belt of Upper Paleozoic rocks is bounded on the east by Upper Triassic Karmutsen Formation volcanics (Vancouver Group) and on the west by the Early to Middle Jurassic Island Plutonic Suite. The geology of the uplift has recently undergone reinterpretation and the stratigraphy has been reassigned to several new formations of a redefined Sicker Group and the new Buttle Lake Group (formerly the upper part of the Sicker Group), (Juras, 1987; Massey, Personal Communication, 1990).

The new Buttle Lake Group consists of: (1) the Lower Permian(?) Henshaw Formation composed of conglomerate, epiclastic deposits and vitric tuffs; and (2) the Lower Permian to Pennsylvanian Azure Lake

RUN DATE: 06/02/94
RUN TIME: 11:39:21

MINFILE / pc
PRODUCTION REPORT
GEOLOGICAL SURVEY BRANCH - MINERAL RESOURCES DIVISION
MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES

PAGE: 1
REPORT: RGEN0200

MINFILE NUMBER: **092F 330** NAME: MYRA FALLS (H-W) STATUS: Producer

| Production Year | Tonnes Mined | Tonnes Milled | Commodity | Grams Recovered | Kilograms Recovered |
|---|---|---|---|---|---|
| 1992 | 1,156,489 | 1,171,629 | Silver | 20,271,000 | |
| | | | Gold | 988,054 | |
| | | | Copper | | 18,427,907 |
| | | | Lead | | 1,963,466 |
| | | | Zinc | | 32,840,938 |
| 1991 | 1,104,436 | 1,081,400 | Silver | 19,565,000 | |
| | | | Gold | 963,114 | |
| | | | Copper | | 17,041,682 |
| | | | Lead | | 1,626,605 |
| | | | Zinc | | 31,293,015 |
| 1990 | 1,156,519 | 1,171,337 | Silver | 21,354,000 | |
| | | | Gold | 1,079,054 | |
| | | | Copper | | 20,019,000 |
| | | | Lead | | 265,000 |
| | | | Zinc | | 34,428,000 |
| 1989 | 1,239,673 | 1,229,262 | Silver | 29,132,000 | |
| | | | Gold | 1,339,499 | |
| | | | Copper | | 23,234,000 |
| | | | Lead | | 302,000 |
| | | | Zinc | | 39,222,000 |
| 1988 | 1,247,575 | 1,255,124 | Silver | 34,875,293 | |
| | | | Gold | 1,469,107 | |
| | | | Copper | | 26,858,000 |
| | | | Lead | | 99,000 |
| | | | Zinc | | 45,385,000 |
| 1987 | 1,089,796 | 1,089,796 | Silver | 31,757,428 | |
| | | | Gold | 1,322,033 | |
| | | | Copper | | 25,145,000 |
| | | | Lead | | 3,371,000 |
| | | | Zinc | | 47,581,000 |
| 1986 | 1,066,664 | 1,066,664 | Silver | 43,637,121 | |
| | | | Gold | 1,704,588 | |
| | | | Copper | | 24,728,110 |
| | | | Lead | | 4,490,731 |
| | | | Zinc | | 56,849,571 |
| 1985 | 585,670 | 585,670 | Silver | 27,131,675 | |
| | | | Gold | 811,884 | |
| | | | Copper | | 8,200,962 |
| | | | Lead | | 1,377,572 |
| | | | Zinc | | 29,484,968 |

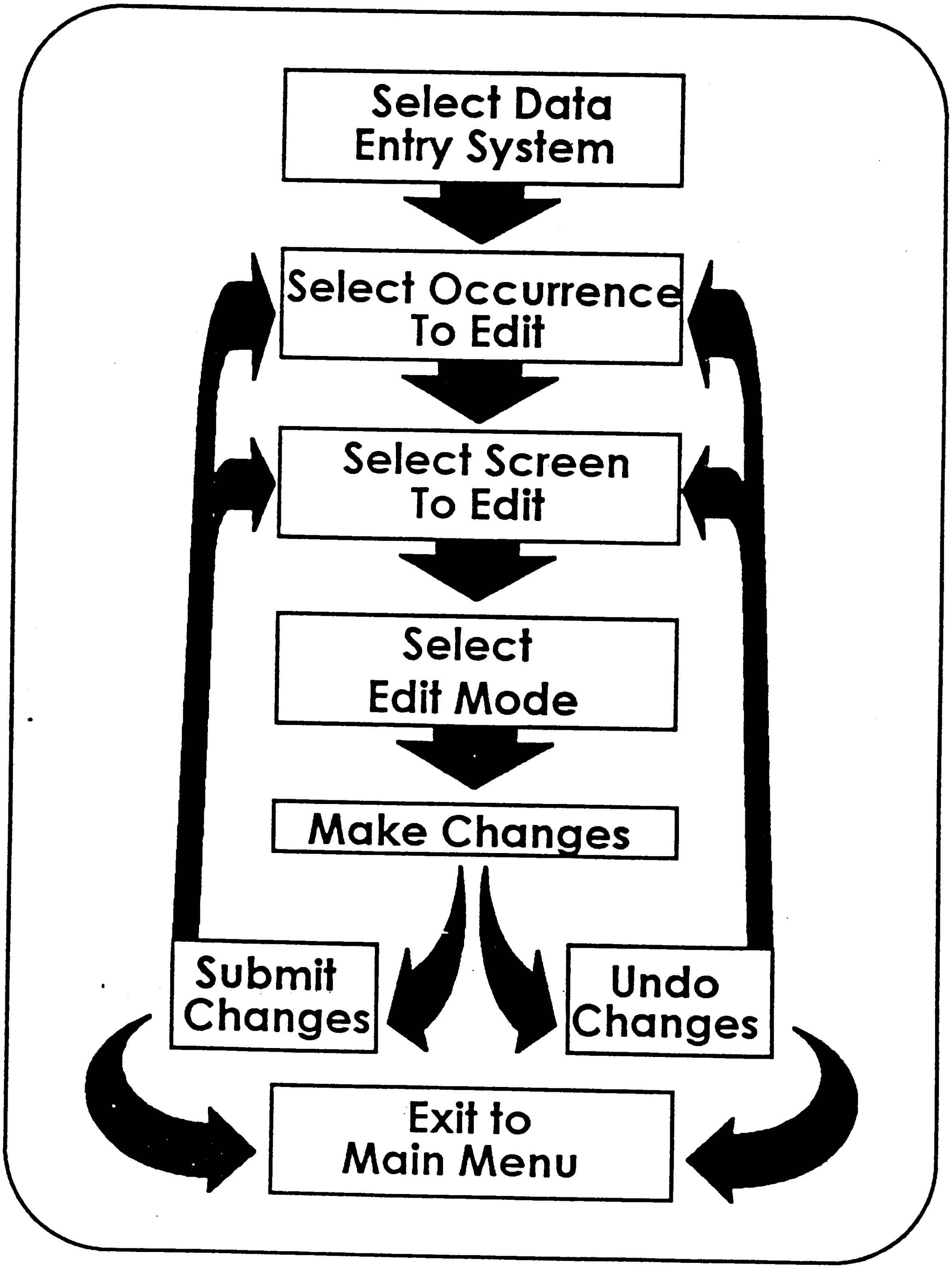
**SUMMARY TOTALS:** 092F 330 NAME: MYRA FALLS (H-W)

| | | Metric | | Imperial | |
|---|---|---|---|---|---|
| | Mined: | 8,646,822 | tonnes | 9,531,490 | tons |
| | Milled: | 8,650,882 | tonnes | 9,535,965 | tons |
| Recovery: | | | | | |
| | Silver: | 227,723,517 | grams | 7,321,470 | ounces |
| | Gold: | 9,677,333 | grams | 311,133 | ounces |
| | Copper: | 163,654,661 | kilograms | 360,796,666 | pounds |
| | Lead: | 13,495,374 | kilograms | 29,752,198 | pounds |
| | Zinc: | 317,084,492 | kilograms | 699,051,447 | pounds |

Comments:

1990: 1986-1990: Combined output of H-W and Lynx (092F 071).
1985: Combined output of H-W, Lynx (092F 071) and Myra (092F 072).

Figure 1. Steps for Data Entry in MINFILE/pc



**0. Main Menu**

**SCREEN** DEPOSIT **EDIT** HELP **PRINT**

```
Identification
Mineral Occurrence
Host Rock
Geological Setting
Reserves
Production
Capsule Geology
Bibliography
Work History
Exit to Main Menu
```

```
Append
Revise
---------
Browse
Delete
Move
Insert
---------
Submit
Undo
---------
Options
Compare
```

```
1. Master report - MINFILE
2. Master report - Update
3. Production report - MINFILE
4. Production report - Update
```

SCREEN **DEPOSIT** EDIT **HELP** PRINT

```
Select from list
Previous in list
Next in list
------------------
MINFILE No. Select
------------------
Create
Delete
Append from updates
```

```
MINFILE/pc Help System
Friendly Finder            : ON
DOS Command Shell
```

```
 DEPOSIT        SCREEN        EDIT        PRINT        HELP
 Select from list            MINFILE / pc                        21/07/92
 Previous in list             Data Entry                            12:15
 Next in list         of Energy, Mines and Petroleum Resources

 MINFILE No. Select         —— Identification ——

 Create                01               Names: MCKINLEY (L.140S)
 Delete                                               Mining Method
 Append from Updates   oducer           Open Pit:    Underground:
                            ———— Location ————
 Exit to Main Menu                Mining Divisions       : Greenwood
                                  UTM Zone               : 11
 Latitude      :  49 32 30        Northing               : 5488380
 Longitude     : 118 23 18        Easting                : 399557
 Elevation     : 1333 metres      Location Certainty     : Within 500 m
                            ———— Comments ————

 Date Coded    : 24/07/85       Coded by  : GSB       Field Checked: N
 Date Revised  : 24/07/85       Revised by: GO        Field Checked: N

                                                 | Deposits :  10675
```

```
 DENT4020                      MINFILE / pc                        21/07/92
                                Data Entry                            14:14
              Ministry of Energy, Mines and Petroleum Resources     APPEND

                             - Mineral Occurrence -

 MINFILE No.    : 092HSW092               Name : HARRISON GOLD

 Commodities    : Gold
 MINERALS                                 DEPOSIT
 Significant    : Gold                    Characteristics: Vein
 Associated     : Quartz                  Classifications: Epigenetic
 Alteration     : Sericite                Shape          : Irregular
 Alterat'n Type: Sericitic                Modifiers      : Fractured
                                          Dimension      :     x     x      metres
 AGE                                      Strike/Dip     :     /
 Mineralization: Tertiary                 Trend/Plunge   :     /
 Isotopic       : 24.5 Ma +/- 1 Ma
 Material Dated: Sericite                        Method: Potassium/Argon
 COMMENTS: Age date from vein sericite in Portal Stock adit (Fieldwork 1984)

 For multiple fields use Escape when done             | Deposits :  1
```

**MINFILE/pc V. 4.0**
**Menu Tree**

# MAIN

## MINFILE Deposits

### Data Entry
- Deposit Selection
- Screen Selection
- Edit Fields
- Print Reports
- Help System

### Search
- Reset Total Deposits
- Location
- Commodity
- Status
- MINFILE No./Name
- Mineralogy
- Age (host rock, mineral)
- Deposit Character/Class
- Deposit Type
- Lithology
- Formal/Informal Host
- Production
- Inventory
- EXIT

### Report
- MINFILE Master
- Production
- Capsule Geol./Bib.
- Map Legend
- Map Commodity Index
- Dictionary Control
- MINFILE No. Index
- Primary Name Index
- Primary Commodity Index
- NTS Map Index
- Alphabetical Index
- Commodity Index
- Prod.'s & Potential Prod.'s
- Confidential Notes
- EXIT

### Utilities
- Reset Total Deposits
- Import/Export Search
- Import/Export Updates
- Device Setup
- Append/Delete Data
- Parcel/Archive Functions
- Pack/Reindex Database
- Renumber MINFILE Occ.
- EXIT

## Exploration Projects

### Data Entry
- Project Selection
- Screen Selection
- Edit Fields
- Occurrence Link
- Print Reports
- Help System

### Search
- Reset Total Deposits
- Project Details
- EXIT

### Report
- Exploration Master
- Prod.'s & Potential Prod.'s
- Exploration & Development
- EXIT

### Utilities
- Reset Total Projects
- Import/Export Search
- Import Notices from MIS
- Device Setup
- Append/Delete Data
- Parcel/Archive Functions
- Pack/Reindex Database
- EXIT

## System

- Code Table Maintenance
- User Maintenance
- EXIT

F1 - HELP
F9 - Shell to DOS
Esc - Previous menu or cancel

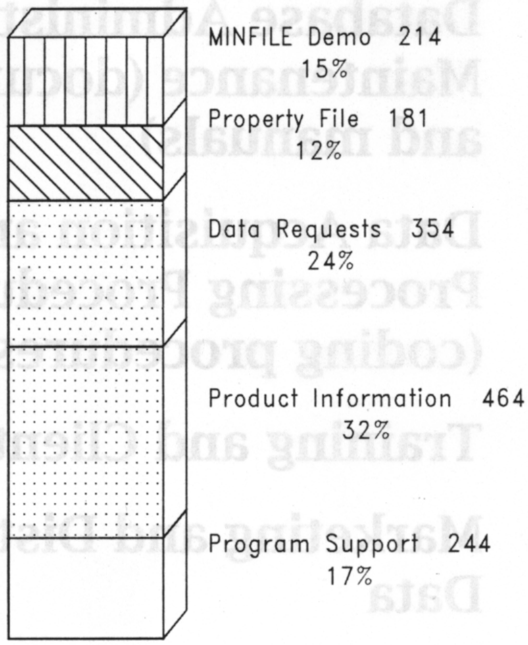
# MINFILE products...

1. 1:250,000 NTS area data diskettes ($5/disk)
2. Paper printouts ($5-$50)
3. Mineral inventory maps by NTS area ($5)
4. Coding manual, custom searches, MINFILE/pc and User's manual (FREE)
5. Provincial MINFILE location index ($5)
6. Open Files: Major Industrial Mineral Deposits, Major Deposits in B.C. ($10)
7. Complete digital dataset of the Province ($60)
8. Complete set of MINFILE maps for the Province on microfiche ($10)

# MINFILE Client Inquires

## 1990–91

Total Inquiries 1457




GSB, April 30, 1991

# Mineral Deposit Databases

## Project Management

- Concept, Designing, Planning (budget, staff)
- Database Design and Data Dictionary
- System Testing and Quality Assurance
- Database Administration and Maintenance (documentation and manuals)
- Data Acquisition and Processing Procedures (coding procedures)
- Training and Client Support
- Marketing and Distribution of Data
- New Technology and Future Planning
- Designing and Producing Computer Generated Products for Users

# Project Management

## Topics

### Theory

- Concept
- Design
- Project Planning
- Implementation
- Acceptance
- Assessment
- Summary

### Practical

- The MINFILE Experience

*Lecture by: L. Jones, D. Jakobsen*
*References: Three E Management Course Notes*

# Concept: Idea

- Compare the current situation with a more desirable one.

- Develop idea about how to improve the situation by:
  - Problem solving techniques
  - Intuitive flash
  - Random trial and error

- Produce objective statement
  - why do the project?
  - what is the concept?
  - what is the expected result?
  - what are the benefits?

# Design: Create a description of WHAT will be produced

- Understand the intent of the concept in detail
- Determine the needs of whoever is supposed to benefit from the concept
- Define the boundaries and limits of the project (scope)
- Propose a suitable product to satisfy the intent of the concept and the needs of the owner and the user

# Design cont.

- Get GENERAL approval
- Make detailed design decisions to unmistakably define the product
- Get SPECIFIC approval
- Assemble a communication package (proposals, design documents)

# Project Planning: Create a description of HOW the output will be produced

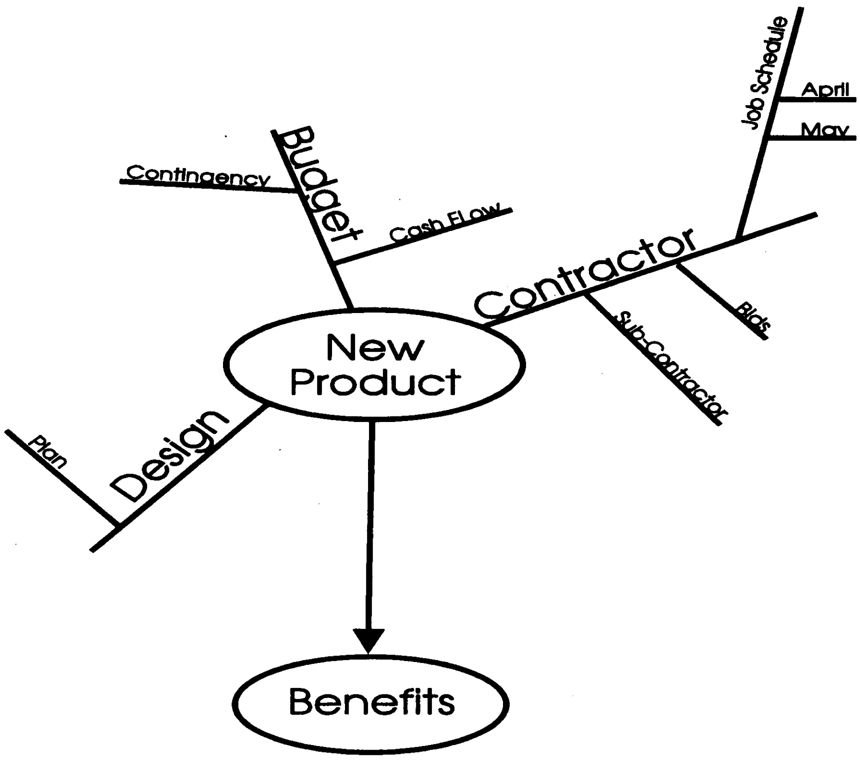
- Make contingency plans

- Develop work breakdown
  - by task
  - by sub-project
  - by time period
  - by resource

- Need to know:
  - what other task must precede this task ?
  - who or what will do it?
  - what is to be done?
  - how long will it take?

# Project Planning cont.

- Decide Precedence of events
  - make contingency plans first
  - use a MIND MAP which is a graphic representation of the events



# Project Planning cont.

- consider working from finish to start
- consider using TASK BOXES

## TASK BOX

<table>
<tr><td>Task No.</td><td></td><td>Resource</td></tr>
<tr><td colspan="3">Description</td></tr>
<tr><td>Daily Allocation</td><td></td><td>Duration</td></tr>
</table>

# Project Planning cont.

- indicate appropriate milestones

- Allocate resources
- Calculate cost and cash flow projection
- Establish a quality assurance system

# Project Planning cont.

- Establish authority structure
  - who is responsible for what?
  - who do you need to communicate with?

- Produce detailed communication package

- Develop a process to monitor the work and respond to unplanned events (contingency plans to adjust $, time or resources)

- Establish deliverables and deadlines

# Implementation: The product is created as designed and planned

- Establish and maintain rapport with all engaged in or affected by the project work
- Activate the work and quality monitoring system devised during the planning phase
- Respond to variances
- Re-plan, re-structure and re-define as required
- Exercise good leadership

# Acceptance: Acceptance of product

- Deliver product
- Test product
- Sign-off/accept product
- Produce the final Report

# Assessment

- How has the overall situation changed since the project was conceived?
- How do these changes affect the need for the project?
- Could this have been foreseen more accurately?
- Was the user's assessment of the needs correct?
- Might the needs have been better met some other way?
- Did the design conform to the criteria specified by the concept?

# Assessment cont.

- To what extent did the product match the design?
- How adequate was the plan?
- Were cost and time estimates realistic?
- Was the quality appropriate?
- How good is the documentation?
- Was a better approach overlooked?

**ETC.....**

# Summary

- Define a need
- Come up with an idea to fulfill this need
- Design a product that would meet the idea
- Plan how to produce this product
- Implement the plan and produce the product
- Accept the final product
- Assess the success of the project

# The MINFILE Experience:

## A project 26 years in the making and still evolving

### Historical background:

- 1967 - Manual Card File
- 1969 - Revised Card File
- 1973 - MINDEP
- 1976 - MINFILE (Honeywell)
- 1981 - MINFILE (IBM)
- 1985 - Redesign MINFILE(VAX)

# The MINFILE Experience cont.

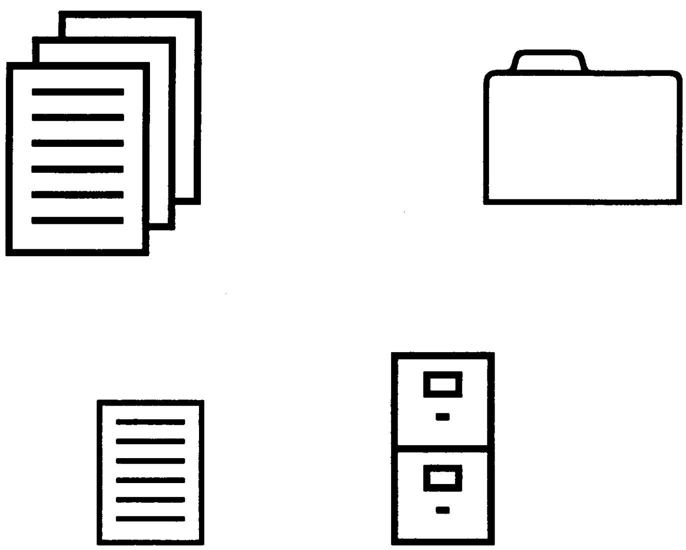
- 1987 - MINFILE/pc V. 1.0
- 1988 - MINFILE /pc V. 2.0
- 1989 - MINFILE/pc V. 2.13
- 1991 - MINFILE/pc V. 3.0
- 1992 - Improvements and User Manual
- 1993 - MINFILE/dg

- **Each of these are milestones in the project and each of these are sub-projects within the larger MINFILE project**

# Defining a need

- The government, industry and individual geologists collect a lot of data on B.C. mineral deposits

- The government collects data through regulatory requirements



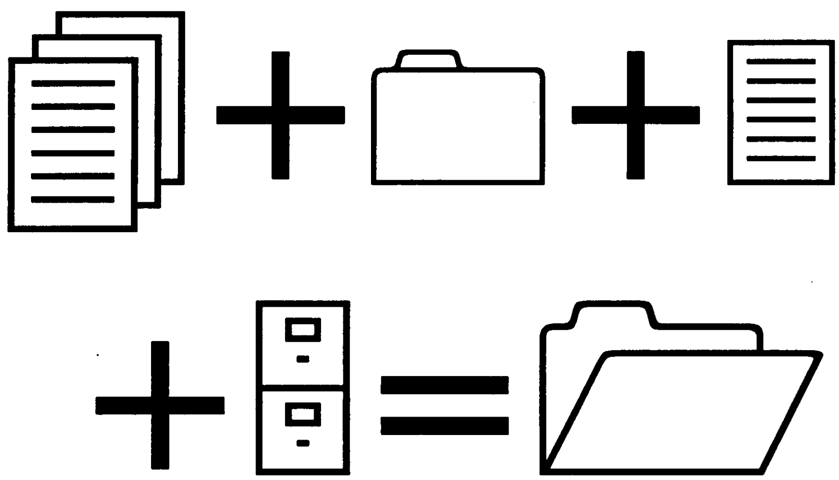
# Defining a need cont.

- The government, industry and individual geologists all need access to all this data to:
  - ⇨ Avoid duplication
  - ⇨ Build scientific and geological knowledge
  - ⇨ Save research time
  - ⇨ Avoid decisions based on incomplete data
  - ⇨ Provide a sound basis for government decision-making
  - ⇨ Make it possible to assess the mineral potential of different areas of the province

# The Idea

## In 1967:

- **Create a well organized, easily accessible and complete mineral deposit file for British Columbia**



# Design

- Research all available data for each known mineral deposit and compile it in a consistent format

- Create a 1-page form printed in a "fill-in-the-blanks" format for compiling the data consistently

- The format should allow for future computerization of the data

- The location of each deposit will be plotted on standard 1:250 000 National Topographic Maps to 3 degrees precision

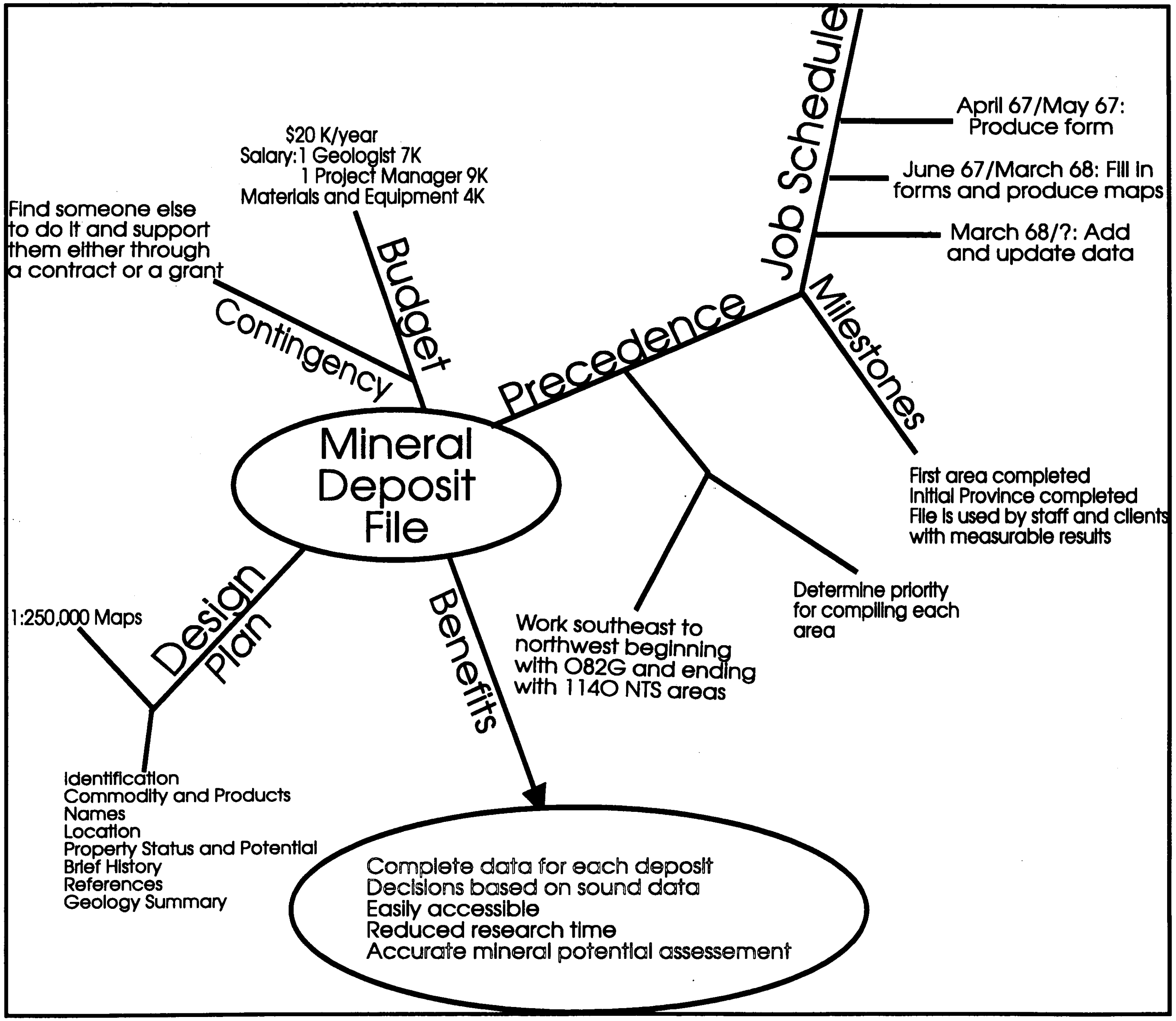
- The maps and the filled in forms will reside with the Mineral Inventory Section of the B.C. Geological Survey Branch in Victoria

# Design cont.

- The maps and forms will be accessible to everyone

- The forms will contain the following data:
  - ⇨ Identification
  - ⇨ Type of commodity and specific products
  - ⇨ Names
  - ⇨ Location
  - ⇨ Property Status and Potential
  - ⇨ Brief History of Development
  - ⇨ References
  - ⇨ Geology Summary Description

# Plan


Mineral Deposit File
Contingency
Find someone else to do it and support them either through a contract or a grant
Budget
$20 K/year
Salary: 1 Geologist 7K
1 Project Manager 9K
Materials and Equipment 4K
Precedence
Job Schedule
April 67/May 67: Produce form
June 67/March 68: Fill in forms and produce maps
March 68/?: Add and update data
Milestones
First area completed
Initial Province completed
File is used by staff and clients with measurable results
Work southeast to northwest beginning with O82G and ending with 114O NTS areas
Determine priority for compiling each area
Design Plan
1:250,000 Maps
Identification
Commodity and Products
Names
Location
Property Status and Potential
Brief History
References
Geology Summary
Benefits
Complete data for each deposit
Decisions based on sound data
Easily accessible
Reduced research time
Accurate mineral potential assessement

# Produce Product

N.T.S: 104B/1W

Deposit No: 21

U.T.M:

METALS: Cu, Ag, Fe, As, Co, Au

Lat - Long.: 56°12.9' 130°20.7'

PROPERTY: Granduc Mine

References: BC MI #3302 Granduc

MMAR 1931, p 47; 1953, p 82; 1954, pp 80-82; 1955, pp 14-16; 1956, "
pp 15-17; 1957, p 6; 1958, p 6; 1960, p 6; 1961, p 8; 1962, p 8;
1964, p 18; 1965, pp 44-48; 1966, p 38; 1967, pp 31-34; 1968, p 46;
1969, p 54

BC Prelim. Map of Granduc Area, 1956

As Repts 89; 90; 328; 340

NMI 104B/1 Cu 1 Granduc (Leduc) (Edna May)

MRB Corp Files: "The Granby Mining Co. Ltd.";
"Granduc Mines, Ltd."; "Granduc Operating Co."

Western Miner & Oil Review, Aug. 1953, p 42

(OVER)

Project 290

104B/1W 21

Norman, G.W.H., "Faults and Folds Across Cordilleran Trends at the Headwaters of Leduc River, Northern B.C.," Petrologic Studies, Buddington Volume, the G.S.A., 1962

GEM 1970, p. 68-73; 1971, p. 34-5

Norman, G.W.H. & McCue, J., "1966 Relations of Ores to Fold Patterns at Granduc, B. C." C.I.M.M. Special Volume No. 8

- This form was accepted and the work proceeded

# Project Assessment

- Assessment of the project two years later indicated that:
  - ⇨ The forms took too long to complete
  - ⇨ There was not enough geological data available on most deposits
  - ⇨ Ideas for the requirements of the geological part of the file changed with time and people
  - ⇨ The file would be useful when complete but had only limited usefulness when incomplete
- It was obvious that a change was required and that the project had so far failed to meet the original objectives

# Result

- The file was re-designed for computer storage and retrieval
- Initially only a few of the items on the original form were input; geology was omitted to be added later
- A new form and program were developed
- Computerization solved some of the problems
- The constant evolution of the program and the methodology of collecting data have been a response to the changing needs of the users and rapidly changing technology

# PROPOSAL FOR MINFILE CODING

| | |
|---|---|
| OBJECTIVE: | Update mineral inventory for Divisional use. |
| TERM: | December 1, 1993 - June 30, 1994. |
| FEES: | Variable according to funds available and priorities. |

## SUMMARY

**This is a proposal for the coding and publication of incomplete areas of the MINFILE database.** MINFILE, a database of over 11,300 metallic, industrial mineral and coal occurrences, is extensively used by the Mineral Resources Division. The data are a component in providing information for and responding to the Ministry priorities of mineral strategy, protected area planning, and resource management. The objective is to complete priority areas according to available funds.

## BACKGROUND and JUSTIFICATION

MINFILE is used extensively by government and industry for resource information, land-use planning, research and exploration planning. The Land Management and Policy Branch use it to contribute to the provincial land-use plan and protected area strategy. The Regional Geologists provide advice and information to government, industry and public clients, while maintaining an up-to-date inventory of mineral deposits and reporting on exploration activity in the province. The Geological Survey Branch delivers MINFILE data to government, industry and academia. The MINFILE database is important to the Commission on Resources and Environment (CORE), whereby it provides mineral resource assessment data for the Mineral Potential Project.

The MINFILE database must contain updated data as the information provides a critical layer of information for Geographical Information Systems and decisions based on land-related data. Approximately 3000 occurrences (includes 30% growth) or 20% of the database remain to be coded.

## PROPOSAL OBJECTIVES

The objective of this proposal is to release a number of map sheet areas to both internal and external users. A budget and time commitment according to prioritized areas are proposed to support personnel in the coding, updating, editing and publication of the MINFILE data and maps.

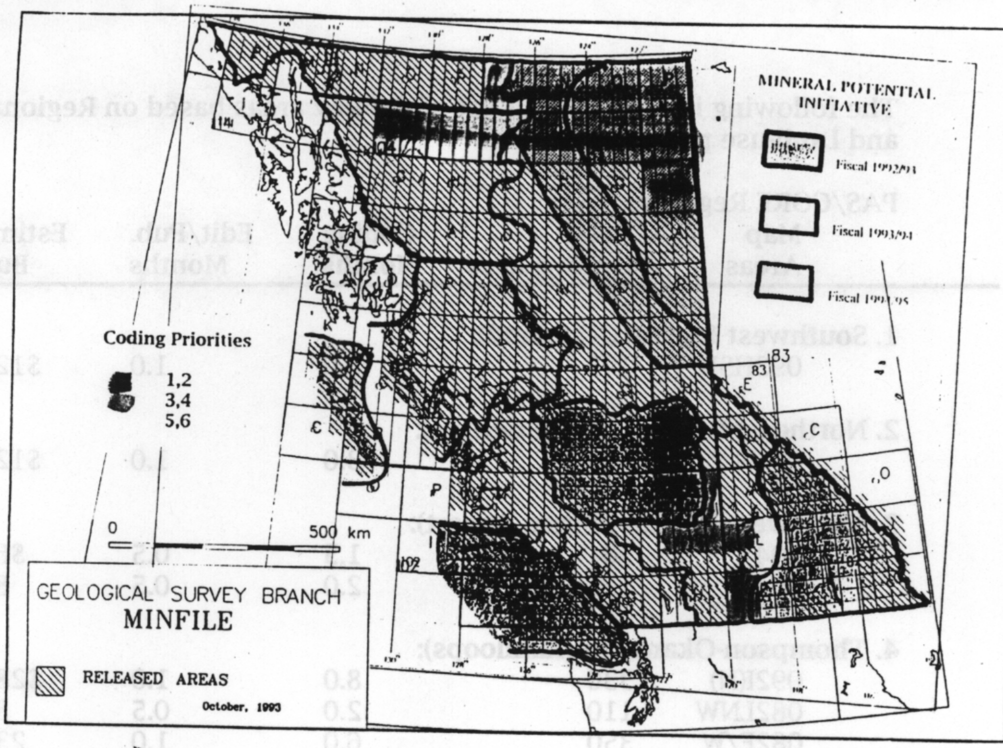
**The following is a prioritized list of the key areas based on Regional Geologist and Land-use priorities:**

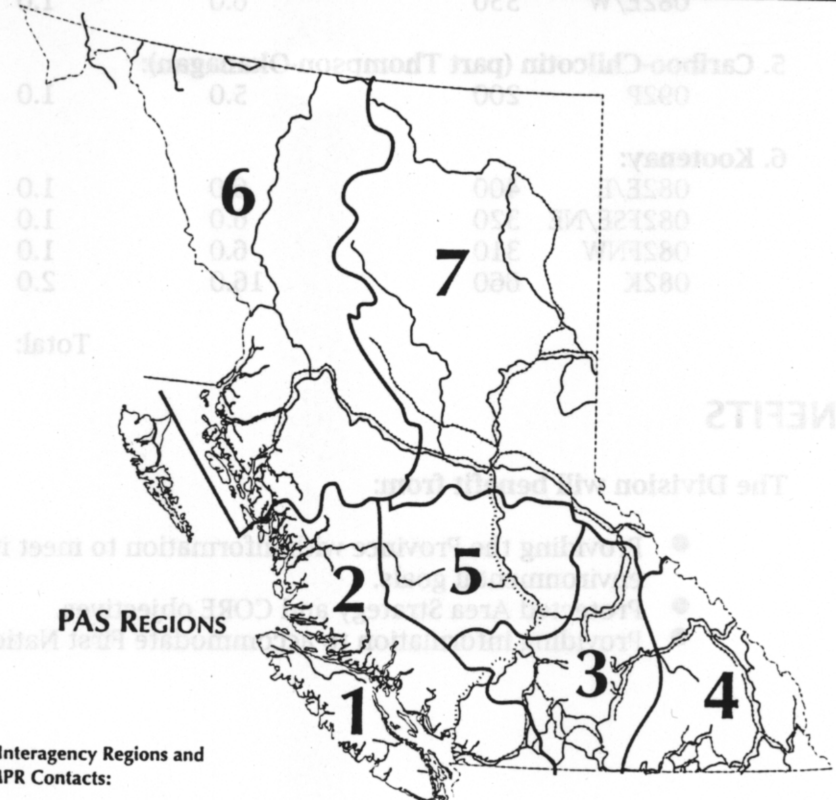
| PAS/CORE Regions Map Areas | Total Occurrences | Coding Months | Edit/Pub. Months | Estimated Budget |
|---|---|---|---|---|
| **1. Southwest Region (Mainland):** | | | | |
| 092HSW | 195 | 3.0 | 1.0 | $12 000 |
| **2. Northeast Region (Prince George):** | | | | |
| 094H-P | 160 | 3.0 | 1.0 | $12 000 |
| **3. Northwest Region (Prince Rupert):** | | | | |
| 104J | 50 | 1.5 | 0.5 | $6 000 |
| 104I | 120 | 2.0 | 0.5 | 8 500 |
| **4. Thompson-Okanagan (Kamloops):** | | | | |
| 092I(N) | 330 | 8.0 | 1.0 | $28 000 |
| 082LNW | 110 | 2.0 | 0.5 | 8 500 |
| 082E/W | 350 | 6.0 | 1.0 | 23 000 |
| **5. Cariboo-Chilcotin (part Thompson-Okanagan):** | | | | |
| 092P | 200 | 5.0 | 1.0 | $17 000 |
| **6. Kootenay:** | | | | |
| 082E/E | 400 | 6.0 | 1.0 | $25 000 |
| 082FSE/NE | 320 | 6.0 | 1.0 | 28 000 |
| 082FNW | 310 | 6.0 | 1.0 | 28 000 |
| 082K | 660 | 16.0 | 2.0 | 50 000 |
| | | | Total: | $246 000 |

## BENEFITS

**The Division will benefit from:**

- Providing the Province with information to meet its economic and environmental goals.
- Protected Area Strategy and CORE objectives.
- Providing information to accommodate First Nations' interests.




**PAS Interagency Regions and MEMPR Contacts:**

1 Vancouver Island – Gregg Stewart, Graeme McLaren

2 Mainland (includes Queen Charlotte Island) – Robert Pinsent, Janet Fontaine

3 Kamloops – Rick Meyers

4 Kootenays – Andrew Whale, Mike Cathro

5 Cariboo – Ted Faulkner

6 Prince Rupert – Mary Lou Malott, Paul Wojdak

7 Prince George – Ted Faulkner

**CORE Regional Planning Processes**

1 Vancouver Island

4 Kootenay-Boundary

5 Cariboo-Chilcotin

# CONTRACT PROPOSAL FOR MAINTENANCE OF MINFILE/dg

| | |
|---|---|
| CONTRACTOR: | Systems Consultants Inc. |
| TERM: | November 1, 1993 - March 31, 1994. |
| FEES: | $20,000 |

## SUMMARY

**This is a proposal for the maintenance and updating of the new MINFILE/dg system.** This system integrates MINFILE, a database of over 11,000 metallic, industrial mineral and coal occurrences, and a new module focusing on exploration and development. The system will be used by the Regional Geologists to maintain and report on exploration activity in the province, and by the GSB to maintain and deliver MINFILE data to government, industry and academia. The system is a component in providing information for and responding to the Ministry priorities of mineral strategy and planning and resource management.

The testing of the new system is near completion and practical implementation will follow. A budget is required to enhance the system, providing for more searches, better data transfer, and improved documentation. Systems Consultants Inc. will be used because of their previous experience with the system and to avoid costly learning time. The objective of this proposal is to release a stable new version of the MINFILE software to both internal and external users.

## BACKGROUND and JUSTIFICATION

Over the last 4 years much effort has been put into the user-requirements, system design and development of a database for use by the Regional Geologists. In September 1992, District Geology and Geoscience Information sections of the GSB sent out a **Request For Proposal for the development of a District Geology Subsystem** (MINFILE/dg). This resulted in a $49,500 contract awarded to Systems Consultants Inc. in October 1992. The system is an enhancement to the existing MINFILE/pc, Version 3.0, which integrates *MINFILE, Notices of Work* and *Exploration* databases. This project resulted in the **delivery of a Functional Design Document, a conversion of MINFILE/pc to FoxPro, 50 functional changes to MINFILE/pc, and a copy of the new integrated MINFILE/dg system** for testing and implementation.

This system, built to original specifications, will serve as the foundation for the Regional Geologists to do data entry and simple reporting on mineral deposits, and exploration and development projects. This proposal will enhance the system to provide more searches capabilities, better data transfer facilities, and improved help system and documentation.

The Regional Geologists provide advice and information to government, industry and public clients, while maintaining an up-to-date inventory of mineral deposits and exploration activity. The MINFILE/dg system will maintain and easily access this information. It will help to reduce data acquisition and management costs, improve the quality and consistency of the information, and provide a solid foundation for resource management and planning. Database development within the Land Management and Policy Branch (LMPB) and the Geological Survey Branch (GSB) hinges on sharing of and access to common, consistent and current land-related data.

## PROPOSAL OBJECTIVES

The objective of this proposal is to release a stable new version of the MINFILE software (Version 4.0) to both internal and external users. A budget is proposed to support a contract for the maintenance and updating of the MINFILE/dg System. Functional changes will be coordinated with additional modifications to the MINFILE/pc software, as identified by system users.

The following is a list of the key objectives:

### Maintenance and Changes

- update the current MINFILE **User's Manual** to reflect the changes in the software
- **software upgrades** (R&R 5.0; FoxPro 2.5)
- context-sensitive **help system**
- more efficient **transfer facility**
- code table look-up in search screens to **input codes**
- redesign **search screens** to include additions to tables
- several **minor changes** not completed in the first phase of development and some identified during testing

### Scope and Design

- a **query system** for the exploration and development data
- a **work history** system
- an **alternate code table look-up system** to Proximity
- a redesign of reserves and production according to an audit

## BENEFITS

The Regional Geologists will benefit from:

- selective searching and reporting
- the ability to combine 5 regional datasets into a single dataset to enable provincial statistics and reporting
- an improved, user-friendly system, including user documentation, help system and code table look-ups.
- the investigation of future enhancements for implementation in 1994/95
- redesign in areas to meet current resource strategies

Ministry of Energy, Mines and Petroleum Resources
MINFILE/District Geology Subsystem (MINFILE/DG)

# REQUEST FOR PROPOSAL
# Requirements Section

## Table of Contents



## Appendices



Geological Survey Branch

# DRAFT

# 1993-94
# Computer Systems Plan
# Geological Survey Branch

**Contents:**



Prepared by:
Geosystems Advisory Group (L. Jones, Chair)

April 28, 1993

# EXECUTIVE SUMMARY

The mandate of the Geological Survey Branch is to assemble, maintain, and market a comprehensive geoscience database for British Columbia. All sections within the Branch provide critical data to fulfilling this mandate. The Mineral Potential Project is a key initiative, challenged to deliver mineral potential maps through the integration of these databases using GIS technology. The Branch computer systems plan identified end products, day-to-day operations, common key issues, and new initiatives. An integrated approach was used to evaluate the strategy of each section.

**Objectives** of the system plan are:

- **To upgrade management and analysis of geoscience data and the map inventory.**
- **To facilitate the mineral resource assessment program by providing an efficient and standardized means of producing mineral potential maps.**
- **To enhance digital communication within the Branch, other Ministries and clients.**
- **To provide a systematic methodology for the integration of the Geological Survey Branch databases.**
- **To maximize the value of the current investment in computer technology.**
- **To be compatible with the Corporate Land Information Strategic Plan.**
- **To align the Branch with Ministry objectives on policy, procedures and standards concerning system technology.**

The following are **system plan highlights** from the previous year:

- **The majority of Branch staff were upgraded to Ministry standard computer platforms.**
- **The MPMP created mineral potential maps for several areas of the province, through the creation and integration of a wide range of multi-sourced data and by key hardware and software acquisitions.**
- **Hardware and software upgrade requirements of staff.**
- **A systems development contract for MINFILE/dg resulted in delivery of a Functional Design Document, a conversion of MINFILE/pc to FoxPro, 50 functional changes to MINFILE/pc, and a copy of the new program.**
- **MINFILE published new User's and Coding manuals.**
- **Network topologies were investigated but not implemented. Communication efforts resulted in the installation and testing of a modem and a pilot LAN in the Kamloops District office.**
- **ARIS unit commenced automation of producing index maps and produced an annual mailout of P.A.C. account statements from the automated pc-based P.A.C. system.**
- **COALFILE data was ported from the VAX to the PC, in dBASE format.**

The following key areas have been identified to meet branch objectives:

- **Network strategy and implementation.**
- **Hardware and software upgrades and training.**
- **Operation and maintenance of existing systems: Mineral Potential, GSB Database, MINFILE and ARIS systems.**
- **Specific and new initiatives: capture management and integration of data, spatial analysis strategy, MINFILE enhancements, PC direction for ARIS, and COALFILE.**

The following are the key recommendations, in order of priority, by the Geosystems Advisory Group to improve operations of the Branch and to serve our clients better; costs estimates are preliminary:

- **Plan a network strategy for the Branch. Progressively install peer-to-peer LANs within all sections. ($15,000 per group (5/group) or $12,000 for server + $700/station to upgrade)**
- **Justify and address general and specific hardware and software acquisitions. ($75,000 - $100,000)**
- **Continue to maintain support for existing Branch systems. ($50,000)**
- **Evaluate several GIS's and data analysis packages and implement the best solution for spatial analysis. ($20,000)**
- **Implement a UNIX-based GIS for a corporate GIS/Data Management system. ($15,000)**
- **Enhance MINFILE/pc including a new interface for search routines, redesign of the reserves and production and work history. ($40,000)**
- **Upgrade, promote and distribute COALFILE. ($10,000)**
- **Evaluate the ARIS system to improve its efficiency. ($15,000)**
- **Evaluate the MINFILE system including conversion choices for a multi-user environment, digitally generated MINFILE maps, and links between the MINFILE and ARIS systems. ($65,000 - $80,000)**
- **Proceed with capture and analysis of aeromagnetic, gravity and LANDSAT data. ($2500)**
- **Implement individual employee career and education plans. (variable costs)**
- **Investigate marketing strategies. (variable costs)**

The Geological Survey Branch has a highly skilled group of people and has demonstrated the ability to efficiently deliver quality products. With competition for funding and rapid technological changes, the Branch is challenged to maintain these key success factors. The Branch has the opportunity for the innovative implementation of computer technology and to become a major contributor in the land-use planning process. As well, improvements can be made on production time and overhead costs. The result will be satisfied clients, consisting of users within the Branch, groups in other Ministries, users in industry and the general public.

# Systems Testing & Quality Assurance

## Outline

- Introduction
- Why Test?
- Definition of Testing
- Types of Errors
- Testing Principles
- Test Case Design/Testing Techniques
- Levels of Testing
- Summary

**Lecture by:** L. Jones and C. McPeek
16 November 1993

**Reference:** Program and System Testing Techniques
by Cirrus Enterprises Inc.
March 1988

## Introduction

Evaluation of system development projects over the years has produced one fairly constant analysis - approximately 50% of the total cost of each project has been devoted to "testing".

Typically, however, project estimators classify testing as an "add-on" and schedulers usually schedule only 10-20% of project time and budget to testing.

Testing of a system development project involves the methodical and effective testing of the components of a system, whether they be hardware or software, and the project as an entity.

Each of the following groups of individuals within an organization, will, and should, approach testing with different objectives:

a. **programmers**

Will be concern with accuracy of program code and whether or not requirement specifications have been met.

b. **systems analysts**

Will be concerned about whether the system meets functional specifications and that the business case is satisfied.

c. **technical support**

Will be concerned with the technical components of the system, their acquisition, and integration into the operating environment.

d. **data entry/users**

Will be concerned about ensuring that they have the right equipment to do the job, that the procedures are accurate, the system is user friendly and effective., and whether their needs are met.

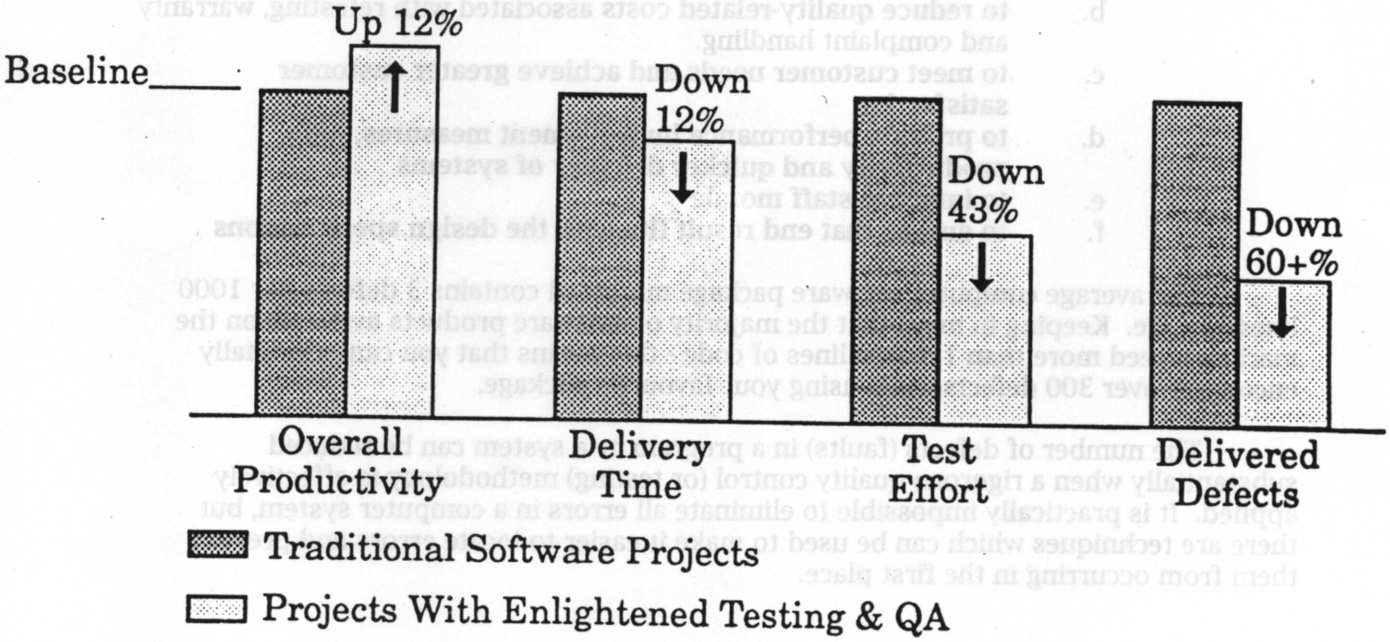
e. **system development manager/project leader**

Will be concerned about the overall business case, the schedule, project resources, and budgeting.

There are techniques available which will ensure all of the objectives of these separate interest groups are met.

*What portion of the cost of the system development project would be dedicated to the testing phase?*

## Comparison of Software Testing & QA Techniques




**Source: Studies by IBM, DEC and others**

## Why Test?

**There are significant penalties to be paid for inadequate or improper testing:**

a. **Unreliable systems**
b. **Inefficient manpower utilization**
c. **Redundant testing**
d. **Longer than estimated development times**
e. **Frustrated users/customers**

**Purpose Benefits of thorough system testing and quality assurance:**

a. **to improve software quality and reliability.**
b. **to reduce quality-related costs** associated with retesting, warranty and complaint handling.
c. **to meet customer needs and achieve greater customer satisfaction**
d. **to provide performance improvement measures, high productivity and quicker delivery of systems**
e. **to improve staff morale**
f. **to ensure that end result fits with the design specifications**

The average computer software package marketed contains 3 defects per 1000 lines of code. Keeping in mind that the majority of software products available on the market exceed more than 100,000 lines of code - this means that you can potentially encounter over 300 defects while using your favourite package.

The number of defects (faults) in a program or a system can be reduced substantially when a rigorous quality control (or testing) methodology is effectively applied. It is practically impossible to eliminate all errors in a computer system, but there are techniques which can be used to make it easier to locate errors and prevent them from occurring in the first place.

## Definition of Testing

When one tests a program, one wants to add some value to the program - improving the reliability of the program.

So in order to make a program or system more reliable - it must be testing with the INTENT OF FINDING ERRORS. Testing should not be approached with the idea of proving that the program(s) works properly. A SYSTEM DEMONSTRATION is the technique used to show that a program does what it is supposed to. If it does work property - IT CAN STILL HAVE ERRORS!

For most purposes then, a test is the process of finding errors and a SUCCESSFUL test is one in which errors ARE DISCOVERED.

# Systems Testing

## Definition

⇒ A test is the process of finding errors and a SUCCESSFUL test is one in which errors ARE DISCOVERED.

√ add value to the program.

√ improving reliability of the program.

√ be intent on finding errors.

√ system demonstrations show a program working.

√ IT CAN STILL HAVE ERRORS!

# Types of Errors

## a. Specification problems

The program specification provided the programmer is incorrect, incomplete, ambiguous, or self-contradictory. Or the specification changes as the code is being written and the programmer is aiming at a moving target.

*Example:* *Changes to Functional Description during program development.*

## b. Program/function errors

Missing or wrongly worded functions within a program module - or functions which serve no purpose.

*Example:* *Appending a file to the end of Bibliographies was originally misinterpreted, such that the programmer appended several files to one bibliography instead of one file to several bibliographies.*

This is a case of not understanding the way we do business.

## c. Testing errors

Incomplete or ineffective test case preparation can leave program defects undetected.

*Example:* *Problem with lithologies when deleting then appending occurrences, without pack/reindexing. Ranking is lost in multiple fields due to indexing problem.*

## d. External Interfaces

External interfaces are the means by which the system communicates to the outside world. They include devices such as printers, modems, etc. There can be errors communicating between hardware components.

*Example:* *Different printer types.*

## e. Internal Interfaces

Internal interfaces are interfaces with other software such as compilers, operating systems, other program modules.

*Example:* *DOS problems with backup/restore of various versions of DOS.*

# Types of Errors (cont.)

## f. Control and Sequence Errors

- assuming events occur in a specific sequence
- initiating a process before prerequisites have been met
- waiting for an impossible combination of prerequisites
- failing to recognize when prerequisites have been met
- missing a processing step
- using the wrong processing step
- redundant processing

*Example:* *During data entry problems occur in a screen when entering fields randomly rather than in sequence.*

## g. Resource Management Problems

Improper use or allocation of memory in the CPU for use by data files, programs, subroutines, or memory variables can all create havoc with a program.

*Example:* *Loading MINFILE/pc low Vs high memory.*

## h. Process Errors

- arithmetic and manipulative errors
- incorrect initialization of variables or files
- program control and statement sequence execution

*Example:* *Production figures originally incorrect by one decimal point in database.*

## i. Data Errors

These errors arise in the incorrect specification of data elements, their formats, the number of elements, and their initial values.

*Example:* *Data Coded/Date Revised fields have different date formats.*

## j. Documentation Errors

These are errors caused by inadequate or incorrect documentation and/or procedure instructions to the users/operators. The system is expecting one situation or occur but the user/operator does something unexpected.

*Example:* *Reserves in MINFILE.... If reserve category is assay only one calculation can exist. If reserve category any of the others, two calculations may exist. The testing of reserves was done before the formal rules were written in the Coding Manual and these rules were not clearly outlined to all the users doing testing.*

```
MENU0000                     MINFILE / dg
                              Main Menu
             Ministry of Energy, Mines and Petroleum Resources

                       Search Database ......... 1

                       Report Generation ....... 2

                       Utilities ............... 3

                       Minfile Data Entry ...... 4

                       Project Data Entry ...... 5

                       Code Table Maintenance .. 6

              File 'C:\minfile\data\E33' does not exist.

              ³ Cancel ¤                          < Ignore >
Gathering Inf                                              its :  11338
```

```
MENU0000                     MINFILE / dg
                              Main Menu
             Ministry of Energy, Mines and Petroleum Resources

                       Search Database ......... 1

                       Report Generation ....... 2

                       Utilities ............... 3

                       Minfile Data Entry ...... 4

                       Project Data Entry ...... 5

                       Code Table Maintenance .. 6

                    Variable 'PRJTYP_C' not found.

              ³ Cancel ¤                          < Ignore >
Gathering Inf                                              its :  11338
```

## Testing Principles

- **Test early and often.** Detection of errors early are easier and less costly to fix.
- **Define the expected output or result** so that erroneous results are not interpreted as valid.
- A **programmer should avoid attempting to test their own program** as the programmer may not want to expose errors or may have a misunderstanding of the program specification.
- Thoroughly **inspect the result of each test.**
- **Test cases must be written for invalid and** unexpected, as well as **valid** and expected **input conditions.**
- **Examining a program to see if it DOES NOT DO what it is supposed to do** is only half the battle. The other half is seeing whether the program DOES WHAT IT IS NOT supposed to do. Example - a payroll program is supposed to print cheques and is wrong if it doesn't. It is also wrong if it prints cheques and deletes the first record of the file.
- **Avoid throw-away test cases** unless the program is a throw-away program. Creating test conditions and test data is a costly process and the investment should be saved for later use. Re-testing of a program which was modified or fixed is not as rigorous if the original test conditions were saved. Errors found in early versions of the program must be verified as fixed in later versions.
- Do not plan a testing effort under the assumption that no errors will be found. Testing is the process of executing a program with the **intent of finding errors.**
- The **probability of the existence of more errors in a section of a program is proportional to the number of errors already found** in that section. (roughly 80/20).
- Testing is an extremely creative and intellectually challenging task. There is more creativity required for testing than for designing a program.

# Test Case Design

One of the most important considerations in program and system testing is the design and development of effective test cases.

**Here are some guidelines to use when designing test cases:**

## Single Condition Statements

For programs containing only one condition per decision statement, a minimum test criterion is of a sufficient number of test cases to (1) evoke all outcomes of each decision at least once and (2) invoke each point of entry at least once (to ensure that all statements are executed at least once).

## Multiple Condition Statements

For programs containing decisions having multiple conditions, the minimum criterion is a sufficient number of test cases to evoke all possible combinations of condition outcomes in each decision, and all entry points into the program.

## Range Values

If an input condition specifies a "range" of values (e.g. item count can be from 1 to 999), identify three valid tests - two being the top and bottom of the range, and one between (1,999, 38), and two invalid tests (<1 and >999). Check for negative and zero values when the range expects positive values greater than zero.

## Set of Values

If an input condition specifies a "set" of input values and each one is handled differently by the program, identify a valid test and two invalid ones. Try a blank value.

## "Must Be" Values

If an input condition specifies a "must be" situation (e.g. first character must be a letter), identify one valid test and two invalid tests.

## Sequence of Input

If an input condition specifies a particular sequence of input focus attention on the first and last elements of the set. Test with no values input.

# Test Case Design (cont.)

## Input Testing

Check for the following:

- input file (field) is empty
- input file (field) is not available
- input has 1 record
- all records are the same
- improper sequence
- security features are executed properly
- screen displays are readable and usable
- screen displays are presently in proper sequence

## Output Testing

Check for the following:

- last record written or line printed
- formats proper
- files are opened and closed properly
- totals are accumulated properly
- report headers, footers, page numbering is proper
- proper page breaks
- special forms are produced properly
- data records which contain totals or other results are created or updated properly
- reports are presented in proper sequence
- screen displays are presented in proper sequence
- results of computations

| Test Procedure | Expected Result | Initials |
|---|---|---|
| 1. Perform the test cases below | | |
| (a) Test menu item #1<br>- Search Database<br><br>Choice: 1 | Search DATABASE - screen appears | ____ |
| (b) Test menu item #2<br>- Report Generation<br><br>Choice: 2 | Report Generation - screen appears | ____ |
| (c) Test menu item #3<br>- Utilities<br><br>Choice: 3 | Utilities - screen appears | ____ |
| (d) Test menu item #4<br>- Data Entry<br><br>Choice: 4 | Data Entry - screen appears | ____ |
| (e) Test menu item #5<br>- Query Database<br><br>Choice: 5 | Query Database - screen appears | ____ |
| (f) Test exit from main menu<br><br>Choice: 0 | Exit MINFILE returns to the DOS prompt | ____ |
| (g) Test incorrect key sequence<br>Enter letters and invalid numbers | Error message | ____ |

| Date: | Time: | Completed by: | Status: |
|---|---|---|---|
| Comments: | | | |

| Test Procedure | Expected Result | Initials |
|---|---|---|
| 1. Test example<br><br>(a) Primary Commodity: (any valid codes)<br>All of: (any valid codes)<br>None of: (any valid codes)<br><br>(b) Cursor to the last field and return | Verify correctness | ______ |

(2) Search Database - Commodity

Comments: This screen functions and appears the same as the B.C. MINFILE.

To perform any tests, a list of all MINFILE Numbers and corresponding Commodity information must be obtained. This list will be used to verify that the search was performed correctly and the correct records were retrieved.

The tester is to be creative when performing searches, use different combinations of fields and values. There are no restriction on which field may remain empty.

Test: An example test is given. The tester should perform many such tests, using a variety of combinations. All problems should be logged.

Objective: To test the functionality of the Search Database - Commodity screen.

# Levels of Testing

There are six levels of testing. The first five levels are testing which should be performed by the Contract Systems Personnel and will be touched on lightly. The sixth level will be explained in more detail.

LEVEL 1 - **Module Testing (or Unit Testing)**
LEVEL 2 - **Function Testing**
LEVEL 3 - **Software Integration Testing**
LEVEL 4 - **System Integration Testing (or Migration Test)**
LEVEL 5 - **System Demonstration**
LEVEL 6 - **User Acceptance Testing**

## Module Testing

Module testing is the process of testing the individual subprograms, subroutines, or procedures which comprise a program. Rather than initially testing the program as a whole, testing is first focused on the smaller building blocks of the program. The reasons for this approach are: it is a way of managing the complexity of testing, it eases the debugging task since errors can be isolated to a particular module, and it provides the ability to test multiple modules simultaneously.

## Function Testing

Function testing is the process of attempting to find discrepancies between a program and its external specification (i.e. its input/output). We define a function as a set of related program modules which, when executed in proper sequence, perform a specific task. In simple terms, it is a program.

## Software Integration Testing

Software Integration testing is the process of ensuring that programs which are intended to operate simultaneously or in conjunction with other programs are able to do so.

## System Integration Testing

The System Integration Testing process involves a series of tests to be conducted to ensure that the newly developed set of programs will operate on the host computer, including peripherals such as printers and plotters, for which it is intended. Some of the major testing processes involved are: configuration testing, volume testing, stress testing, security testing, storage testing, recovery testing, procedure testing, and conversion/compatibility testing.

## System Demonstration

The purposed of the System Demonstration level of testing is to demonstrate that the performance and efficiency expectations have been met.

# User Acceptance Testing

User Acceptance testing is the process of comparing the program to its initial requirements and the current needs of its end users. The best way to conduct user acceptance testing is to devise test cases attempting to show that the system DOES NOT meet the specifications. This test is also concerned with accuracy of the user documentation. The documentation should be inspected to ensure that is conforms to the functions of the programs.

The responsibilities of the User during the User Acceptance testing will be outlined shortly, but generally, it is up to the User to determine whether or not they want to proceed with the implementation of the system as a production system. If the user accepts the system without qualification - then they have no right to criticize the operation or performance of the system.

A comprehensive user acceptance TEST PLAN should be developed, and should contain the following items: a description of the system (or component) being testing, a list of the people involved in the test and their responsibilities, where the tests are to be conducted, what computer resources are required and when, what technical support will be required and when, how long the tests are expected to take, where the source data is to be obtained from, what is to be tested, testing schedule and expected performance. Keep in mind that not only are programs to be tested, also the consideration must be given to the following when preparing test cases: user procedures, user documentation, hardware interfaces, other software interfaces, conversion of data from manual or other computer systems, training of user staff, backup and recovery, security.

A set of TEST DATA, when run against a program or series of programs, will result in output which is expected and pre-determined. Exacting test cases must be developed to ensure a good cross section of tests are carried out. They must reach all areas of the system - input, output, processing, and hardware and software interfaces.

Keep well DOCUMENTED procedures used for testing and outcomes. Well written test cases will find errors. Document those errors giving as much detail as possible. Always include the following: date, time, author, version of system you are testing, error symptom, expected results, results obtained, any sample output reports/displays which document the errors, and problem report number. IT IS BETTER TO GIVE TOO MUCH INFORMATION THAN NOT ENOUGH. Retain these forms for follow up testing and future reference.

Words of wisdom:

- if you can not re-create the error it will be hard for any systems person to correct it.
- beware of cascading errors (that is errors caused by previous errors).
- some errors detected will result in Change Requests Vs Fault Reports (i.e. if the error was not the result of a specified change originally outline in the Specifications Document then it is a new request and should be recorded as a future change).

# User Acceptance Testing

- ⇒ the process of comparing the program to its initial requirements and the current needs of its end users.
- ⇒ attempt to show that the system DOES NOT meet the specifications.
- ⇒ accuracy of the user documentation.
- ⇒ determine if the system is a production system.
- ⇒ develop a comprehensive user acceptance TEST PLAN.

# User Acceptance Testing

## TEST PLAN

- ⇒ a description of the system (or component) being testing.
- ⇒ a list of the people involved in the test and their responsibilities.
- ⇒ where the tests are to be conducted.
- ⇒ what computer resources are required and when.
- ⇒ what technical support will be required and when.
- ⇒ how long the tests are expected to take.
- ⇒ where the source data is to be obtained from.
- ⇒ what is to be tested.
- ⇒ testing schedule and expected performance.

# User Acceptance Testing

## OTHER CONSIDERATIONS

- user procedures
- user documentation
- hardware interfaces
- other software interfaces
- conversion of data from manual or other computer systems
- training of user staff
- backup and recovery
- security

# User Acceptance Testing

## IMPLEMENTATION

- **realistic test data**
- **develop test cases to reach all areas of the system**
- **document procedures used for testing and outcomes**
    - date, time, author
    - version of system you are testing
    - error symptom
    - expected results
    - results obtained
    - any sample output reports/displays which document the errors
    - problem report number

***it is better to give too much information than not enough***

**retain these forms for follow up testing and future reference**

# User Acceptance Testing

## WORDS OF WISDOM

- if you can not re-create the error it will be hard for any systems person to correct it.
- beware of cascading errors (that is errors caused by previous errors).
- some errors detected will result in Change Requests Vs Fault Reports (i.e. if the error was not the result of a specified change originally outline in the Specifications Document then it is a new request and should be recorded as a future change).

# MINFILE DETAILED DESIGN DOCUMENT

## Table of Contents

# PROJECT FAULT REPORT

**Customer Name:**________________________________ **Fault #:** ________________

**Project Name:**__________________________________ **Version:** ________________

**Priority:** ______ (1 - Testing held up; 2 - New release; 3 - Fix as time allows; 4 - Discuss and __________________ )

**Fault Description:** **Prepared By:**________________ **Date:** ___________

**Solution Description:** **Responded By:**________________ **Date:** ___________

# PROJECT CHANGE REQUEST

**Customer Name:** ______________________________ **Request #:** ________________

**Project Number:** _______________________ **Project Manager:** ________________

**Project Code:** _______________________________________ **Date:** ________________

**Change Requested:** _______________________ **Requested By:** ________________

**Reason for Change:**

**Cost Amount:** **Prepared By:** ________________

**Ramifications:**

**Approved (A) / Rejected (R):** __________________

**Customer Signature:** __________________ **Company Signature:** ______________

**Name:** _________________________________ **Name:** ___________________________

**Signature:** _____________________________ **Signature:** _______________________

**Date:** __________________________________ **Date:** ____________________________

# Training and Client Support

## TOPICS

- Introduction and Background
- Training Approach
    - Target Audience
    - Skill Level
    - Hands-on Experience
    - Costs
    - Documentation
    - Workshop
- Client Support
    - The Problem
    - Options
    - The MINFILE Help desk
- Conclusion

**Lecture by: D. Jakobsen**

# Introduction and Background

- 5 years ago none of the geologists on the MINFILE project had computers.
- The MINFILE database resided on the mainframe computer (VAX) and the geologists gave filled-in forms to data entry clerks.
- There was no training or documentation and computer knowledge or skills were not required.
- In April 1989, the geologists each got a 286 desktop computer and the fun began.

# Introduction and Background cont.

- Some learned quickly, some learned slowly, some learned not at all.
- Initially we used our computers as typewriters because we didn't know any better.
- Fortunately, Larry had excellent computer skills and we pestered him constantly for help.
- We received many calls from clients requesting help and/or information.
- We made haphazard attempts to train our "front-line" staff on MINFILE. That is, the district geologists and our colleagues in the Branch.

# Introduction and Background cont.

- We struggled gamely on in this way until 1991.
- The most recent version of the software (MINFILE/pc V.3.0), which includes the data entry module, was developed in 1991.
- Now we could input the data directly on our personal computers.
- At the same time, the MINFILE database was removed from the VAX to the personal computer.
- Because of these two things we quickly had to learn some new skills.

# Introduction and Background cont.

- These included:
  - Security
  - Data transfer
  - System testing
  - Back-ups and storage
  - Various software packages that we now use routinely.

- MINFILE/pc V. 3.0 is a fairly complex piece of software and the team needed to understand it to be able to help our clients. We also had to recognize the need for more formal training, documentation and user support.

# Training Approach

- Target Audience:
  - ⇨ General public to Major mining companies and staff.

- The lowest common skill level of this target audience is **NO** computer knowledge, therefore, basic computer skills need to be taught.
  - ⇨ Previously, we insisted that clients have a basic knowledge of DOS, but eventually realized that this didn't work.
  - ⇨ Computer basics for some staff training can be left out.

# Training Approach cont.

- Hands-on Experience:
  - ⇨ To learn new software you must use it and computer training must include hands-on exercises, a lecture is not enough.
- Costs:
  - ⇨ We do external training on a cost recovery basis, excluding salaries.

# Training Approach cont.

- Documentation:
  - ⇨ Our first user's manual was published in Dec. 1992.
  - ⇨ It took us a long time to recognize the need for a manual. We believed that the program was so easy to use that a manual was unnecessary.
  - ⇨ The manual significantly reduced our support activities.
  - ⇨ We also have information materials that we use to advertise the project and our products.

# WORKSHOP: THE MINFILE TRAINING APPROACH

- The workshop was developed through trial and error.

**The Key features are:**

- The Workshop Notes match the workshop exactly.
- Hands-on exercises, using appropriate examples, are interspersed with lectures (remember the attention span of participants).
- Low student/teacher ratio, lots of personalized help and attention.

# WORKSHOP cont.

- The computer is shown on the overhead for live demonstration purposes.
- The timing on the Agenda is flexible so that each section has the necessary time.
- The language is kept simple, avoiding jargon.
- We try to have fun, keeping it light and using lots of graphics.

# WORKSHOP cont.

- The first formal internal training workshop was in Nov. 1991.
- The first formal external training workshop was in Nov. 1992.
- We have now done the external workshop 3 times, for about 45 clients.

# WORKSHOP cont.

- Advertising Brochure

# REGISTRATION

## HURRY, HURRY, HURRY...
## FIRST COME, FIRST SERVED !

FILL IN THE FOLLOWING FORM, DETACH AND MAIL OR FAX BY APRIL 9/93 TO:

D. JAKOBSEN, MINFILE UNIT
GEOLOGICAL SURVEY BRANCH
#201 - 553 SUPERIOR STREET
VICTORIA, B.C. V8V 1X4
PHONE: 356-2829 FAX: 356-8153

FIRST NAME INITIAL LAST NAME

COMPANY

ADDRESS

CITY POSTAL CODE

TELEPHONE: HOME BUSINESS

**NOTE:**

- **There will be no registration available at the Workshop, you MUST pre-register.**
- **Payment of $100.00 (payable to: Minister of Finance) MUST accompany your registration, this will be returned to you if there is no room in the workshop.**
- **You will be contacted to confirm your participation.**
- **We reserve the right to cancel if the response is poor.**
- **Cancellation by the participant will not be accepted after Apr. 9/93.**



# MINFILE/pc V. 3.0

KEG '93

ARE YOU PLANNING ON ATTENDING KEG '93?

☐ YES ☐ NO

IS MINFILE/pc V. 3.0 A MYSTERY TO YOU ?

☐ YES ☐ NO


ARE YOU INTERESTED IN A LOGICAL SOLUTION?

☐ YES ☐ NO

WOULD YOU LIKE TO EXPLORE THE MINFILE DATABASE ?

☐ YES ☐ NO

COULD YOUR COMPUTER SKILLS USE SOME HELP ?

☐ YES ☐ NO

IF YOU ANSWERED YES TO ANY OF THESE QUESTIONS, READ ON. .

# THE SOLUTION IS. . .

## ATTEND THE BEST (not to mention only) BASIC MINFILE/pc WORKSHOP IN THE WORLD!!!

WE ARE PLEASED TO BE ABLE TO INVITE YOU TO A **ONE DAY WORKSHOP:**

| | |
|---|---|
| DATE: | APRIL 18, 1993 |
| TIME: | 08:30 TO 16:30 HOURS |
| PLACE: | ACCESS CENTRE, CARIBOO COLLEGE - DOWNTOWN CAMPUS<br>152 - 63 WEST VICTORIA STREET<br>KAMLOOPS, B.C. |
| COST: | $100.00 PER PERSON (INCLUDES: COFFEE, COURSE MATERIALS AND MANUALS, MINFILE/pc PROGRAM AND SAMPLE DATASET, AND THE USE OF A COMPUTER FOR THE DAY) |
| LIMIT: | 15 PARTICIPANTS |

# AGENDA

1) INTRODUCTION TO B.C.'S MINERAL DEPOSITS DATA (MINFILE)
2) INSTALLING MINFILE/pc V. 3.0
3) LOADING MINFILE DATA
4) BASIC DOS
5) SEARCHING THE MINFILE DATA
6) REPORTING ON SEARCH RESULTS
7) UTILITIES AND DATA TRANSFER
8) DATA ENTRY
9) DISCUSSION AND EVALUATION
10) SUGGESTIONS:

# WORKSHOP cont.

- Agenda

## Workshop Agenda

✔ Basic DOS

✔ Introduction to MINFILE

✔ Installing the Program and Data

✔ Searching the Data

✔ Data Interpretation

✔ Reporting on Search Results

✔ Utilities and Data Transfer

✔ Data Entry

✔ Discussion and Evaluation

# Client Support

## The Problem

- Before the release of V. 3.0, in April 1991, it was estimated that about 2.5 days per week were spent by the MINFILE team helping user's solve problems.

- At this time there were 400 clients and the MINFILE team dealt with 1062 inquiries during the period 1990-1991.

- Marketing efforts were steadily increasing the amount and type of clients and these were using a wide variety of hardware.

# Client Support cont.

- Version 3.0 of the MINFILE/pc program was more complex and the team anticipated an increase in support activities.

**It was clear that we needed to deal with this issue, so we investigated some options:**

A. Support and Maintenance from the consultants (SHL Systemhouse):

⇨ They would set up a Help desk available from 8 am to noon, Monday to Friday, staffed by an experienced and knowledgeable person.

# Client Support cont.

⇨ The price for this deluxe solution was $50,000 per year.

B. Continue with the existing situation; a help desk type solution in-house:
   ⇨ This would mean a continued demand on staff time.

C. Hire an in-house expert:
   ⇨ High cost.

D. User pays for support:
   ⇨ Requires support from an outside vendor who then does the work and collects the fees.

# Client Support cont.

E. Client support to be handled with a combination of an in-house help-desk and a general maintenance and support contract with SHL.

⇨ Approximately 70% of the work in-house and 30% by SHL.

**We chose option E and the MINFILE Help desk was developed.**

# Conclusion

**As soon as possible, we recommend that:**

- In-house staff be trained on all appropriate software and hardware.
- A User's Manual and information materials be produced.
- A Help desk system be implemented.
- Client training be initiated.

# HELPDESK

## Problems Database Structure (PROBLEMS.DBF):

| Field | Type | Length |
|---|---|---|
| Company | C | 50 |
| Clientname | C | 20 |
| Problem1 | C | 55 |
| Problem2 | C | 55 |
| Solution1 | C | 55 |
| Solution2 | C | 55 |
| Area | C | 8 |
| Fix | L | 1 |
| Time | N | 4 |
| Date | D | 8 |
| ComType | C | 6 |
| RecBy | C | 3 |

## Address Database Structure (ADDRESS.DBF):

| Field | Type | Length |
|---|---|---|
| Company | C | 50 |
| Last_Name | C | 25 |
| First_Name | C | 20 |
| Street | C | 50 |
| City | C | 20 |
| Prov_State | C | 10 |
| Country | C | 15 |
| Code | C | 10 |
| Phone | C | 14 |
| Fax | C | 14 |
| PC_VERS_1 | L | 1 |
| PC_VERS_2 | L | 1 |
| PC_VER_213 | L | 1 |
| PC_VER_300 | L | 1 |
| Manual_Usr | L | 1 |
| Manual_Cod | L | 1 |
| Info_Pack | L | 1 |
| Date_Recv | D | 8 |
| Recv_By | C | 3 |
| Date_Sent | D | 8 |
| Sent_By | C | 3 |
| Notes | C | 50 |

# HELPDESK

## INTRODUCTION:

The British Columbia Geological Survey Branch (GSB) maintains a comprehensive mineral inventory database of over 11 000 metallic mineral, industrial mineral and coal occurrences known as MINFILE. The database has evolved over the past 25 years from a simple manual card file to a powerful mainframe and microcomputer based Geoscience Information System. The MINFILE database is available to a diverse user-community through MINFILE/pc, a menu-driven program for IBM/pc compatible computers. MINFILE/pc is a search-report and data-entry program valuable to researchers of the MINFILE database.

The program allows user's to search the data, report on search results and add, delete or change the mineral occurrence data in the database. By January 1993, 536 clients had received the MINFILE/pc program.

The HELPDESK program is the client support supplement to MINFILE/pc for the internal use of the GSB. This program keeps two databases: an Address database (ADDRESS.DBF) and a Problems database (PROBLEMS.DBF). The program utilizes a run-time version of FOX+ and Proximity Scan. The HELPDESK program contains user-friendly pull-down and pop-up menus and has a brief on-line help facility.

The Address database contains client addresses and the MINFILE products that each client has. This database is useful for creating mailing lists to notify clients of upgrades to MINFILE/pc and new data releases. The GSB must track the number of copies of MINFILE/pc V. 3.0 because it incorporates Proximity Scan, a licensed piece of software that the GSB purchases.

The Problems database contains information on the problems that clients have contacted the GSB about. When a client contacts the GSB with a problem, the database is examined for a similar problem and the solution. This enables the GSB to quickly solve client problems and evaluate the problems that clients are experiencing for correction in future releases of MINFILE/pc.

# PROBLEMS:

The Problems routines assume that the Problems database exists. The database, if missing, can be re-created using dBASE or FOX+. A list of the file structure occurs at the end of this document. A form, called a Problem Log, is used to gather the problem information. This form is then given to the staff member who maintains the HELPDESK. The name and address of clients contacting the GSB with problems should be in the database.

## READ PROBLEM:

This option will read the problems stored in the Problems database. When selected, a screen pops up and prompts you to enter a problem area or type: DOS, MINFILE, data, hardware or other. Tabbing from field to field will allow you to select a specific client by entering the company or last name. Input the first few letters of the problem area or type, company name or last name. Proximity Scan will search the database and find up to 64 of the closest matches. An entry is selected by moving up or down with the arrow keys until the desired entry is highlighted and then pressing ***CTRL-ENTER*** (press the ***CTRL*** and the ***ENTER*** keys simultaneously). A screen containing all the information on that entry will pop up. To exit this screen press any key.

## ENTER PROBLEM:

This option allows the user to enter a problem into the Problems database from the Problem Log. A window pops up when this option is selected and prompts you for the client's last name or company. The entry is then chosen by highlighting it and pressing ***CTRL-ENTER.*** The input screen pops up with blank fields that are then filled. The address, phone number, fax number and MINFILE/pc version information is listed at the bottom of the input screen. This information should be verified for accuracy while speaking with the client.

At the input screen you will be prompted for a description of the problem (2-lines), a description of the solution given to the client (2-lines), the problem type or area (DOS, MINFILE, data, hardware or other), a fix flag ("y" or "n"), the time taken in minutes, the date, the communication type (phone, fax, office, mail or other) and the initials of the staff member who received the problem.

**NOTES:**

- The problem area or type and the communication type fields both give you pop-up menus so you simply select the appropriate choice.

- Problems are split up into five types or areas: DOS, MINFILE, data, hardware or other.

- The fix flag is added if the problem is caused by the MINFILE/pc program and needs to be fixed in future versions.

- The date defaults to the current date but can be changed.
- The communication type (phone, fax, office, mail or other) is mainly for statistical purposes.
- Some edit checks are built into the Problems routine. The data will not be added if important fields are left blank. These fields are: Problem line 1, Solution line 1, problem area or type, communication type and time. This forces the inclusion of important information and allows the user to exit if they change their mind.

### BROWSE:
This option is only to be used by experienced database people because it can permanently alter or damage the data. This routine is used to change information, to enter something that the edit checks do not allow or to delete and undelete (before "packing") records. The commands are listed at the top of the screen and other commands can be accessed using the F10 key.

### PACK:
This routine is used to remove all deleted records permanently and to shrink the size of the database, it "packs" the database.

### DELETE:
This option allows you to choose a record to delete. The routine uses Proximity Scan and has the same commands as described in the READ PROBLEM and ENTER PROBLEM sections. Once a record has been chosen, by pressing ***CTRL-ENTER,*** the program will ask you if you really want to delete the record ("y" or "n"). This makes it difficult to delete an entry accidentally. The deleted entry is flagged in the database and will not appear except when using the BROWSE routine. You can undelete the entry by going into BROWSE, selecting the entry by highlighting it and pressing ***CTRL-U***. To permanently remove the entry, pack the database.

## ADDRESS:
This option assumes that the Address database already exists. If the Address database is missing a new one can be created using the structure listing found at the end of this document and the FOX+ or dBASE programs. A form, called the Client Record, must be filled out when a client receives a MINFILE product. The form is then given to the staff member maintaining HELPDESK for input.

## READ ADDRESS:
This option allows the user to read the addresses currently stored in the Address database. When chosen a screen will pop up and prompt you to enter the name of the company you wish to look up. To look up the client using a different piece of information (e.g., phone number) you can use the tab key to move through the record until you reach the desired field. Enter the first few letters of the word you are looking for and Proximity Scan will list up to 64 of the closest matches found in the database. Use the up and down arrows to highlight the record you want and press ***CTRL-ENTER*** simultaneously. A screen will pop up containing all the information on the client. This includes the version of MINFILE/pc the client has, if he has a User's manual, information package, etc. Press any key to exit the address screen.

## ENTER/EDIT ADDRESS:
This option allows you to edit an existing address record or add a client name to an existing company record. A window pops up when this option is chosen and prompts you to input the company name. Highlight the record of interest using the cursor keys and press ***CTRL-ENTER.*** The input screen will pop up with all the information stored in that record as the default information. You can move around from field to field and edit the information. Once you reach the bottom you are prompted to add or replace the record. If you are adding a name to an existing company record then you want to add the record. If you are updating the information then you want to replace the record.

To add a client to the Address database press the ***ESC*** key while in the first screen. A blank input screen will appear and you can fill-in the information. The routine verifies that the company name or the last name of the client is entered. If both are left blank the record is not added. The notes field at the bottom of the screen is used to document special data requests and any other information that might be important to record.

## BROWSE:
See the BROWSE sub-section under the PROBLEMS section.

## PACK:
See the PACK sub-section under the PROBLEMS section.

## DELETE:
See the DELETE sub-section under the PROBLEMS section.

# OPTIONS:

This area gives you a couple of miscellaneous options to aid you in using HELPDESK.

## HELP:

This is the on-line help program. When chosen, a menu will pop up to allow you to choose either Entering Information, Reading Information, Browsing, Packing or Configuration. Highlight the area (using arrows) press ***ENTER*** and a screen will pop up with the requested help information. To exit the help screen press any key.

## CONFIGURE:

This option enables the user to change the background pattern and the background color used in the HELPDESK screens. This allows users to choose a screen that is easy on the eyes. A screen with ten different patterns will pop up when this option is selected and you choose a pattern. A new screen then pops up allowing the user to choose one of ten color combinations. These choices are stored in a file called screen.mem. The changes are kept until changed again, even if the user exits the program.

# RECOMMENDATIONS:

The HELPDESK program does not have the capability of creating reports within the program. R&R Relational Report Writer is a good report program for use with FOX programs and is recommended for use with HELPDESK.

It is recommended that only one person add information to the HELPDESK. If more than one person is adding information to the databases then several different copies of the databases would exist. The person entering the information should distribute an updated copy of the Address and Problems databases at least once a month. Forms have been created for this purpose and should be used.

## Problems Database Structure (PROBLEMS.DBF):

| Field | Type | Length |
|---|---|---|
| Company | C | 50 |
| Clientname | C | 20 |
| Problem1 | C | 55 |
| Problem2 | C | 55 |
| Solution1 | C | 55 |
| Solution2 | C | 55 |
| Area | C | 8 |
| Fix | L | 1 |
| Time | N | 4 |
| Date | D | 8 |
| ComType | C | 6 |
| RecBy | C | 3 |

## Address Database Structure (ADDRESS.DBF):

| Field | Type | Length |
|---|---|---|
| Company | C | 50 |
| Last_Name | C | 25 |
| First_Name | C | 20 |
| Street | C | 50 |
| City | C | 20 |
| Prov_State | C | 10 |
| Country | C | 15 |
| Code | C | 10 |
| Phone | C | 14 |
| Fax | C | 14 |
| PC_VERS_1 | L | 1 |
| PC_VERS_2 | L | 1 |
| PC_VER_213 | L | 1 |
| PC_VER_300 | L | 1 |
| Manual_Usr | L | 1 |
| Manual_Cod | L | 1 |
| Info_Pack | L | 1 |
| Date_Recv | D | 8 |
| Recv_By | C | 3 |
| Date_Sent | D | 8 |
| Sent_By | C | 3 |
| Notes | C | 50 |

# MINFILE/pc 3.0

## ORDER FORM

MINFILE/pc v3.0 ☐ ☐ Data: ____________________

User's Manual ☐ ____________________

Product List ☐ ____________________

Coding Manual ☐ ____________________

Info. Package ☐ ____________________

Name ____________________

Company Name ____________________

Address ____________________

City ____________________

Province ____________________ Postal Code ____________________

Telephone No. ____________________ Fax No. ____________________

Date Received ____________________ Recv. By ____________________

Date Sent ____________________ Sent By ____________________

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26/08/91

# Problems Log for MINFILE/pc

Company: ____________________

Client Name: ____________________

Problem: ____________________

____________________

____________________

____________________

Solution: ____________________

____________________

____________________

____________________

____________________

Prob. Type: DOS MINFILE Hardware Data Other

Program Fix? Y / N

Date: __/__/__ (dd/mm/yy)

Time Taken _____ Mins.

Communication Type: Phone Fax Office Mail Other

Received By: ____________________

26/08/91

Month: ____________ Page: ____________

Name: ____________

# Client Record

| DATE | CLIENT | AFFILIATION | PURPOSE | CODE | TYPE |
|---|---|---|---|---|---|
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**TYPE:** P - Phone, C - Correspondence, O - Office, F - Fax, D - Delegate, EM - EMail, M - Meeting, T - Training.

**CODE:** PI - Product Information, DR - Data Request, PS - Program Support, PF - Property File, DEMO - Demonstration; A - Administrative, P - Project, ARIS - Assessment Report.

**AFFILIATION:** I - Industry, B - Geological Survey Branch, G - Government, P - Public, C - Contractor, U - University.

# Marketing and Data Distribution

## OUTLINE:

Introduction
Marketing Concepts
Strategy and Planning
The Marketing Plan
Marketing Implementation
Distribution
Examples
Summary

Lecture by: L. Jones
17 November 1993

Reference: Beckman, M. Dale, David L. Kurtz, Louise Boone (1992): *Foundations of Marketing*, Fifth Canadian Edition, Dryden Canada

# Marketing

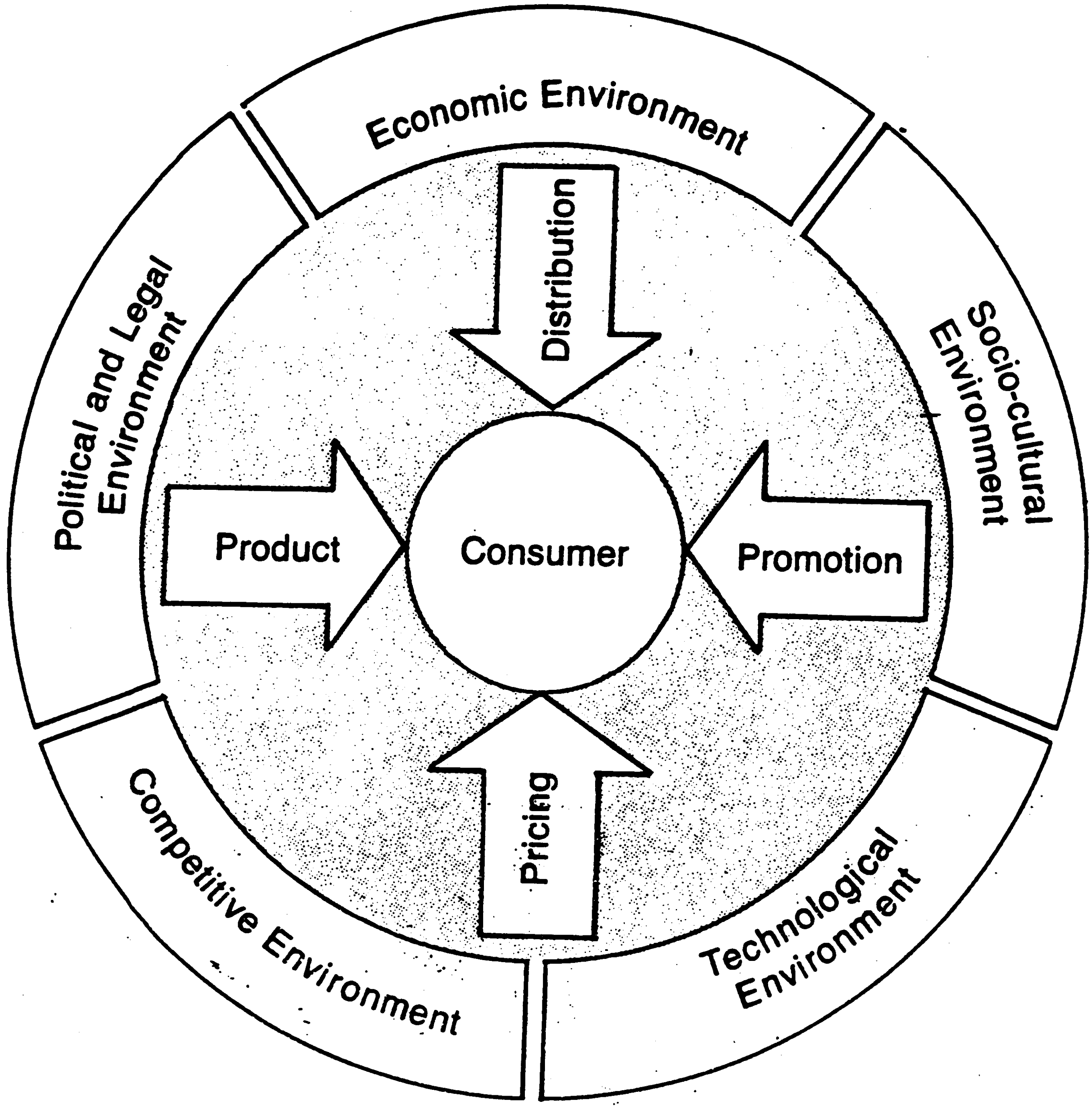
## BUSINESS PURPOSE:

⇒ identify and create a client
⇒ identify needs
⇒ products and services to meet needs
⇒ communicate product or service
⇒ make the product or service
⇒ price to reflect costs
⇒ follow-up and servicing

## MARKETING DEFINED

⇒ the process of planning and executing the conception, pricing, promotion and distribution of ideas, goods and services to create exchanges that satisfy individual and organizational objectives.

# Elements of the Marketing Mix Operate within an Environmental Framework



# Marketing

## TARGET MARKET (*client identification*)

⇒ major national and international exploration and mining companies
⇒ environmental groups
⇒ consultants
⇒ academia
⇒ government
⇒ rock and mineral collectors
⇒ geochemical labs.

## STRATEGY AND PLANNING

⇒ develop corporate strategy
⇒ develop marketing strategy
⇒ develop marketing plan.

## CORPORATE STRATEGY

⇒ the overall purpose and direction of the organization that is established in the light of the challenges and opportunities found in the environment, as well as available organizational resources. This is sometimes expressed as a **mission statement.**

# Marketing

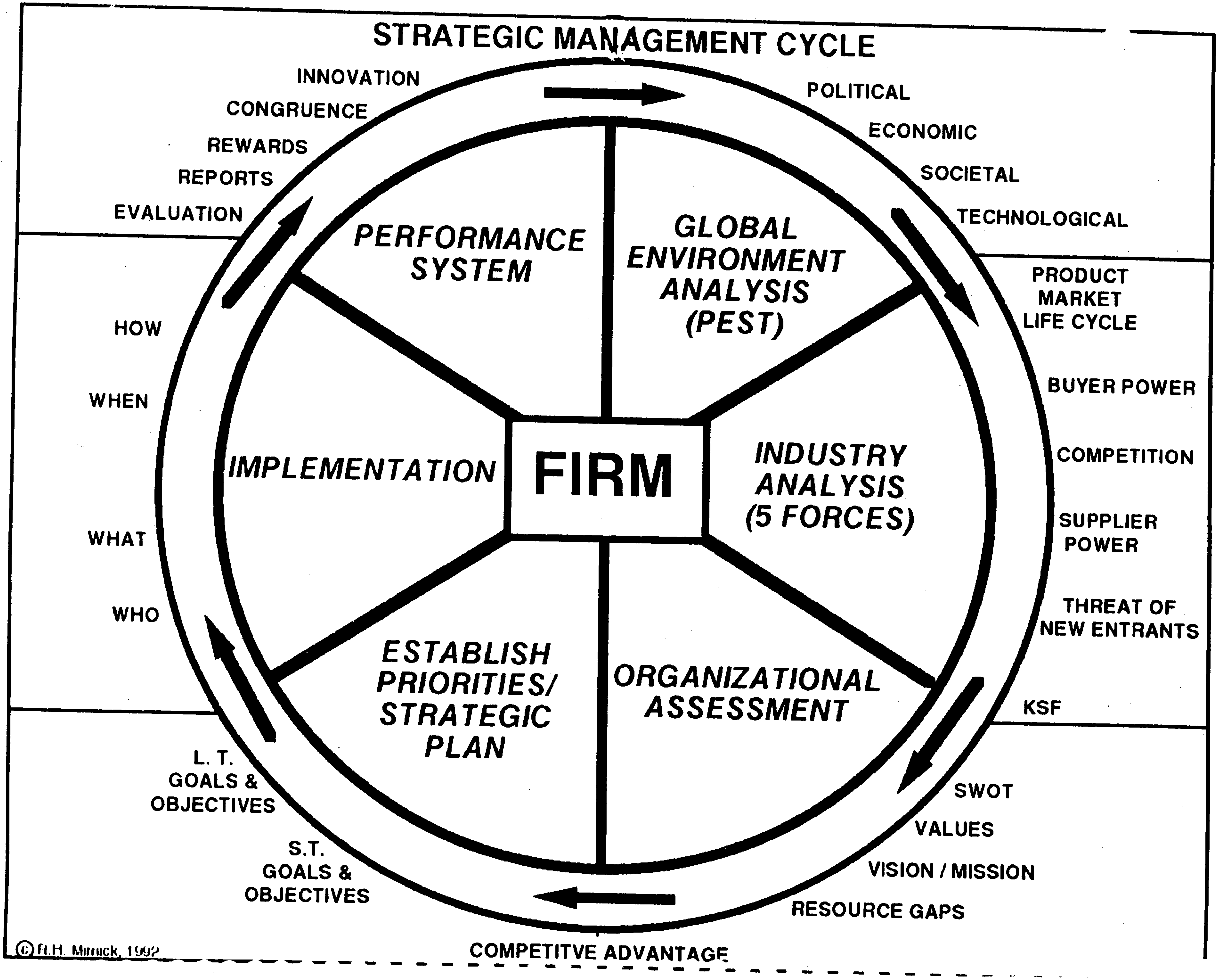
## GEOLOGICAL SURVEY BRANCH MANDATE:

The Geological Survey Branch of the Ministry of Energy, Mines and Petroleum Resources is charged with providing the geological inventory required to develop British Columbia's mineral resources, to improve government's stewardship of our mineral endowment, and to help manage and protect Crown lands.

The Branch's mandate is to:

*Assemble, maintain, and market a comprehensive geoscience database for B.C. to provide a sound base for*

1. *exploration & development of the province's mineral resources;*
2. *planning & resource management decisions by governments; and,*
3. *public information on geological resources and hazards.*




© R.H. Mirnick, 1992

## Exhibit 2–2 The SWOT Analysis—with Suggestions of What to Look For

### *Internal*

#### *Strengths*

Adequate financial resources?
Well thought of by buyers?
An acknowledged market leader?
Well-conceived functional area strategies?
Access to economies of scale?
Insulated (at least somewhat) from strong competitive pressures?
Proprietary technology?
Cost advantages?
Product innovation abilities?
Proven management?
Other?

#### *Weaknesses*

No clear strategic direction?
Obsolete facilities?
Lack of managerial depth and talent?
Missing any key skills or competencies?
Poor track record in implementing strategy?
Plagued with internal operating problems?
Falling behind in R&D?
Too narrow a product line?
Weak market image?
Below-average marketing skills?
Unable to finance needed changes in strategy?
Other?

### *External*

#### *Opportunities*

Serve additional customer groups?
Enter new markets or segments?
Expand product line to meet broader range of customer needs?
Diversify into related products?
Add complementary products?
Vertical integration?
Ability to move to better strategic group?
Complacency among rival firms?
Faster market growth?
Other?

#### *Threats*

Likely entry of new competitors?
Rising sales of substitute products?
Slower market growth?
Adverse government policies?
Growing competitive pressures?
Vulnerability to recession and business cycle?
Growing bargaining power of customers or suppliers?
Changing buyer needs and tastes?
Adverse demographic changes?
Other?

# Marketing

## MARKET STRATEGY PLANNING

⇒ state objectives
⇒ identify problems and opportunities
⇒ study previous plans
⇒ alternative strategies
⇒ identify risk factors
⇒ action plan
⇒ contingency plans

## OPERATIONAL ORGANIZATIONAL REQUIREMENTS

⇒ Identify:
- resources held
- resources required
- resource gaps

⇒ responsibilities
⇒ timetables
⇒ implementation and controls

## THE MARKETING PLAN

⇒ a program of activities that lead to the accomplishment of the marketing strategy.
⇒ what should be included in the Plan to meet strategy objectives and organization effectiveness?

**Strategic Planning Process Model**

Company
- Resources
- Management
- Performance
  - balance sheet
  - income statement
- Market mix

Market segments
Consumer profiles

Environment
- political
- environmental
- sociological
- technological
- competition

<u>analysis</u>

SWOT - <u>focus</u>
(match strengths with opportunities)
↓
Core Business Strategy - <u>strategy formulation</u>
↓
Operating Plans - <u>implementation</u> **(Marketing Plan)**
budgets
↓
Review - <u>follow-up</u>

**Process** *(Figure 6-2)*:

1. analyze market and environmental opportunities and threats
2. analyze business strengths and weaknesses
3. generate objectives and strategy
4. evaluate objectives and strategy
5. plan implementation and control programs

# Marketing

## THE MARKETING PLANNING PROCESS

I. **Situation Analysis**: *Where Are We Now?*

A. **Historical Background**
B. **Client Analysis**
Who are the clients we are trying to serve?
What market segments exist?
How many potential are there?
What are their requirements?
C. **Marketing opportunities:** *What exist for the organization?*

II. **Marketing Objectives**: *Where Do We Want to Go?*

**Example:** *The objective of this marketing plan is to develop a strategy to attract investors to explore and develop gold resources. The plan will identify a target market, strategies, issues, opportunities, and data gathering and implementation methods.*

III. **Strategy, Developing a Marketing Mix**: *What should we do with each of the marketing mix elements? How can we get there?*

A. Product/Service Decisions
B. Pricing Decisions
C. Distribution Decisions
D. Communication Decisions
E. Financial Considerations
F. Control Aspects: monitor, change, feedback

# Marketing

## IMPLEMENTING THE PLAN: The Marketing Mix

**marketing mix** is the blending of the four elements (price, product, communication, distribution) of marketing to satisfy clients.

√ **product** management requires decisions about what kind of product is needed, its uses, package design and new-product development. Products include services which are performance and symbolic attributes designed to produce client-satisfaction.

√ **pricing** includes methods of setting reasonable, possibly profitable and justified prices.

√ **distribution** is the selection and management of marketing channels, which are the steps that products take to the client, and the physical distribution of the products.

√ **communication** - selling, advertising, promotion, and publicity. Communicate the benefits of investing.

# MINFILE/pc 3.0

## ORDER FORM

MINFILE/pc v3.0 ☐ | ☐ Data: ____________________

User's Manual ☐ | ____________________

Product List ☐ | ____________________

Coding Manual ☐ | ____________________

Info. Package ☐ | ____________________

Name ____________________

Company Name ____________________

Address ____________________

City ____________________

Province ____________________ Postal Code ____________________

Telephone No. ____________________ Fax No. ____________________

Date Received ____________________ Recv. By ____________________

Date Sent ____________________ Sent By ____________________

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26/08/91

# MINFILE PUBLICATIONS (January 1994)

| Product Type | No. Occ. | Rel. Date | Paper Price | No. Pages | Notes |
|---|---|---|---|---|---|
| 082FSW | 374 | 91 June | $30.00 | 947 | |
| 082G | 257 | 91 June | $20.00 | 401 | |
| 082G,J | 322 | 91 June | $5.00 | | Disk price |
| 082J | 65 | 91 June | $7.50 | 108 | |
| 082LSW | 157 | 93 Oct | $15.00 | 303 | |
| 082M | 244 | 87 Nov | $20.00 | 480 | |
| 082N,O | 92 | 93 Oct | $7.50 | 172 | |
| 083D,C | 46 | 92 Mar | $7.50 | 115 | |
| 092B | 149 | 91 Jan | $25.00 | 291 | |
| 092C | 149 | 91 Jan | $25.00 | 299 | |
| 092E | 69 | 89 June | $7.50 | 144 | |
| 092F | 565 | 90 June | $50.00 | 1215 | |
| 092G | 197 | 90 June | $10.00 | 400 | |
| 092HNE | 303 | 92 Dec | $25.00 | 551 | |
| 092HNW | 73 | 92 May | $7.50 | 160 | |
| 092HSE | 244 | 92 July | $25.00 | 566 | |
| 092ISE | 189 | 90 Feb | $20.00 | 371 | |
| 092ISW | 96 | 91 June | $10.00 | 176 | |
| 092J | 234 | 92 Jan | $20.00 | 464 | |
| 092K | 154 | 89 June | $12.00 | 287 | |
| 092L,102I | 344 | 89 June | $30.00 | 777 | 2 sheets for map ($10.00) |
| 092M,102P | 17 | 92 May | $5.00 | 40 | |
| 092N | 62 | 92 May | $7.50 | 144 | |
| 092N,092M | 79 | 92 May | $5.00 | | Disk price |
| 092O | 119 | 92 Jan | $12.50 | 206 | |
| 093A | 150 | 89 Sept | $15.00 | 293 | |
| 093B | 57 | 89 Sept | $5.00 | 113 | |
| 093C | 15 | 89 Sept | $5.00 | 27 | |
| 093D,103A | 34 | 89 Sept | $5.00 | 60 | |
| 093E | 113 | 87 Nov | $10.00 | 142 | |
| 093F | 50 | 89 Sept | $5.00 | 96 | |
| 093G | 56 | 89 Sept | $5.00 | 78 | |
| 093H,083E | 126 | 89 Sept | $10.00 | 233 | |
| 093I | 22 | 89 Sept | $5.00 | 47 | |
| 093J | 24 | 89 Sept | $5.00 | 39 | |
| 093K | 93 | 89 Sept | $7.50 | 161 | |
| 093L | 301 | 89 Sept | $30.00 | 630 | |
| 093M | 194 | 92 Mar | $15.00 | 321 | |
| 093N | 219 | 93 Jan | $20.00 | 415 | |
| 093O | 48 | 92 Mar | $5.00 | 89 | |
| 093P | 23 | 89 Sept | $5.00 | 25 | |
| 094A | 9 | 92 Mar | $5.00 | | Map price |
| 094A,B | 42 | 92 Mar | $5.00 | 84 | |
| 094B | 33 | 92 Mar | $5.00 | | Map price |
| 094C | 161 | 92 Sept | $15.00 | 248 | |
| 094D | 171 | 92 Sept | $15.00 | 326 | |
| 094E | 233 | 92 Dec | $30.00 | 622 | |
| 094F | 30 | 92 May | $5.00 | 51 | |
| 094F,G | 66 | 92 May | $5.00 | | Disk price. |
| 094G | 36 | 92 May | $5.00 | 59 | |
| 103B,C | 79 | 89 Apr | $7.50 | 162 | |
| 103F,K | 54 | 89 Apr | $7.50 | 97 | |
| 103G | 45 | 89 Apr | $7.50 | 89 | |
| 103H | 73 | 89 Sept | $7.50 | 131 | |
| 103I | 223 | 89 Sept | $20.00 | 414 | |
| 103J | 48 | 89 Apr | $7.50 | 83 | |
| 103O,P | 261 | 90 Feb | $25.00 | 588 | |
| 104A | 175 | 93 Mar | $18.00 | 375 | |
| 104B | 360 | 89 Feb | $35.00 | 897 | 2 sheets for map ($10.00). |
| 104F | 8 | 88 July | $5.00 | | Map price. |
| 104F,G | 130 | 88 July | $15.00 | 247 | |
| 104G | 122 | 88 July | $5.00 | | Map price. |
| 104H | 30 | 92 Jan | $7.50 | 63 | |
| 104K | 116 | 88 July | $15.00 | 260 | |
| 104M | 87 | 93 July | $7.50 | 157 | |
| 104N | 133 | 88 Dec | $15.00 | 253 | |
| 104O | 50 | 88 Dec | $7.50 | 97 | |
| 104P | 117 | 88 Dec | $12.50 | 216 | |
| 114P | 84 | 88 Dec | $10.00 | 146 | |
| 1993 Mines & Expl. | 150 | 94 Jan | $5.00 | | Disk only; data of Open File 1994-1. |
| Coding Manual V.3.32 | | 92 Nov | $0.00 | 102 | Information Circular 1992-30. |
| Industrial Minerals | 398 | 92 Jan | $10.00 | | Open File 1992-9. |
| Major Deposits in BC | 373 | 92 Mar | $10.00 | | Disk only. |
| MINFILE/pc V. 3.0 | | 91 July | $0.00 | | Disk. |
| Provincial Database | 11368 | 94 Jan | $75.00 | | 15 disks; may be bought separately. |
| Provincial Index | 11368 | 94 Jan | $5.00 | | Disk only; includes report generator. |
| Provincial Maps | 66 | 92 Jan | $10.00 | | Microfiche; covers 101 NTS areas. |
| User's Manual V.1.0 | | 92 Dec | $0.00 | 158 | Information Circular 1992-28 |

**NOTE:**
Map area products are available in disk ($5.00 each), map ($5.00 each) and paper format (prices as noted).

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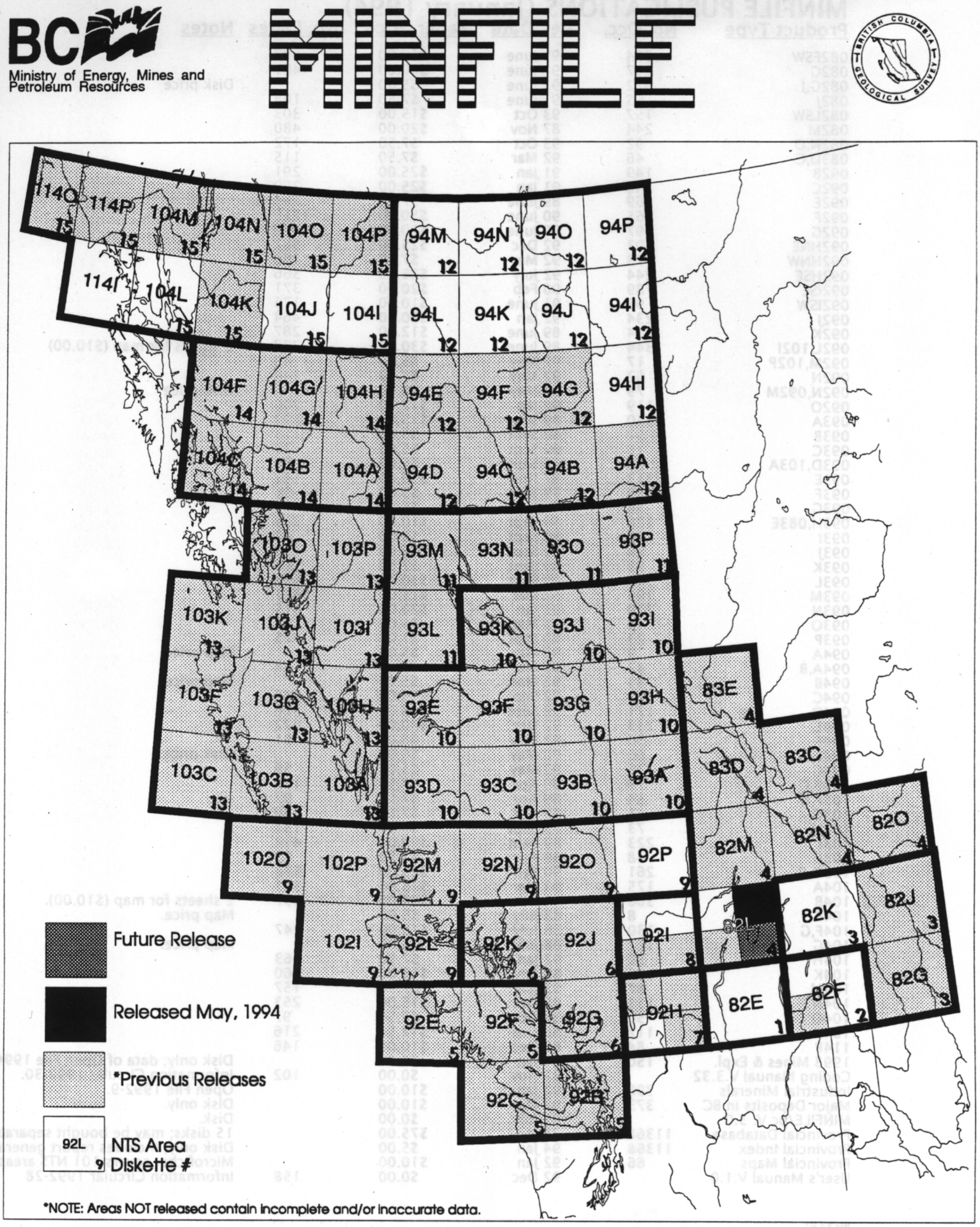



# DISTRIBUTION OF PROVINCIAL DISKETTES

# MINFILE Project Management

## PROJECT ELEMENTS

- Concept, designing, planning (budget, staff)
- Database Design and Data Dictionary
- System Testing and Quality Assurance
- Database Administration and Maintenance (documentation and manuals)
- Data Acquisition and Processing Procedures (coding procedures)
- Training and Client Support
- Marketing and Distribution of Data

⇒ **New Technology and Future Planning**

- Designing and Producing Computer Generated Products for Users

# Future Trends

- LAN (Local Area Networks)
- Client/servers
- CD-ROM (compact disc-read only memory)
- GIS (Geographical information systems)
- AI (Artificial Intelligence / Expert Systems)

## KEY AREAS FOR SYSTEM ENHANCEMENTS
**Opportunity for leadership roles by sections**

- ☑ *Hardware upgrades*
- ☑ *Software upgrades*
- ☑ *System development*
- ☑ *Networking*
- ☑ *Application integration*
- ☑ *Training*

# KEY SUCCESS FACTORS

- **highly skilled group of people; ability to respond quickly to change**
- **ability to efficiently deliver quality products; respected reputation**

# CHALLENGES

- **competition for funding**
- **rapid technological changes**
- **communication**

# OPPORTUNITIES/BENEFITS

- **innovative implementation of computer technology**
- **become a major contributor in the land-use planning process**
- **improvements on production time and overhead costs**
- **enhance service quality**
- **reduce business life cycle**
- **satisfied client-base**

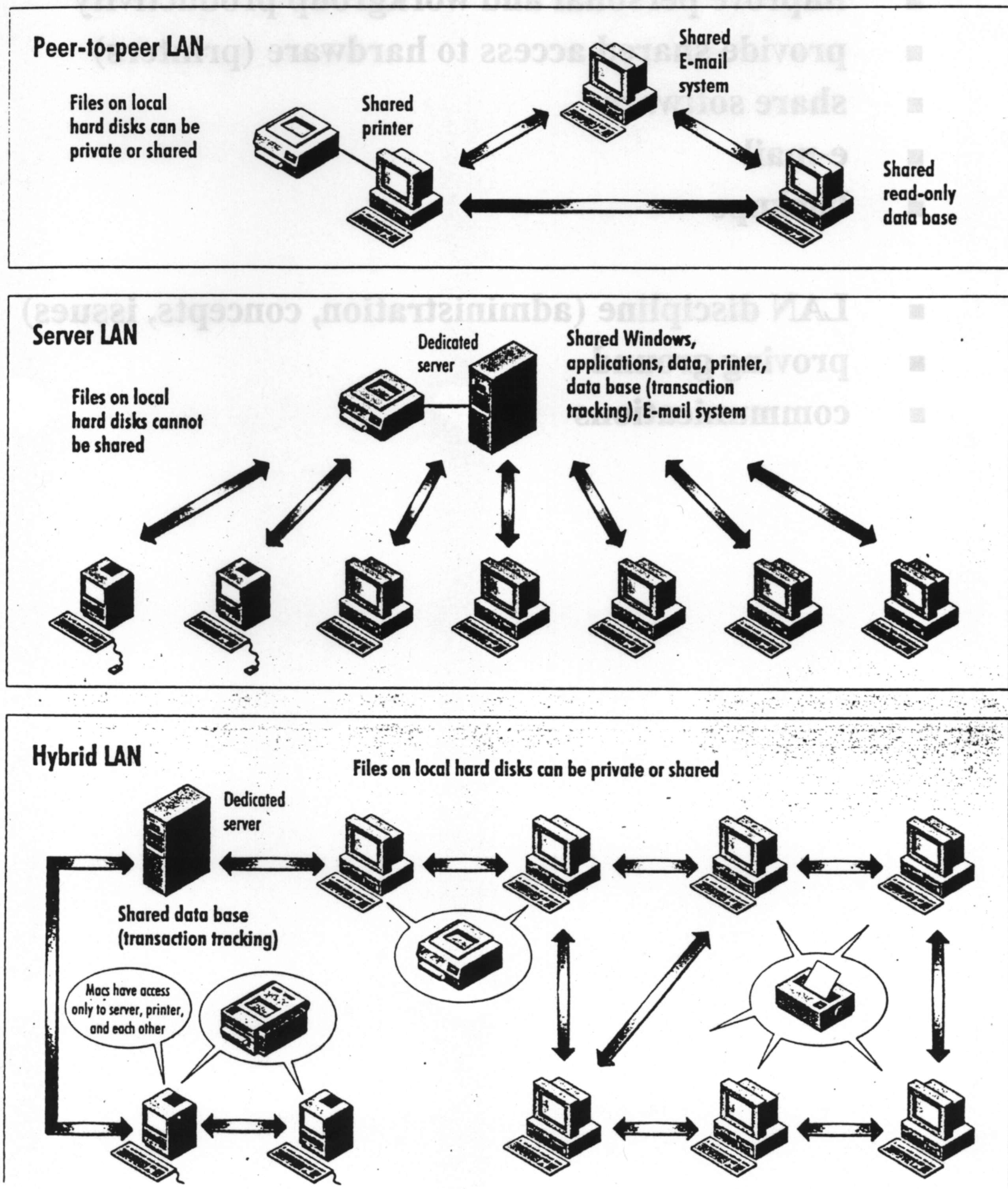
# ADVANTAGES/BENEFITS OF LANS

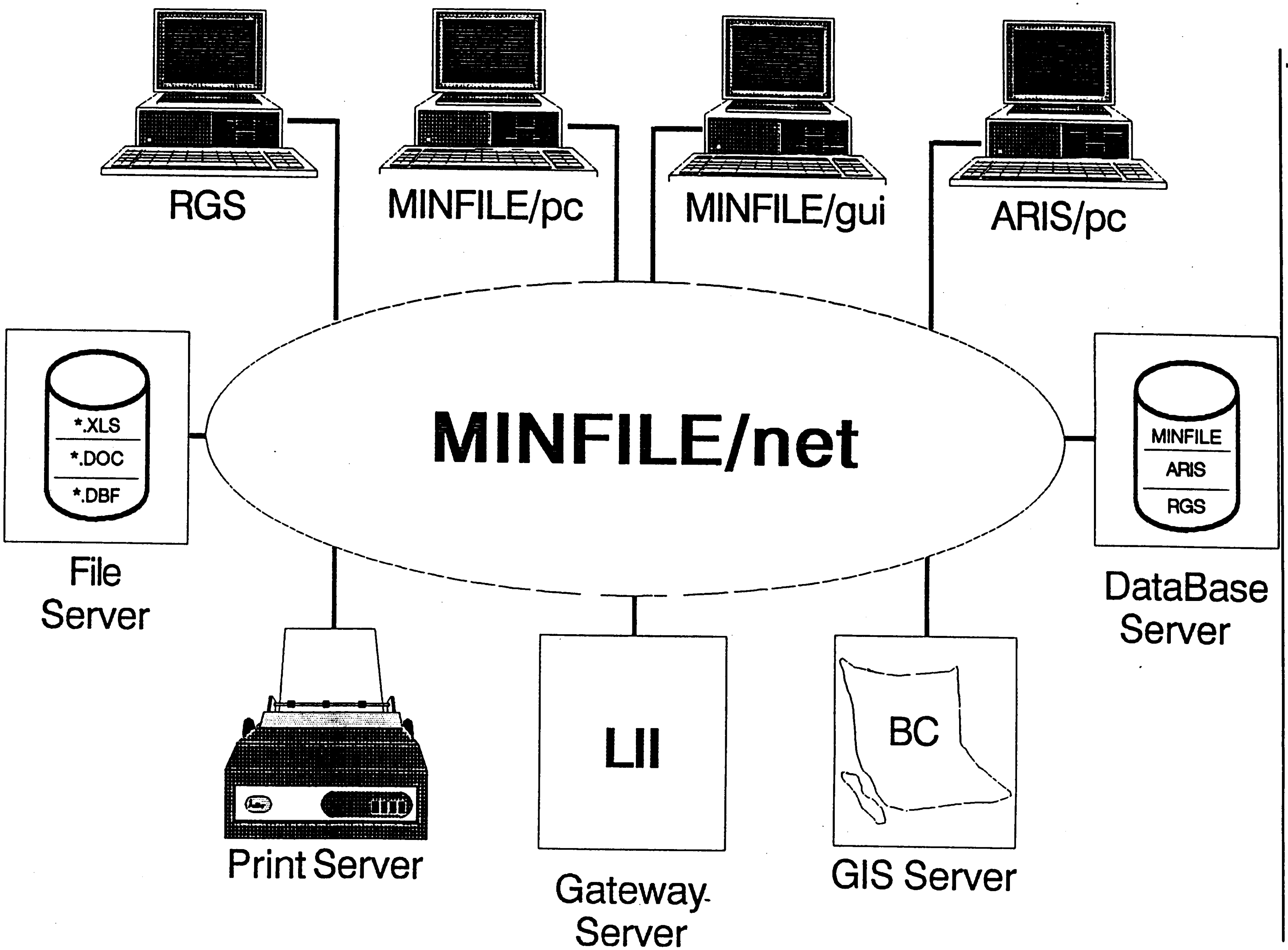
- ability to share information (transfer files)
- efficient information retrieval
- improve personal and workgroup productivity
- provide shared access to hardware (printers)
- share software
- e-mail
- backups

- LAN discipline (administration, concepts, issues)
- proving ground
- communications

# A Tale of Three Networks

*Traditionally, you've had to choose between a peer-to-peer network, which offers flexible printer and file sharing, and a server-based LAN such as NetWare, which requires a central server and administrator but offers a better platform for sharing applications. Today, thanks to DOS 5.0's memory tricks and advanced peer-to-peer technology, you can run NetWare and your peer-to-peer NOS on the same workstations and get solid multiuser support plus simultaneous freestyle resource sharing.*




RGS
MINFILE/pc
MINFILE/gui
ARIS/pc
*.XLS
*.DOC
*.DBF
File Server
MINFILE/net
MINFILE
ARIS
RGS
DataBase Server
Print Server
LII
Gateway Server
BC
GIS Server

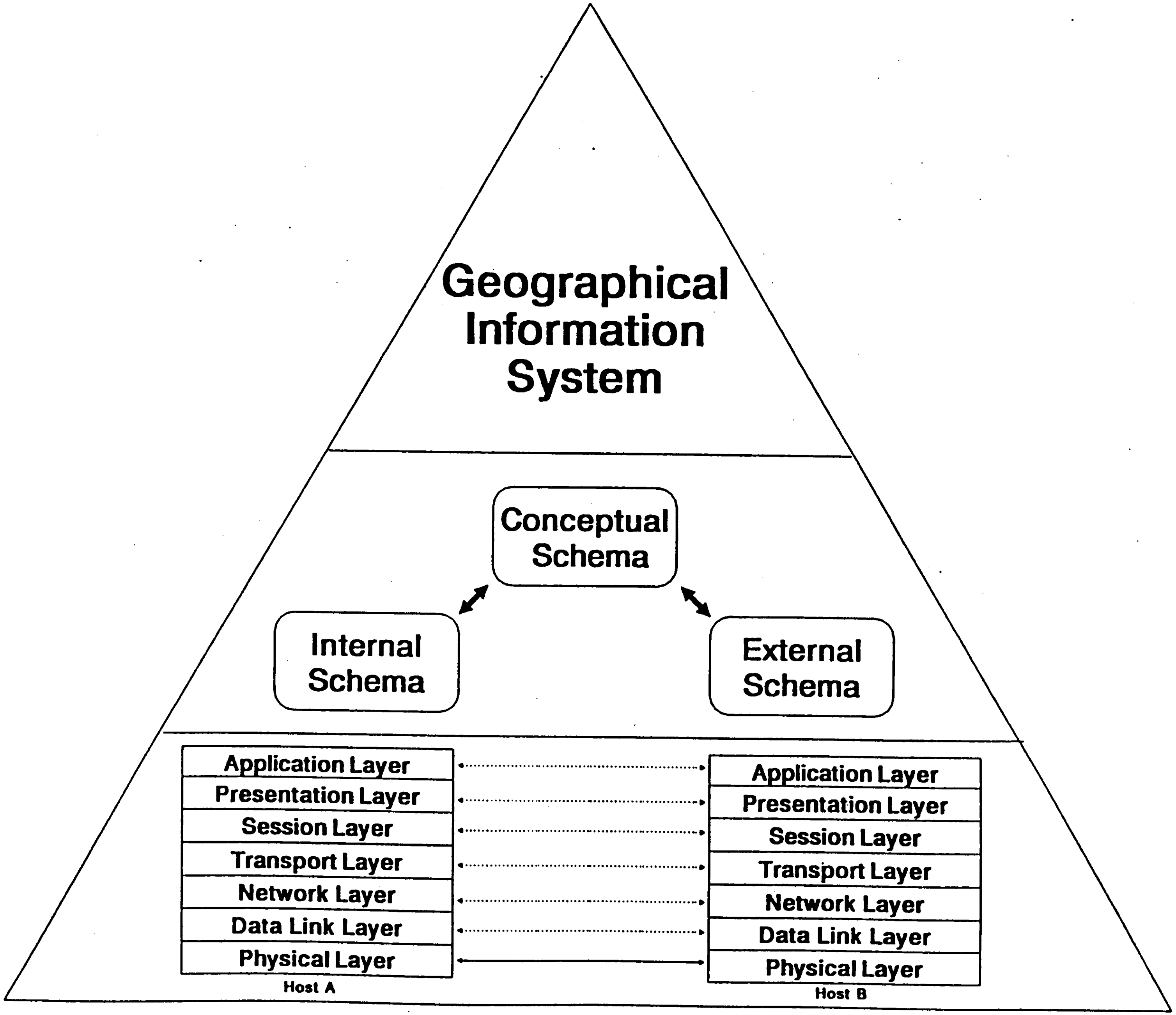



Diagram 2: The exposed lower layers of the proposed Reference Model of Geomatics

# COMPUTER TECHNOLOGY TRENDS

L.D. Jones, June 29, 1992

## INTRODUCTION

While mainframes will still have a role in the handling of strategic corporate data, PC's are considered the engines for the end users due to the power, ease of use, industry support and low cost. While an organization's base data and systems exist, the organization is challenged to use the data from a strategic business perspective. In business, technology is important, but how to implement it is the key to success. Businesses are stressing the need for reliability, industry standards and the ability to expand.

Business planning leads to information systems planning. Businesses will generally use technology tools to achieve the goals of the organization; technology, although strongly influences organizations, should not dictate how an organization does business. Major corporations generally first define their business role and strategy. Data is then collected, with the key or primary data, such a personnel and accounting, on mainframes. The organization will then derive secondary or support data, which may reside on the mainframe or on PC's. Technology activities or a model will then fit into the overall business strategy of an organization. While an organization's base data and systems exist, the organization is challenged to use the data from a strategic business perspective.

This report will discuss some of the major trends of the Canadian computer industry and focus on technology specific to the corporate strategy of the Geological Survey Branch.

**CHALLENGE:**

- **grow with the changes in user-need and technology**
  - ***information strategy***
  - ***minimum of cost and effort***

**MESSAGES:**

- **Technology alone cannot solve business problems**
- **Need people and business strategy**
- **Technology is important, but how it is used is the key to success**

## THE COMPUTER TECHNOLOGY INDUSTRY

### General Trends

The computer technology industry is very competitive and is undergoing a complete structural change. Technological enhancements are rapidly advancing and, as a result, quickly become outdated. Computer prices are decreasing while performance increases, thus causing an economic environment of declining margins. Businesses are moving from mainframes to PCs, and to client-server technology. Scalable versions of operating systems, such as Unix, which will run on platforms from workstations to supercomputers, are in the forefront. With the move away from mainframes, business are turning to outsourcing, which is the leasing of equipment and expertise, to operate their corporate computer systems. Internationally, joint ventures are common, such as Japanese-American computer consortiums, where the Japanese have the hardware technology and the Americans have the software. Multimedia, the ability to interact with computers in multiple ways during the same session, will become a reality and is expected to grow dramatically (50% increase in sales/year).

In the Canadian software industry there is a lack of qualified people. Skills are becoming obsolete; there are too many programmers and demands for people with PC-based application-development skills. Training is not being adequately addressed by government, business and educators. However, employment growth in the industry is expected to be 20% in the next 3 years.

**MAJOR TRENDS:**

- **Fewer resources**
- **Greater competition; structural change**
- **Open integration of systems**
- **Downsizing**
  *moving applications off a mainframe and onto smaller machines, usually networked microcomputers or personal computers (PCs).*
- **Customer-driven**
  *connectivity, security, integration, growth, configuration flexibility, and innovation.*

**SOLUTIONS:**

- **Client/server technology**
  *reduce computing costs, more productive applications and better access to information.*
- **Distributed computing; software applications**
- **Standards compliance**
- **Standard interfaces (Windows)**
- **Flexibility, growth and cost effectiveness**
- **Scalability**
  *multiprocessing, upgradable, protect investment.*
- **Pervasive, consistent internetworking**
- **Outsourcing**
  *the leasing of equipment and expertise to operate corporate computer systems; contracting out non-strategic functions.*

Customers are becoming more sophisticated. They want connectivity, security, integration, growth, configuration flexibility, and innovation. Users of computer technology are demanding the ability to switch among differing hardware and software brands with ease; industry is responding by developing client-server applications, Unix operating systems and open systems. Users want more choice in hardware and software to match the best environments and applications for their business needs. For open systems and client-server applications to succeed they will have to provide two key functions: internetworking and interoperability. Internetworking concerns the linking, with gateway and local-area network technology, of separate platforms. Open systems (OSI,TCP/IP) provide the set of common standards that vendors require to implement products that can be linked. Interoperability addresses how applications interact across the network. Examples are databases and E-Mail gateways. Clients will want an amalgam of well-accepted PC LAN-based components, such as Windows, Windows applications, a solid but simple E-Mail with good directory services and X.400 gateways.

- **Identify the business motivation**
  *how to improve operating efficiency and costs;*
  *how to provide a competitive advantage and accelerate the business cycle.*
- **Analyze the flow of information**
  *logical work flow within the organization;*
  *design networks, processing power, and data distribution.*
- **Establish the system architecture**
  *networks - LAN;*
  *databases - multi-user, data integrity, compatibility of access methods;*
  *development tools - SQL-based; user interface builders; and integrated development tools.*
- **Establish the application architecture**

**after Freitag**

The market for reduced instruction set computing (RISC) based systems will grow at a compounded annual rate of 28% from 1991 to 1995 while unit revenues will grow at a 45% rate, according to a report by Electronic Trend Publications. Reasons for this are RISC is linked with UNIX, the price of a RISC system will continue to drop sharply, resulting in RISC desk-top systems, which will replace mainframes.

**CLIENT/SERVER IMPLEMENTATION:**
**CLIENT/SERVER BUDGET:**

- **Hardware and operating system ($35 000)**
  *486 PC, 16M RAM, 600M hard drive, UNIX, ethernet, 386 servers*
- **Application software ($4000)**
  *relational database, SQL*
- **Training and support ($40 000)**

Sales of mainframes declined 4.7% in 1991, while overall computer hardware sales grew 3.1%. Sales were slowed by lack of upgrade capability in mainframes and economic and technological uncertainty. Currently, 200 Canadian companies, including major utility companies, travel agents, insurance companies and banks, operate roughly 400 mainframes. Existing mainframes may be replaced, but their total number will not likely increase substantially. Data processing and manipulations will take place at lower-level computers and the mainframes will become data depositories and file servers. Major companies will still require the mainframe to handle huge amounts of data and the multitude on existing users. Mainframes are also easier to manage and back up.

## Downsizing

Downsizing refers to moving applications off a mainframe and onto smaller machines, usually networked microcomputers or personal computers (PCs). While mainframes will still have a role in the handling of strategic corporate data, PC's are considered the engines for the end users due to the power, ease of use, industry support and low cost. PCs are typically one-third to one-half the cost of mainframes when software and network costs are included. As well, mainframe software and thinking are being ported onto PC networks. With this shift, applications such as E-Mail are being moved. The AS/400, as a minicomputer platform for vertical, business-oriented solutions, is becoming a popular choice as an alternative to MVS type of environments. The technology and software tools to support downsizing are still "immature". Concerns for businesses involved in downsizing include costs of converting the software or getting the old system running on the new hardware as networks are not as simple as the central processors of the mainframes.

## Networking

All currently noncommunicating PCs are potential candidates for interconnection. Large corporations are increasingly developing a company-wide strategy of including both mainframes and PCs within their overall computing capability. User are accustomed to the friendliness of microcomputers and demand that packages be equally easy to install, access and use. They want transparent access to the host so that they can work on host-applications using the capabilities of the PC. Desired features may include context-sensitive help, on-line tutorials, menu-driven installation and configuration, and common user-interfaces. The PC-to-host market is becoming saturated and, with the move to corporate LANs, gateway-products to gain access to mainframes appear to be gaining popularity.

In a recent survey of PC-LAN users, the most important purchasing criteria are compatibility with existing LANs (31%), vendor reliability (20%), quality (12%), commitment to open systems standards (11%), lowest price (9%), post-sale support (8%), highest performance (5%), technical innovation (2%). LAN design, installation and management is a highly specialized discipline requiring experts who understand the complex interdependencies between hardware and software and networks.

## Standards and Open Systems

The International Standards Organization (ISO) develop or adopt standards for computer languages, architecture and systems, in order to overcome the problems of incompatibility between computer platforms. National standards organization, such as those in the U.S.A., are very influential in setting computing standards due to their large high tech industry. New standards often influence the computing market for products and jobs. For example, new directions in computing standards are being set by Open Systems Interconnect (OSI), which sets standards for the movement of data within systems and Open Systems Architecture (OSA), which attempts to eliminate problems of computer incompatibility and vendor dependence.

Solutions for open systems networking will force organizations to either implement a coexistence strategy or a transition strategy. A transition will occur when a organization runs one protocol, but wishes to run only another protocol. A harder alternative is the coexistence of two different protocols in an organization.

The telecommunications industry, has experience rapid growth and communications protocols for the business world tend to be those developed by vendors such as IBM and DEC. In general, a communication protocol is a set of rules for formatting the transmission of data, consisting of a destination header, the message and a error-checking trailer. Industry has been slow to adopt a single international standard for data communications. However, there is a gradual move towards using the OSI standard. This standard is a seven-layer hierarchy, defining the electrical characteristics, communications standards, and software applications for computer systems. The first four layers define the transfer of data and the top three layers, called the user layers, deal with computer sessions and data processing. See OSI reference model.

**OSI REFERENCE MODEL**

| | | |
|---|---|---|
| 7 | Application | - Application/Information content displayed in layer 6. |
| 6 | Presentation | - Code conversion and data formatting; terminal standards, display rules. |
| 5 | Session | - Coordination of interaction between end-application processes; English language translated into network technology. |
| 4 | Transport | - End-to-end data integrity and quality of service; assembles and disassembles data packets for layer 3. |
| 3 | Network | - Switching and routing of information. |
| 2 | Data Link | - Transfer of units of information to the other end of a physical link, responsible for data integrity between nodes. |
| 1 | Physical | - Transmission of the bit stream to the transmission medium. |

**OPEN SYSTEMS**

| | | |
|---|---|---|
| • | Hardware | - from CISC (complex) to RISC (reduced instruction set) |
| • | Software | - from Proprietary to Open Systems |
| • | Applications | - from Timesharing to Client/Server |

**WHY - OPEN SYSTEMS:**

- Standards
- User-driven vs vendor-driven
- Investment protection
- Adaptable to change
- Do more with less

**WHAT - OPEN SYSTEMS**

**A vendor-neutral applications environment compliant with international standards.**

**HOW - OPEN SYSTEMS**

- **Connectivity**
  ***the ability to move any piece of information within the network, regardless of the media transmission technologies.***
- **Interoperability**
  ***enables all system elements to exchange information between network devices, regardless of the vendor.***
- **Portability for the user and application**
- **Leverage strengths of all environments**
- **Distribute portions of applications across a network**
- **Share processing power and data management**
- **Specialty services available to all**
- **Any system can be a client or server**

## Electronic mail

Electronic mail (E-Mail) includes fax, electronic data interchange (EDI), Telex, voice mail and other products. E-Mail is increasingly seen as a tool for enhancing productivity and as a platform for further application development. Standard message exchange protocols and user directories, developed under the OSI model, further stimulate new products that will serve to build a global E-Mail network that rivals telephone networks.

E-Mail is one of the key applications developing in the LAN environment, as it opens the door to enhancing productivity through improved communications. Rudimentary messaging capabilities are included with most LAN operating system software; however, products with more enhanced features are being sought after by many users. LAN vendors will likely add more attractive features to their mail component. The key competitive factor in this market is protocol observance or connection to outside services.

E-Mail growth has been spurred by the growth of PCs, data communications, and application software standardization. The growth of standard interchange methods, such as the X.400 standard, hopes to create a uniformity in communications protocols and to eliminate the barriers imposed by proprietary systems. This provides groups with the global compatibility and functionality to construct private, multi-vendor networks for electronic mail exchange. See figure 1 on E-Mail Connectivity Schematic.

Full-featured E-Mail systems include mailboxes, editors, store and forward, directories, distribution lists, bulletin boards, message headers and storage, security and access to outside systems. In addition to these basic technologies, opportunities exist for the development of advanced features and applications, to further organize and manage office communications. These extended features include application programming interfaces (APIs), attachments, EDI, facsimile, forms, graphical user interfaces (GUIs) and gateways.

E-Mail has measurable advantages over alternative forms of communication, such as telephones, postal and courier services, and intracompany mail. Restrictions however, include the scope of service, ease of use, cost and security. Efficiency benefits, such as speed of delivery and message turnaround, must be weighed against large start-up costs. Traditional cost justification methods, such as costs on a per-user basis and message volume, are difficult to measure. Justifications may become strategic payoffs such as time savings, multitasking, and the acceleration of shared ideas and their documentation in a workgroup. Thus messaging becomes an extension of the thinking process as opposed to the automation of some process otherwise handled in some other medium. E-Mail, if carefully planned and considered an investment and an asset, will likely benefit an organization in positive, unforeseen ways.

Organizations are moving from private (in-house) and public E-Mail systems, to local area network (LAN)-based E-Mail systems, which are growing at a rate of 150% per year. E-Mail is playing a more significant role in business applications. Commercial electronic mail systems appears to be emerging at the leading edge of a trend towards inter-corporate electronic mail and will form a key part of the electronic data exchange. Five to 8% of E-Mail is sent externally to other companies and this is predicted to increase substantially as more companies wish to establish direct links with their business partners, suppliers and customer. Larger companies are increasingly looking to X.400-based systems, which address tying electronic data interchange into internal mail systems. Domain networks like the Internet and UUCP are growing and may emerge as national and international E-Mail backbones.

## CONCLUSION

Although not as active as it once was, the PC-to-mainframe communications market is still important to the growing number of companies that want access to information and applications residing on mainframes or minicomputers. Many computer companies however, unable to compete with the extensive product lines of major vendors, have found a niche market in micro-to-minicomputer links or Macintosh-to-host connectivity products. Although product-purpose is identical, the market strategy differs, such as modular versus complete solutions, each having its advantages, depending on the knowledge of the user. Businesses will focus on technological applications for two levels: the large computers to handle the increased volume of data and decentralized processing units in order to permit the shifting of the business closer to the points of service. Clients will want an amalgam of well-accepted PC LAN-based components, such as Windows, Windows applications, a solid but simple E-Mail with good directory services and X.400 gateways. The challenge is to keep informed on where the technology is going in five to 10 years down the road. Technology is important. But how to implement it is the key to success in networking.

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# A Computer Program which Uses an Expert Systems Approach to Identifying Minerals

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**ABSTRACT**
This paper describes a mineral identification program which utilises a shell system for creating expert systems of a classification nature. It has been specifically tailored to three subdomains, these being identification of minerals in: hand specimens, thin sections of rocks, and polished sections of rocks. The program has facilities for building new expert systems and amending existing expert systems. The expert systems created use inexact reasoning, and thus can handle both missing and inaccurate data. Explanation and help facilities are also available.

**Key words:** Computer assisted instruction; geology teaching; mineralogy and crystallography.

### Introduction

We have developed an "expert system" designed to act as an advisor for the identification of minerals. The system is called *MICA* (Mineral Identification by Computer Assistance) (see Hart, 1986a) and can be used as an aid by students and teachers for mineral identification in hand specimen or when using a petrographic microscope.

The system has the following features:

(a) a limited subject domain (identifying minerals);
(b) the ability to handle both erroneous and missing data;
(c) help and explanation facilities;
(d) a facility for checking the appropriateness of entered values;
(e) a facility to allow a system manager to expand the data base by adding further properties and minerals;
(f) a facility for asking which tests should be applied next to help in the identification.

These features allow the system to be classified as an expert system (Anonymous, 1985).

Other geologically based expert systems include the *Dipmeter Advisor System* (Smith and Baker, 1983), *Prospector* (Duda and others, 1979; Duda and Gaschnig, 1981; Gaschnig, 1982; Campbell and others, 1981), and *LITHO* (Bonnet and Dahan, 1983). All of these systems are related to prospecting.

Smith and Leibovitz (1986) have published details on a mineral data base and computer program for mineral identification called *MINIDENT*. Their system utilizes a large number of mineral properties including composition, optical properties, symmetry, cell dimensions, density, hardness and x-ray diffraction data, and is designed more for high level use by professional mineralogists. The system described here differs from *MINIDENT* in that it utilises properties readily observed in hand specimen or under the petrographic microscope, and is designed more as a teaching aid for student use.

### Defining the Problem

The main aim of the system is to provide a short list of minerals which fit a description or list of properties for an unknown mineral. A further aim is to advise the user which tests to carry out to shorten the list.

The problem of identifying minerals is basically one of classification. Minerals have a finite number of characteristics which can be used in their identification, and the problem is theoretically simple. It is made more complex when the data entered are either incomplete or inaccurate. Some properties may also be very similar, and the system must be able to cope with users who cannot distinguish subtle differences in values, or who are not aware of terms that more accurately describe particular qualitative properties.

For the operation of the system, mineral properties can be divided into two groups: (1) properties which consist of discrete values and which are normally described by a single word or a phrase (for example, in hand specimen: lustre, colour, streak, form, crystal system, whether the mineral is magnetic, and so forth); and (2) properties which can be expressed with numeric values (for example, hardness and specific gravity).

### How the System Identifies Minerals

Kerr (1959) claims that much wasted time and effort in identifying minerals can be avoided if a systematic approach is adopted. The *MICA* system has been designed to follow a systematic logic routine (Figure 1). Properties will always be tested in the same order. In general this will be the order in which they were entered onto the data base, but this can be changed if desirable.

In practice the system:

(a) asks the user to list all observable properties (in a sequence commonly used in mineral identification);
(b) creates a list of all minerals it knows about;
(c) assigns each mineral an initial score of 20;
(d) asks the user to enter values for each property;
(e) checks the value entered against all values on the data base for each mineral;
(f) if a mismatch occurs, deducts the value associated with a property from the score for that mineral;
(g) deletes minerals with a score of zero or less;
(h) presents a list of most probable minerals (from most likely to least likely) with their remaining score as a value out of 20.

Once the system has given its answers, the user can ask it how it arrived at its score for a particular mineral. The user can also ask which tests should be performed next (in practice these will be the tests which enable the top three minerals to be distinguished from each other).

### Special Cases -- Partial Mismatches

For mismatches of quantitative measurements, a sliding scale, similar to that used in fuzzy logic (Zadeh, 1965; Gains, 1976; Negoita, 1985), is used. For example, if a user estimated the specific gravity of galena to be 8.0 (whereas, galena's actual specific gravity ranges from 7.4 to 7.6 (Dana, 1932)), this would be an excusable mistake and consequently would be

## Expert Systems Approach to Identifying Minerals

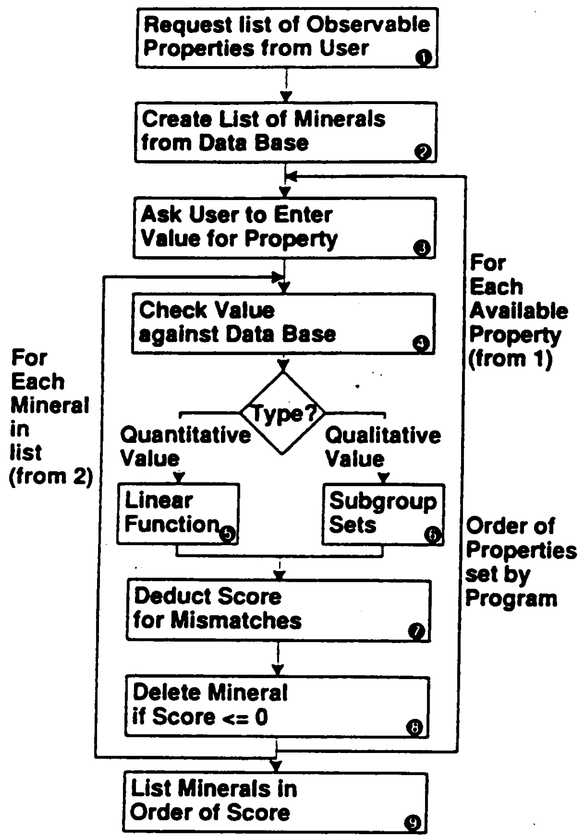


**Figure 1. Basic sequence of steps used by MICA to identify minerals.**

given a higher weight (a lower score subtracted) than a less excusable estimate such as estimating galena's specific gravity to be 10.5. Score adjustment is made using a linear function. The program *PROSPECTOR* (Duda and Gaschnig, 1981) employs a similar principle but uses a non-linear function.

For qualitative properties, values are divided into sets of subgroups of similar values, and each subgroup is given a score. The system locates the lowest scored subgroup containing both the entered property value and the data base value, and subtracts this score from the total mineral score. For example, many observers may not be able to distinguish between a vitreous and adamantine lustre, so these values are included in a low-score subgroup. Consider quartz, which has a vitreous lustre. If the lustre is given as adamantine then it is a more excusable mistake than a lustre of metallic, and a lower score would be subtracted for adamantine than for metallic. (Metallic only occurs with vitreous in a high-score subgroup, as these values are unlikely to be confused.)

### Knowledge Base

The knowledge base, like that of many other expert systems (for example *GEM* (Davis and Nanninga, 1985)), has two parts: factual data and knowledge about this data.

Traditional expert systems have presented knowledge about data as production rules (Quinlan, 1980; Waterman, 1979). However, more recently other methods such as frames (Aikins, 1983; Mylopoulos, 1981; Fikes, 1981), table-driven rules (Pasik and Schor, 1984), and knowledge areas (Geogeff and Bonollo, 1983) (containing procedural information), have been used. The approach taken here is to have a series of attributes (mineral properties), each of which is defined by a set of higher-level attributes (attributes of these properties), descriptions, and "legal values." The higher-level attributes consist of both "housekeeping" functions (such as property name, name of file where data are stored, number of decimal places stored on the data base, question to ask the user when obtaining a value for this property), and knowledge used in determining the correct mineral (for example, processing algorithm, dependency, and score associated with the property). The descriptions and "legal values" are kept in a dictionary which is separate from the storage of other attributes. The dictionary serves two purposes: first, to validate data entered by the user, and second, to provide descriptions for the help facility.

### Knowledge Acquisition

The shell editor allows the system manager to create a new knowledge base for a different domain. In this case the editor takes the system manager through a step-by-step process ensuring that all the information that the system needs (including descriptions) is entered. This information includes all properties and all minerals to be used in the new domain.

Once a new data base has been created, any part of it can be amended. Amending descriptions, scores, or adding new legal values for a property, adding aliases for a value, or adding groupings of values only affects the dictionary entries. If a new property is added, then the system manager must enter the following:

(1) a description of the property;
(2) each legal value for that property and its description (or its minimum and maximum values);
(3) a score for that property;
(4) the value of that property for each mineral on the data base.

If a new mineral is added, then the system manager is prompted to enter in its formula as well as the value for every property appropriate to that mineral.

### Implementation

The current version of *MICA* (Version 2) was developed in *UNSW Prolog* on a SUN workstation, under the UNIX operating system, and using one megabyte of memory. Currently under version 2, two demonstration data bases have been set up. The first has 92 minerals and 12 properties for identification of minerals in hand specimen.The second uses 38 minerals and 9 properties for microscopic analysis of minerals in thin section. Both data bases can be expanded to approximately 200 minerals and the program is designed to incorporate a data base for the identification of minerals in polished section using reflected-light microscopy.

The system uses a minimum of 254k bytes of memory. The amount of memory used during a terminal session is dependent on how much processing is done, but an average session is likely to use a total of 500k bytes of memory. (Supplying data for all 12 hand specimen properties in the data base used 428k bytes of memory and took four minutes to arrive at the answers.) The slowness is partly due to the fact that the system uses an interpretive version of Prolog. Memory requirements are affected to some extent by the inefficiency of the system's garbage collector.

### Results

In addition to extensive checking by the authors, the system was tested for both hand-specimen and thin-section identification of unknown minerals using three groups of students from different levels of the undergraduate-degree-level geology course at the Canberra College of Advanced Education. The success of the system during testing depended on the ability

## Expert Systems Approach to Identifying Minerals

| MINERAL | MICA SCORE* (POSN)# | MINERAL WITH TOP SCORE |
|---|---|---|
| **Group 1: First year (hand specimen) (11)** | | |
| Hornblende | 13 | (=2)Andalusite (16) |
| Orthoclase | 5 | (14)Calcite (13) |
| Hematite | 2 | (2)Uraninite (6) |
| Hornblende | 8 | (=4)Turquoise (19) |
| Chlorite | 20 | (1)Chlorite (20) |
| Garnet | 11 | (10)Opal (18) |
| Hornblende | 9 | (3)Actinolite |
| Orthoclase | 20 | (1)Feldspar (20) |
| Fluorite | 13 | (=1)Calcite, Fluorite (13) |
| Orthoclase | 14 | (2)Andalusite (15) |
| Fluorite | 13 | (1)Fluorite (13) |
| **Group 2: Second year (thin section) (7)** | | |
| Augite | 3 | (12)Staurolite (15) |
| Olivine | 18 | (2)Pigeonite (20) |
| Kyanite | 17 | (1)Kyanite (17) |
| Hornblende | 11 | (1)Hornblende (11) |
| Tremolite | 11 | (1)Actinolite** |
| Garnet | 17 | (=1)Sphalerite, garnet |
| Andalusite | 11 | (=3)Hornblende (14) |
| **Group 3: Third year (thin section) (6)** | | |
| Serpentine | 9 | (3)Muscovite (14) |
| Plagioclase | 7 | (=1)Andalusite, feldspar |
| Prehnite | 9 | (1)Prehnite (9) |
| Biotite | 17 | (1)Biotite (17) |
| Plagioclase | 18 | (1)Feldspar (18) |
| Augite | 20 | (1)Augite (20) |

**Table 1. Results of student trials of MICA. Note: *top score is 20 (high score accurately described, low score inaccurately described); #if several minerals have the same score = placed in front of position: **actinolite and tremolite are identical in thin section.**

of the observers to enter reasonably accurate data, but even so, it was able to cope with significant errors in a number of the total properties. Results of these tests are summarized in Table 1 and indicate that in most cases *MICA* is able to place the correct mineral amongst its top six suggested answers, even given inexperienced observers. In each test the student was also asked to identify the mineral after describing its properties. Overall, *MICA* performed better than the students, particularly at the first- and second-year level, commonly giving a correct result for the same properties, for which a student misidentified the mineral. This probably reflects the weaker knowledge base of the inexperienced observer.

### Conclusion

The demonstration data bases have shown that the *MICA* system can be a useful aid for identifying minerals. The shell aspects of the system enable it to be used for several different subdomains (for example, hand specimen, thin section, and polished section) within the overall domain of mineral identification. It could also be extended to include a data base of chemical analyses for rapid mineral determination from electron microprobe data. The ability to add or delete properties enables an individual laboratory to tailor the system to its own requirements. As minerals are easily added or deleted, the data base can be gradually built up over a period of time. The demonstration data bases have also illustrated that it is easy to correct mistakes on the data base once they are discovered.

It is expected that in full scale operation there will be a settling-down period of about six months while errors in the data base are found and corrected. During this settling-down period scores will also need to be adjusted so as to give optimal results. Fine tuning and adjustments to the grouping of easily confused values would also greatly improve the reliability of the results.

The system has considerable merit as a teaching aid in that it can reduce the time spent checking through reference lists of mineral properties. This is often a frustrating exercise for students, particularly at the initial learning stage. The facility for interrogation of the system also allows the user to check which observed properties have affected a particular result and helps familiarise the user with diagnostic mineral properties.

The system is currently being incorporated into the second- and third-year geology programs at the Canberra College of Advanced Education.

### Acknowledgements

We thank those students who so willingly co-operated in the testing of the system.

### Availability of the MICA System

Copies of the *MICA* system, together with a user's manual (Hart, 1986b) and a system manager's manual (Hart, 1986c), are available from the Canberra College of Advanced Education at nominal cost determined by the C.C.A.E. These are available on half-inch 1600 bpi tape, using the "tar" and "cpio" formats of Unix. Requests should be directed to Dr. Jan Newmarch at the College address.

Before this system can be used, *UNSW PROLOG* must be purchased from Dr. C. Sammut, Department of Computer Science, University of New South Wales, Kensington, N.S.W., Australia (approximate cost A$150).

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# DATA MODELLING CONCEPTS

## OUTLINE:

- Introduction
- Philosophy of Data Modelling
- Why Data Model?
- Levels of Models and Terminology
- Modelling Data Entities and Relationships
- Keys
- Data Dictionary
- Referential Integrity
- Normalization
- Physical Modelling/ Denormalization
- Practical Application

**Lecture by:** L. de Groot, L. Jones
18 November 1993

**Reference:** Technology, Engineering & Computing (TEC)
University of Victoria

# INTRODUCTION

The objective of this lecture is to develop an appreciation of what is involved in preparing data models. This will help you to prepare initial data models for your own area of the enterprise and to participate effectively in later reviews of the overall data model. While the task of preparing the actual data model for the enterprise is left to the expert, the assistance of knowledgeable users is essential.

# PHILOSOPHY OF DATA MODELLING

Data modelling is an art, not a science. While there are rules which need to be followed, most complex models have more than one correct representation.

a) Data tends to remain stable over time.
Processes (applications) tend to change over time.

b) Application development should therefore be data driven.

c) All users with a stake in the data MUST be actively involved in the modelling process.
   - Need to know ALL data requirements.
   - Need to buy into the model - must understand it - use of appropriate jargon makes it meaningful.

d) Data is and should be treated as an enterprise resource.

e) Data should be modelled independent of the applications which use it.

f) Proper data management requires planning and design.

g) Data should be managed by a unit with responsibility and authority.

h) Proper data management requires senior management commitment.

i) Database technology is used for controlled sharing of data.

# WHY DATA MODEL?

## a) Communication Vehicle

- A data model is used to communicate an understanding of the meaning of the business data and the business terms.
- Make sure you TALK and LISTEN to people. You are attempting to model the business - not your interpretation of it or of what you think it should be.
- Use the business jargon and acronyms where appropriate.
- Ensure the users understand and approve of the data model (best way is to use their terminology wherever you can).

## b) Data Quality

- Data quality is a serious issue in many organizations. The definition of data is not consistent across business areas; different areas may have different coding for the same item OR they may use the same name for something which they believe is the same, but will have slightly different definitions of the data.
- For example: Date Received - in the department? in the mail room?, etc.
- One of the advantages of a data model is that is should provide consistent definitions of the data used throughout the organization.

## c) Data Integrity

- Means that all statements of fact must be consistent. If there are redundant definitions, then they must be consistent.
- Redundancy occurs when the same data is stored in multiple locations. The ability to keep all copies current and synchronized becomes more difficult as the number of copies increase.
- One of the major advantages of a normalized data model is increased data integrity due to reduced redundancies, and, therefore, simpler updating.

## d) Data Independence

- A data model is used to separate how the data is accessed from how it is physically stored. This allows greater flexibility in handling database growth, changes to the physical storage of the data, new applications, and isolates changes to the business functions.
- We want to avoid creating fragmented systems, each with their own set of data, and each unable to communicate with the others.

## e) Data Flexibility

- Data should be defined once and once properly. If the data model is defined to support a particular application, then other applications may not be able to easily use the data and may have to go through complex conversions.
- By modelling the data independently of any application, the subsequent use of the data tends to be more flexible since it is modelled in a more generic way, rather than being tied to the way a specific application views the data. Eg. fancy query tools.

# LEVELS OF MODELS

There are three levels of models - conceptual, logical and physical.

**a) Conceptual Model -**

- It is a ***high-level model*** showing the major ***business entities and their relationships.***
- Meant to show non-technical staff an overview of the data.
- This model contains the business entities and their inter-relationships.

**b) Logical Model**

- The logical model shows the entities at a lower, more ***detailed level.*** It contains the ***business data entities and their inter-relationships.*** This model is independent of the physical implementation.

**c) Physical Model**

- The physical model contains the ***database design***; as such it is ***dependent on the actual database management*** (or file system) that will be used. It contains changes made to the logical model for ***performance*** or other technical issues. It is the model which will be implemented.

# TERMINOLOGY

## a) Entity

- An entity is something of interest to the enterprise.
- In database modelling, the term entity is used for those items about which we collect and store data. It can be a person, place, thing, event or concept. It can be a real physical item such as a machine or an actual person, or it can be an abstract concept such as a job title or a customer account.
- Entity names are nouns, are always in the singular form (Eg. OCCURRENCE NOT OCCURRENCES), and may be composed of multiple words. The name should convey meaning, and should use business terms wherever possible.
- Although an entity is identified by a single name it may have multiple aliases. These aliases should be documented in the Data Dictionary. It is important to identify and document aliases, otherwise you may develop a data model which contains an entity twice.

## b) Entity Occurrence

- Each entity is given a unique name. Each instance of an entity is referred to as an entity occurrence.

## c) Attribute

- An attribute is defined as a characteristic, property or description.
- An entity is characterized by attributes which define and describe it. For example: a mineral occurrence has a name, number, production year, etc. Each of these items is an attribute of the entity MINERAL OCCURRENCE.
- Other terms often used in place of attribute are data element, data field, field and data item.
- An attribute is identified by a single name, but it may have multiple aliases. Again, these aliases should be documented in the Data Dictionary.

## d) Attribute Value

- An actual item of data represented by an attribute is referred to as an attribute value.
- MINERAL OCCURRENCE NAME could have values of Skookum, Hollyrood, Winfield, etc. Each instance of a data value is referred to as a data occurrence. For example: if the mineral occurrence names given above form a list, then the second data occurrence of the attribute MINERAL OCCURRENCE NAME has a data value of Hollyrood.
- Frequently, an entity has a number of attributes to describe it. When an attribute uniquely defines one occurrence of an entity, the attribute is called a primary attribute, or simply, key.
- All attributes that are not primary attributes are referred to as secondary attributes. In a data base, every entity must have a primary attribute. It may have zero, one, or many secondary attributes.

An entity called MINERAL OCCURRENCE is shown in the following figure as a table to illustrate the terms described in this section. This figure is often referred to as a Data Table. Such tables form the basis of the data model for a relational DBMS.

## Terminology

Primary Key

Secondary Attribute

Attribute Value

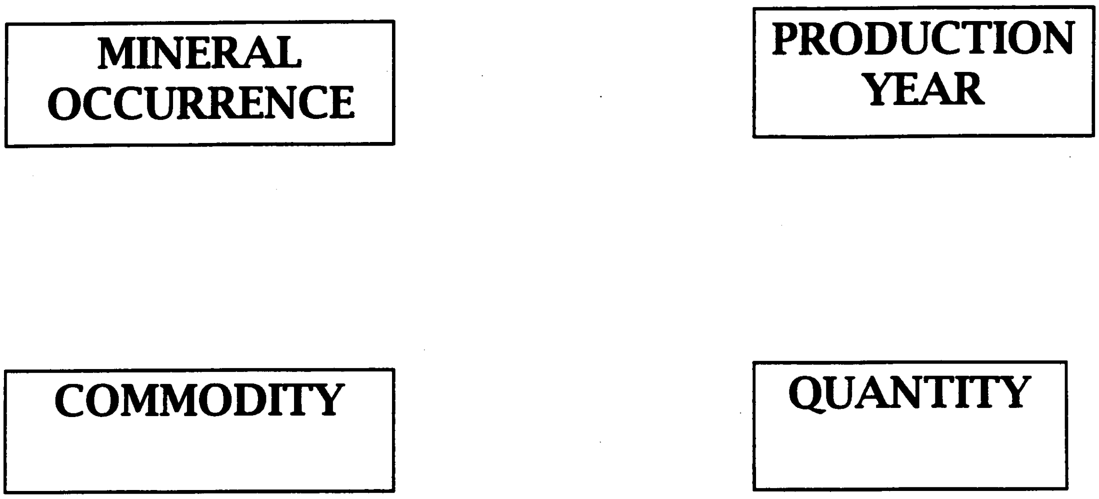
| MIN. OCCUR. NO. | MIN. OCCUR. NAME 1 | MIN. OCCUR NAME 2 | PRODUCTION YEAR | COMMODITY |
|---|---|---|---|---|
| | | | | |
| 123 | Christopher | Anthony | 1978 | Gold |
| 742 | Sensor | | 1979 | Gold |
| 925 | Hollyrood | Bedard | 1983 | Silver |
| 1892 | Damask | | 1989 | Lead |

Primary Key Value

Entity Occurrence

**A table to represent the attributes and values of the entity MINERAL OCCURRENCE.**

# MODELLING DATA ENTITIES



## MODELLING DATA ENTITIES

In modelling data, we simply draw a box to represent each different entity and then write the name of the entity into the box. This is referred to as an entity chart. Each box on this diagram has a primary key and may have a number of secondary attributes. These are not shown on an entity chart.

## MODELLING ENTITY RELATIONSHIPS

To become a useful model, the diagram must show the relationships that exist among the data entities. Relationships represent the business rules and policies of the organization.

Relationship names are verbs, and may be composed of multiple words. The name should convey meaning, and should use business terms wherever possible.

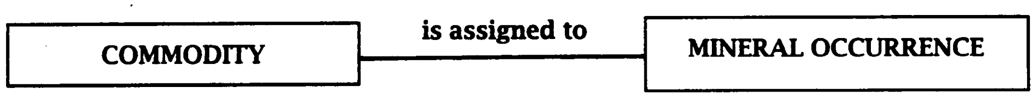
This section defines the types of relationships that can occur and shows how they can be represented on a diagram.

To indicate that a relationship exists between two data entities, a line is drawn to connect them and the name (description) of the relationship is placed over the line. For example:

**Entities and relationships are identified by phrases like:**

*NOUN VERB NOUN or ENTITY RELATIONSHIP ENTITY*

**Some examples of these are:**




- *an AIRPLANE has ENGINES*
- *a MINERAL OCCURRENCE may have many COMMODITIES*
- *an EMPLOYEE may be a GEOLOGIST*
- *a CLERK takes RESERVATIONS on ROOMS for GUESTS*

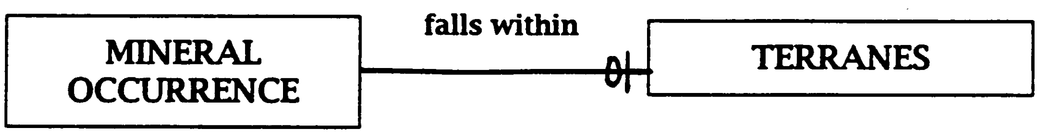
# TYPES OF ENTITY RELATIONSHIPS - ONE WAY

## One-and only-one:

- a RESERVATION reserves (exactly) one ROOM

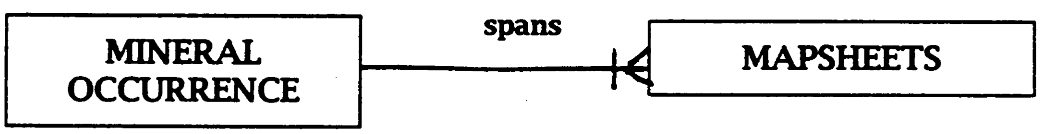

## Zero-or-one:

- a MINERAL OCCURRENCE may fall within TERRANES



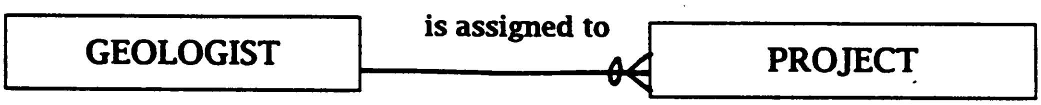

## One-or-many:

- a MINERAL OCCURRENCE may span several MAPSHEETS




## Zero-or-many:

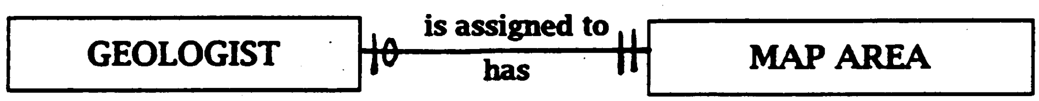
- a GEOLOGIST may be assigned to multiple PROJECTS



# TYPES OF ENTITY RELATIONSHIPS - TWO WAY

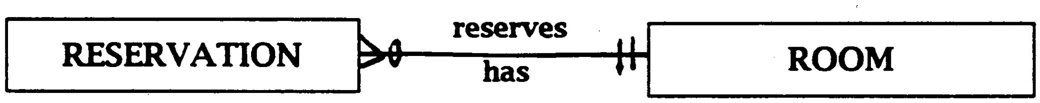
## One-to-one:

- a GEOLOGIST is assigned to one MAP AREA
- a MAP AREA has only one GEOLOGIST

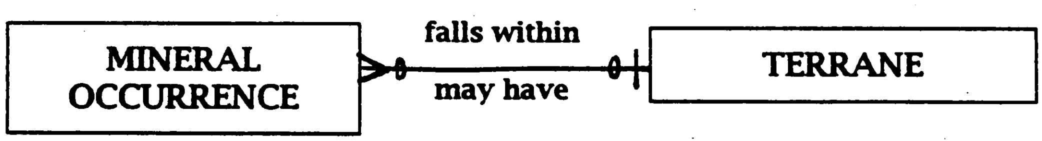



## One-to-many:

- a RESERVATION is for exactly one ROOM
- a ROOM may have many RESERVATION




- a MINERAL OCCURRENCE may fall within TERRANE
- a TERRANE may have several MINERAL OCCURRENCES



# KEYS

## Primary Key

- One or more attributes that uniquely identify an entity occurrence.
- Every entity must have a primary key.
- Any attributes, or combination of attributes, which can be used to uniquely identify an entity occurrence are called **Candidate Keys**. Any of these could be used as the Primary Key for the entity. One of these is chosen as the Primary Key. The selection of the Primary Key should take into account the stability of the key, that is you want a Primary Key whose value is not likely to change once the entity occurrence has been created.

## Composite Key

- In those cases, where no single attribute meets the needs of a primary key, two or more attributes are combined together to form the necessary primary key. Such combined keys are called composite keys, or compound keys.

- For example: MINFILE NO. 092HNE004

## Surrogate Key

- A surrogate key is an artificial attribute created to ensure a unique primary key. Sometimes composite keys can be awkward to use, and expensive to use for foreign keys; other times the primary key may be subject to change. In these cases surrogate keys, commonly called Skeys, can be introduced. For example: an employee number is really a surrogate key introduced by the business itself to create uniqueness.
- Surrogate keys have a place, but they should be used with caution. They do complicate the data model and can make data access more difficult. This is especially true for end users who are using ad hoc query tools.

## Intelligent Key/Business Key

- An intelligent key is one which has meaning to the user. It may have meaning in the key value itself (Eg. a client's name) or it may have embedded meaning (Eg. client numbers which start with the digit 1 are large preferred customers).

## Blind Key

- A blind key is one which is never seen by the user. It is stored internally in the database, and is referenced by programs, but never by the user.

# KEYS (cont.)

## Foreign Key

- When the Primary Key of one entity is contained in another entity to establish a relationship between the two entities, it is called a Foreign Key.
- Foreign Keys enable the implementation of relationships in a relational data model. While they are not actually part of a logical data model, they are commonly included in the logical model for completeness.
- As an example, suppose you have two tables with the following attributes:

| | |
|---|---|
| Employee | (Emp-ID, Emp-Name, Emp-Add, Dept-No., etc.) |
| Department | (Dept-No., Dept-Name, etc.) |

  - The Primary Key of the Employee is Emp-ID.
  - The Primary Key of the Department is Dept-No.

- The attribute Dept-No in the Employee table is a Foreign Key to the Department table since it identifies the relationship between the two tables (i.e. it identifies the department an employee works in).

# RESOLVING MANY-TO-MANY RELATIONSHIPS

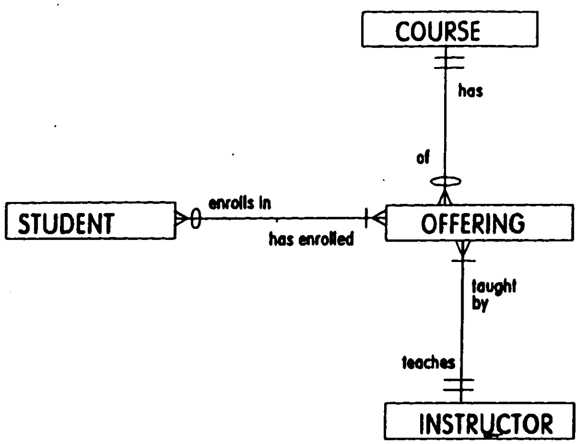
- Many-to-many relationships are not supported by most Database Management Systems.
- While many-to-many relationships are acceptable in conceptual data models, and high level logical models, they are generally removed prior to the completion of the logical data model.
- This can be accomplished by performing the **normalization** process, which will be covered later.

# DRAWING THE DATA MODEL

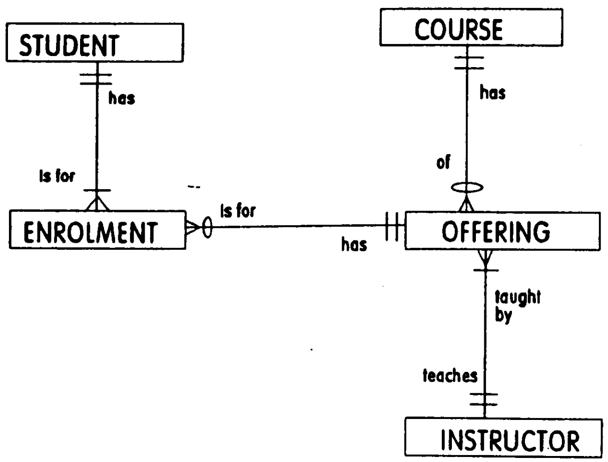
- There are a number of different notations which can be used to draw data models, and a number of tools and formats which can be used to document the definitions behind the diagram.
- A data model may consist of two parts:

  1. An entity chart that shows all the entities involved and the relationships among them.
  2. A set of data tables, one for each entity on the entity chart, that shows the attributes of each entity.

**Data Model**




In the initial data model above, there is a many-to-many relationship between STUDENT and OFFERING. This relationship is converted into an associative entity named ENROLLMENT, producing the following data model:




**Data Tables**

COURSE

| Course-No | Course-Descr |
|---|---|

OFFERING

| Course-No | Year | Term | Fee | Start-Date | Start-Time | End-Date | End-Time | Location | Inst-Id |
|---|---|---|---|---|---|---|---|---|---|

ENROLMENT

| Student-No | Course-No | Year | Term | Grade |
|---|---|---|---|---|

STUDENT

| Student-No | Stu-Name | Stu-Address | Stu-Phone |
|---|---|---|---|

INSTRUCTOR

| Inst-Id | Inst-Name | Inst-Addr | Inst-Phone |
|---|---|---|---|

# DATA DICTIONARY

A data dictionary stores information about the data (metadata = data about data).

A data model is composed of both the entity-relationship diagram (data model diagram), which gives a pictorial representation of the data and its relationships, and a data dictionary which describes the entities, attributes, and relationships shown in the entity-relationship diagram. A data model is not complete if it does not include the data dictionary definitions of each and every entity, attribute, and relationship.

**A data dictionary can be used to answer the following types of questions:**

- What is it?
- What is its identifier (primary key)?
- Where is it?
- Where does it come from?
- Who owns it? Who is responsible?
- Who has authority to access it?
- How does it relate to other data? What are the relationships?
- What are its characteristics? How do I describe it?
- What are its allowable values?
- What aliases does it have?
- Is it mandatory or optional?

**There are two types of data dictionary:**

1. An **Active dictionary** is integrated with tools. When something is changed in the dictionary, it is automatically reflected in the programs, screens, et cetera; when something is changed in a table, it is automatically reflected in the dictionary.

2. A **Passive dictionary** is not integrated with tools. In this case the dictionary is really a documentation tool, and all changes must be manually synchronized between the programs, tables, screens, et cetera, and the dictionary.

# REFERENTIAL INTEGRITY

## As an example, suppose you have two tables with the following attributes:

*Employee* *(Emp-ID, Emp-Name, Emp-Add, Dept-No., etc.)*
*Department* *(Dept-No., Dept-Name, etc.)*

The Primary Key of the Employee is Emp-ID.

The Primary Key of the Department is Dept-No.

The attribute Dept-No in the Employee table is a Foreign Key to the Department table since it identifies the relationship between the two tables (i.e. it identifies the department an employee works in).

# REFERENTIAL INTEGRITY

## Definition

Referential Integrity (R.I.) allows users to define relationships between attribute values in different entities. Simply stated, referential integrity states that a reference in one entity, to another entity, must be valid.

If an entity contains a foreign key to another entity (parent), then there must exist a row in the parent table for each occurring value of the foreign key.

## Need for Nulls

Relational DBMS support the concept of a null. A null is the absence of a value. It is distinct from a blank value for a character string, or a zero value for a numeric field, or a zero length string for a variable length field.

Nulls are required to implement Referential Integrity.

# PREPARING A DATA MODEL FOR THE LARGE ENTERPRISE

Producing the logical data model for a large enterprise is time consuming and difficult.

**Historically, there were two basic approaches:**

## Top Down Modelling:

- start at enterprise level,
- identify major entities,
- break it down into subject areas and work on business functions,
- then model at the application level.

The major problem with top down modelling is that it takes too long. Since each level of the model is completed before attempting to add more detail, the model is not useful until it is completed. Program areas cannot wait for the corporate model to be completed, so work starts on projects without it.

## Bottom Up Modelling:

- start by identifying the business transactions,
- identify attributes,
- determine entities based on user views,
- normalize and synthesize,
- build relationships,
- merge with other models.

The major problem with bottom up modelling is that it takes too long. Note that bottom up modelling starts by identifying the attributes, and then grouping the attributes into entities. This can be a slow process. Also, since you are focusing on the operational data, you often miss the real strategic business rules.

## Best Approach

A better approach is to do a high level corporate model, then do business area models at the detailed level.

An initial conceptual model for the whole enterprise is created which shows only the main business entities and their relationships. Such a conceptual model can serve as a framework into which the local data models can be integrated to develop the final corporate data model.

An advantage of this approach is that the conceptual model can be presented to senior management early in the data base development process. It shows how the enterprise data can be integrated without waiting for the detailed corporate data model to be prepared. Short term results are important to maintain the required support of senior management.

A disadvantage of the initial conceptual model is that it requires an understanding of the overall operation of the enterprise. It may be difficult to find a person who understands both data administration and the entire operation of the enterprise.

Scope is critical. By ensuring that the scope of the business area models is reasonable, and always ensuring that the models are staying within their scope, the models can be delivered in a reasonable amount of time. If the data models are not completed in a reasonable amount of time then application development will not be able to wait for the completion of the model and the applications will be built without the benefits of the data model.

# BASIC STEPS OF DATA MODELLING

1. Determine scope of model
2. Determine business rules
3. Identify entities
4. Identify relationships between entities
5. Identify attributes
6. Determine primary key
7. Determine foreign keys
8. Identify constraints
9. Validate model

Iterate steps 2 through 9 adding more level of detail

10. Review and user sign-off

Keep asking questions. Does it make sense? Don't make assumptions! Include user involvement continually!

# NORMALIZATION

The success in the use of the data base depends upon how well the data model is prepared. It is not difficult to test the proposed model to see if the data required by, and generated by, the operational activities can be provided by, and accepted by, the data base. If data cannot be generated then the data model is modified until the data can be generated.

In the same manner the data model is tested to ensure it can provide the data required to provide the various management reports. If necessary, the model is changed so that it does provide the reports.

One difficulty arises in attempting to make sure that the data base can support ad hoc requests which cannot be predefined. Another difficulty is how to support a wide range of future changes which again cannot be predefined.

One way of solving these difficulties is to undertake a review of the data model to determine whether or not any secondary attribute is likely to become an entity at some time in the future. The change from a secondary attribute to an entity can cause exhaustive restructuring of the data base and extensive modifications to the programs that use the altered data item. It is best to define such secondary attributes as entities initially to avoid such problems. Sometimes, however, the cost is deemed to be too high relative to the chance that the secondary attribute will be defined as an entity.

A second means of designing the data model to better meet data model objectives is to Normalize the data. To normalize a data model is to design it so that it conforms to a set of predefined rules.

These rules were originally developed to aid in designing a data model for use with a hierarchical DBMS. Since the development of normalization, it has been recognized that the same approach can be used on any conceptual data model. That is, it can be used to design the data model for more flexibility regardless of what DBMS is used in implementing the data base. Due to the limitations of some DBMS, some of the flexibility in the normalized conceptual model may have to be sacrificed in order to implement the data base in a practical manner.

# NORMALIZATION (cont.)

## The steps in normalizing a data model are as follows:

1. Identify all the data items and the relationships among them.

2. Develop the entity chart and the corresponding data tables and the data dictionary definitions for each operation - (these are referred to as the local data models).

3. Check to see that the data model will support the data requirements and modify it as necessary.

4. Apply the normalization rules to each of the entity tables.

The result is a set of normalized data tables which together with the entity chart make up the normalized, conceptual data model.

## The normal form rules are summarized as follows:

| | |
|---|---|
| 1NF | Remove repeating groups |
| 2NF | Remove partial-key dependencies |
| 3NF | Remove non-key (transitive) dependencies |
| 4NF | Remove multi-valued independent attributes |
| 5NF | Retain multi-valued dependent attributes |

# APPLYING THE RULES OF NORMALIZATION

The purpose of normalization is to eliminate the possibility of update anomalies. The technique of normalization is to apply a set of rules to the data model.

The normalization process consists of using a set of rules to test the data model. If the data model passes the first rule, then the data model is said to be in "first normal form" or a "first level" data model. If the data model fits the first and second rules, then the data model is said to be in "second normal form" or at the "second level". There are five rules and therefore five levels of normalization of a data model.

The usual method of expressing normalization is to say that the data table or the data model is in "second normal form", written as 2NF. Or you could be asked to "draw the data model in third normal form (3NF).

Although five levels of normalization have been defined, most data models are taken to third normal form; fourth and fifth normal form occur infrequently and are not significant to this course.

# NORMALIZATION SUMMARY

## Normalization can be thought of as:

*One fact in one place*

## One phrase which is often used to describe third normal form is:

*The key, the whole key, and nothing but the key*

The steps to be taken in order to normalize a data table to the 3 NF are summarized in the figure below.

All conceptual files

Change all non flat data tables into flat data tables by eliminating all repeating groups.

1NF

For data tables with compound keys ensure that all secondary attributes are dependent on the whole key and not just part of it.

2NF

Change all data tables in which a secondary attribute is dependent on another secondary attribute.
i.e. ensure all secondary attributes are independent of each other.

3NF

# PHYSICAL DATA MODELLING

## Denormalization

Denormalization is the process of removing levels of normalization when moving from the logical data model to the physical implementation.

This is done to improve performance in time-critical applications, or to reduce resource requirements, either disk storage, or I/O. It is occasionally done to make the physical model easier to use for programs and ad-hoc query tools.

While denormalization can have benefits, it does reduce the flexibility of the data model which was produced by normalization.

## The proper method of denormalization is to:

1. Take the data model to 3NF
2. Selectively denormalize based on performance requirements
3. Document why

When subsequent changes are made to the data model, they should always start with the 3NF logical data model, not with the denormalized physical implementation model.

# MINFILE/pc 4.0 DATABASE STRUCTURE

## ENTITY FILES:

| File | Field | Size | Alias |
|---|---|---|---|
| E01 | MINFILNO | 9 | MINFILE_NUMBER |
| | LAT_DEG | 2 | LATITUDE_DEG |
| | LAT_MIN | 2 | LATITUDE_MIN |
| | LAT_SEC | 2 | LATITUDE_SEC |
| | LONG_DEG | 3 | LONGITUDE_DEG |
| | LONG_MIN | 2 | LONGITUDE_MIN |
| | LONG_SEC | 2 | LONGITUDE_SEC |
| | UTM_ZONE | 2 | UTM_ZONE |
| | UTM_EAST | 6 | UTM_EASTING |
| | UTM_NORT | 7 | UTM_NORTHING |
| | ELEV | 4 | ELEVATION |
| | LOC_ACC | 1 | DEPOSIT_LOCATION_ACCURACY |
| | DEPSIZEL | 4 | DEP_SIZE_L |
| | DEPSIZEB | 4 | DEP_SIZE_B |
| | DEPSIZEW | 4 | DEP_SIZE_W |
| | DIP | 3 | DEPOSIT_DIP |
| | STRIKE | 3 | DEPOSIT_STRIKE |
| | PLUNGE | 6 | DEPOSIT_TREND_PLUNGE |
| | NATMINNO | 18 | NAT_MIN_INV_NO |
| | CANMINNO | 6 | CANMINDEX_NUMBER |
| | CODED | 8 | DATE_CODED |
| | REVISED | 8 | DATE_REVISED |
| | GREVISED | 4 | GEOLOGIST_REVISE |
| | FREVISED | 1 | FIELD_REVISED |
| | FCHECKED | 1 | FIELD_CHECKED |
| | GNAME | 4 | GEOLOGIST_NAME |
| | OPENPIT | 1 | OPEN_PIT |
| | UGROUND | 1 | UNDER_GROUND |
| E02 | STATUS_C | 4 | STATUS_TYPE_CODE |
| | STATUS_D | 20 | STATUS_TYPE_DESC |
| | *QMAPSYM* | *15* | *MAP_SYMBOL* |
| | *SYM_LN_TYP* | *2* | *SYMBOL_LINE_TYPE* |
| | *HATCH_PATT* | *2* | *HATCH_PATTERN* |
| E03 | DOMHRK_C | 1 | DOMINANT_HOST_ROCK_CODE |
| | DOMHRK_D | 15 | DOMINANT_HOST_ROCK_DESC |
| E04 | DEPMOD_C | 1 | DEPOSIT_MODIFIER_CODE |
| | DEPMOD_D | 15 | DEPOSIT_MODIFIER_DESC |
| E05 | DEPCHR_C | 2 | DEPOSIT_CHARACTER_CODE |
| | DEPCHR_D | 20 | DEPOSIT_CHARACTER_DESC |
| E06 | DEPSHA_C | 2 | DEPOSIT_SHAPE_TYPE_CODE |
| | DEPSHA_D | 12 | DEPOSIT_SHAPE_TYPE_DESC |
| E07 | DEPCLA_C | 2 | DEPOSIT_CLASSIFICATION_CODE |
| | DEPCLA_D | 15 | DEPOSIT_CLASSIFICATION_DESC |
| E09 | MINDIV_C | 4 | MINING_DIVISION_CODE |
| | MINDIV_D | 15 | MINING_DIVISION_DESC |
| E10 | NTSMAP_C | 7 | NTS_MAPSHEET |
| E11 | BCMAP_C | 7 | BC_MAPSHEET |
| E12 | TECBLT_C | 2 | TECTONIC_BELT_CODE |
| | TECBLT_D | 18 | TECTONIC_BELT_DESC |
| E13 | TERRAN_C | 3 | TERRANE_CODE |
| | TERRAN_D | 30 | TERRANE_DESC |
| E14 | PHYSIO_C | 4 | PHYSIOGRAPHIC_AREA_CODE |
| | PHYSIO_D | 30 | PHYSIOGRAPHIC_AREA_DESC |
| E15 | META_T_C | 1 | METAMORPHIC_TYPE_CODE |
| | META_T_D | 10 | METAMORPHIC_TYPE_DESC |
| E16 | META_G_C | 2 | METAMORPHIC_GRADE_CODE |
| | META_G_D | 15 | METAMORPHIC_GRADE_DESC |
| E17 | META_R_C | 1 | METAMORPHIC_RELATIONSHIP_CODE |
| | META_R_D | 20 | METAMORPHIC_RELATIONSHIP_DESC |

| File | Field | Size | Alias |
|---|---|---|---|
| E18 | YEAR | 4 | YEAR |
| E19 | COMMOD_C | 2 | COMMODITY_CODE |
| | COMMOD_D | 30 | COMMODITY_DESC |
| E20a | MINCLA_C | 1 | MINERALOGY_CLASS_CODE |
| | MINCLA_D | 15 | MINERALOGY_CLASS_DESC |
| E20b | MINERL_C | 4 | MINERAL_CODE |
| | MINERL_D | 20 | MINERAL_DESC |
| E21 | ALTER_C | 4 | ALTERATION_CODE |
| | ALTER_D | 12 | ALTERATION_DESC |
| E22 | DATMET_C | 2 | DATING_METHOD_CODE |
| | DATMET_D | 30 | DATING_METHOD_DESC |
| E23 | STNAME_C | 6 | STRATIGRAPHIC_NAME_CODE |
| | STNAME_D | 30 | STRATIGRAPHIC_NAME_DESC |
| | STINFORM | 1 | STRATIGRAPHIC_NAME_INFORMAL |
| | STIGMETA | 1 | STRATIGRAPHIC_NAME_IG_META |
| | STGROUP | 1 | STRATIGRAPHIC_NAME_GROUP |
| | STFORM | 1 | STRATIGRAPHIC_NAME_FORMATION |
| E24 | ST_AGE_C | 3 | STRATIGRAPHIC_AGE_CODE |
| | ST_AGE_D | 20 | STRATIGRAPHIC_AGE_DESC |
| E25 | ROCK_T_C | 4 | ROCK_TYPE_CODE |
| | ROCK_T_D | 30 | ROCK_TYPE_DESC |
| E26 | ROCK_M_C | 4 | ROCK_MODIFIER_CODE |
| | ROCK_M_D | 30 | ROCK_MODIFIER_DESC |
| E27 | OREZON_C | 5 | ORE_ZONE_CODE |
| | OREZON_D | 30 | ORE_ZONE_DESC |
| E28 | SAMPLE_C | 4 | SAMPLE_TYPE_CODE |
| | SAMPLE_D | 30 | SAMPLE_TYPE_DESC |
| E29 | RESCAT_C | 2 | RESERVE_CATEGORY_CODE |
| | RESCAT_D | 30 | RESERVE_CATEGORY_DESC |
| *E30* | *DEPTYP_C* | *5* | *DEPOSIT_TYPE_CODE* |
| | *DEPTYP_D* | *50* | *DEPOSIT_TYPE_DESC* |
| *E31* | *PROJ_NO* | *7* | *PROJECT_NUMBER* |
| | *PROPERTY* | *30* | *PROPERTY_NAME* |
| | *PROPERTY_2* | *30* | *PROPERTY_NAME2* |
| | *OWNER* | *30* | *OWNER_NAME* |
| | *OWNER_2* | *30* | *OWNER_NAME2* |
| | *OPERATOR* | *30* | *OPERATOR_NAME* |
| | *DIST_SEQNO* | *3* | *DISTRICT_SEQUENCE_NUMBER* |
| | *DIST_MAPNO* | *3* | *DISTRICT_MAP_NUMBER* |
| | *LAT_DEG* | *2* | *LATITUDE_DEGREE* |
| | *LAT_MIN* | *2* | *LATITUDE_MINUTE* |
| | *LAT_SEC* | *2* | *LATITUDE_SECOND* |
| | *LON_DEG* | *3* | *LONGITUDE_DEGREE* |
| | *LON_MIN* | *2* | *LONGITUDE_MINUTE* |
| | *LON_SEC* | *2* | *LONGITUDE_SECOND* |
| | *LOC_ACC* | *1* | *LOCATION_ACCURACY_CODE* |
| | *CR_DATE* | *8* | *CREATED_DATE* |
| | *RV_DATE* | *8* | *REVISED_DATE* |
| | *CHECKED_BY* | *5* | *CHECKED_BY* |
| *E32* | *NOTIC_TYP* | *1* | *NOTICE_TYPE_CODE* |
| | *NOTIC_DESC* | *20* | *NOTICE_TYPE_DESC* |
| *E33* | *PRJTYP_C* | *1* | *PROJECT_TYPE_CODE* |
| | *PRJTYP_D* | *20* | *PROJECT_TYPE_DESC* |
| | *QMAPSYM* | *15* | *MAP_SYMBOL* |
| | *SYM_LN_TYP* | *2* | *SYMBOL_LINE_TYPE* |
| | *HATCH_PATT* | *2* | *HATCH_PATTERN* |
| *E34* | *STAGE_C* | *1* | *MDAP_STAGE_CODE* |
| | *STAGE_D* | *15* | *MDAP_STAGE_DESC* |

# MINFILE/pc 4.0 DATABASE STRUCTURE

## RELATIONSHIP FILES:

| File | Field | Size | Alias |
|---|---|---|---|
| R02 | MINFILNO | 9 | MINFILE_NUMBER |
| | STATUS_C | 4 | STATUS_TYPE_CODE |
| R03 | MINFILNO | 9 | MINFILE_NUMBER |
| | DOMHRK_C | 1 | DOMINANT_HOST_ROCK_CODE |
| R04 | MINFILNO | 9 | MINFILE_NUMBER |
| | DEPMOD_C | 1 | DEPOSIT_MODIFIER_CODE |
| R05 | MINFILNO | 9 | MINFILE_NUMBER |
| | DEPCHR_C | 2 | DEPOSIT_CHARACTER_CODE |
| R06 | MINFILNO | 9 | MINFILE_NUMBER |
| | DEPSHA_C | 2 | DEPOSIT_SHAPE_TYPE_CODE |
| R07 | MINFILNO | 9 | MINFILE_NUMBER |
| | DEPCLA_C | 2 | DEPOSIT_CLASSIFICATION_CODE |
| R08 | MINFILNO | 9 | MINFILE_NUMBER |
| | NAME | 30 | NAME |
| R09 | MINFILNO | 9 | MINFILE_NUMBER |
| | MINDIV_C | 4 | MINING_DIVISION_CODE |
| R10 | NTSMAP_C | 7 | NTS_MAPSHEET |
| R11 | MINFILNO | 9 | MINFILE_NUMBER |
| | BCMAP_C | 7 | BC_MAPSHEET |
| R12 | MINFILNO | 9 | MINFILE_NUMBER |
| | TECBLT_C | 2 | TECTONIC_BELT_CODE |
| R13 | MINFILNO | 9 | MINFILE_NUMBER |
| | TERRAN_C | 3 | TERRANE_CODE |
| R14 | MINFILNO | 9 | MINFILE_NUMBER |
| | PHYSIO_C | 4 | PHYSIOGRAPHIC_AREA_CODE |
| R15 | MINFILNO | 9 | MINFILE_NUMBER |
| | META_T_C | 1 | METAMORPHIC_TYPE_CODE |
| R16 | MINFILNO | 9 | MINFILE_NUMBER |
| | META_G_C | 2 | METAMORPHIC_GRADE_CODE |
| R17 | MINFILNO | 9 | MINFILE_NUMBER |
| | META_R_C | 9 | METAMORPHIC_RELATIONSHIP_CODE |
| R18a | MINFILNO | 9 | MINFILE_NUMBER |
| | YEAR | 4 | YEAR |
| | MINED | 12 | ORE_MINED |
| | MILLED | 12 | ORE_MILLED |
| R18b | MINFILNO | 9 | MINFILE_NUMBER |
| | YEAR | 4 | YEAR |
| | COMMOD_C | 2 | COMMODITY_CODE |
| | QUANTITY | 12 | QUANTITY |
| R19 | MINFILNO | 9 | MINFILE_NUMBER |
| | COMMOD_C | 2 | COMMODITY_CODE |
| R20 | MINFILNO | 9 | MINFILE_NUMBER |
| | MINCLA_C | 1 | MINERALOGY_CLASS_CODE |
| | MINERL_C | 4 | MINERAL_CODE |
| R21 | MINFILNO | 9 | MINFILE_NUMBER |
| | ALTER_C | 4 | ALTERATION_CODE |
| R22 | MINFILNO | 9 | MINFILE_NUMBER |
| | DATMET_C | 2 | DATING_METHOD_CODE |
| | ISOAGE | 20 | ISOTOPIC_AGE_MINERALIZATION |
| | MATERIAL | 30 | MATERIAL_DATED_MINERALIZATION |
| R23 | MINFILNO | 9 | MINFILE_NUMBER |
| | ST_AGE_C | 3 | STRATIGRAPHIC_AGE_CODE |
| | STNAME_C | 6 | STRATIGRAPHIC_NAME_CODE |
| | DATMET_C | 2 | DATING_METHOD_CODE |

| File | Field | Size | Alias |
|---|---|---|---|
| | ISOAGE | 20 | ISOTOPIC_AGE_HOST |
| | MATERIAL | 30 | MATERIAL_DATED_HOST |
| R24 | MINFILNO | 9 | MINFILE_NUMBER |
| | ST_AGE_C | 3 | MINERALIZATION_AGE_CODE |
| R25 | MINFILNO | 9 | MINFILE_NUMBER |
| | ROCK_T_C | 4 | ROCK_TYPE_CODE |
| | ROCK_M_C | 4 | ROCK_MODIFIER_CODE |
| | LITHUNIT | 11 | LITHOLOGICAL_UNIT |
| R26 | MINFILNO | 9 | MINFILE_NUMBER |
| | OREZON_C | 5 | ORE_ZONE_CODE |
| | RESCAT_C | 2 | RESERVE_CATEGORY_CODE |
| | A_OR_B | 1 | A_OR_B |
| | YEAR | 4 | YEAR |
| | QUANTITY | 12 | QUANTITY |
| | *REPORT_ON* | *1* | *REPORT_ON* |
| R27 | MINFILNO | 9 | MINFILE_NUMBER |
| | OREZON_C | 5 | ORE_ZONE_CODE |
| | A_OR_B | 1 | A_OR_B |
| | YEAR | 4 | YEAR |
| | SAMPLE_C | 4 | SAMPLE_TYPE_CODE |
| R28 | MINFILNO | 9 | MINFILE_NUMBER |
| | OREZON_C | 5 | ORE_ZONE_CODE |
| | RESCAT_C | 2 | RESERVE_CATEGORY_CODE |
| | A_OR_B | 1 | A_OR_B |
| | COMMOD_C | 2 | COMMODITY_CODE |
| | GRADE | 9 | GRADE |
| *R30* | *MINFILNO* | *9* | *MINFILE_NUMBER* |
| | *DEPTYP_C* | *5* | *DEPOSIT_TYPE_CODE* |
| *R31* | *PROJ_NO* | *7* | *PROJECT_NUMBER* |
| | *MINFILNO* | *9* | *MINFILE_NUMBER* |
| *R32a* | *PROJ_NO* | *7* | *PROJECT_NUMBER* |
| | *NOW_NO* | *9* | *NOTICE_NUMBER* |
| | *NOTIC_TYP* | *1* | *NOTICE_TYPE_CODE* |
| | *RECVD_DATE* | *8* | *RECEIVED_DATE* |
| | *APRV_DATE* | *8* | *APPROVED_DATE* |
| | *OPERATOR* | *30* | *OPERATOR* |
| | *MANAGER* | *30* | *MANAGER* |
| | *MGR_TEL* | *14* | *MANAGER_TELEPHONE* |
| | *WK_START* | *8* | *WORK_STARTED* |
| | *WK_END* | *8* | *WORK_ENDED* |
| | *EXP_BUD* | *13* | *EXPLORATION_BUDGET* |
| | *PROD_BUD* | *13* | *PRODUCTION_BUDGET* |
| | *COMPLETED* | *1* | *COMPLETED* |
| | *DISCUSSED* | *1* | *DISCUSSED* |
| | *MDSCREV* | *1* | *MDSC_REVIEW* |
| | *DEP_TARGET* | *60* | *DEPOSIT_TARGET* |
| *R32b* | *PROJ_NO* | *7* | *PROJECT_NUMBER* |
| | *NOW_NO* | *9* | *NOTICE_NUMBER* |
| | *WK_TODO* | *70* | *WORK_TO_DO* |
| | *WK_DONE* | *70* | *WORK_DONE* |
| *R33* | *PROJ_NO* | *7* | *PROJECT_NUMBER* |
| | *PRJTYP_C* | *1* | *PROJECT_TYPE_CODE* |
| *R34* | *PROJ_NO* | *7* | *PROJECT_NUMBER* |
| | *NOW_NO* | *9* | *NOTICE_NUMBER* |
| | *STAGE_C* | *1* | *MDAP_STAGE_CODE* |
| *R35* | *PROJ_NO* | *7* | *PROJECT_NUMBER* |
| | *MINDIV_C* | *4* | *MINING_DIVISION* |
| *R36* | *PROJ_NO* | *7* | *PROJECT_NUMBER* |
| | *NTSMAP_C* | *7* | *NTS_MAP* |

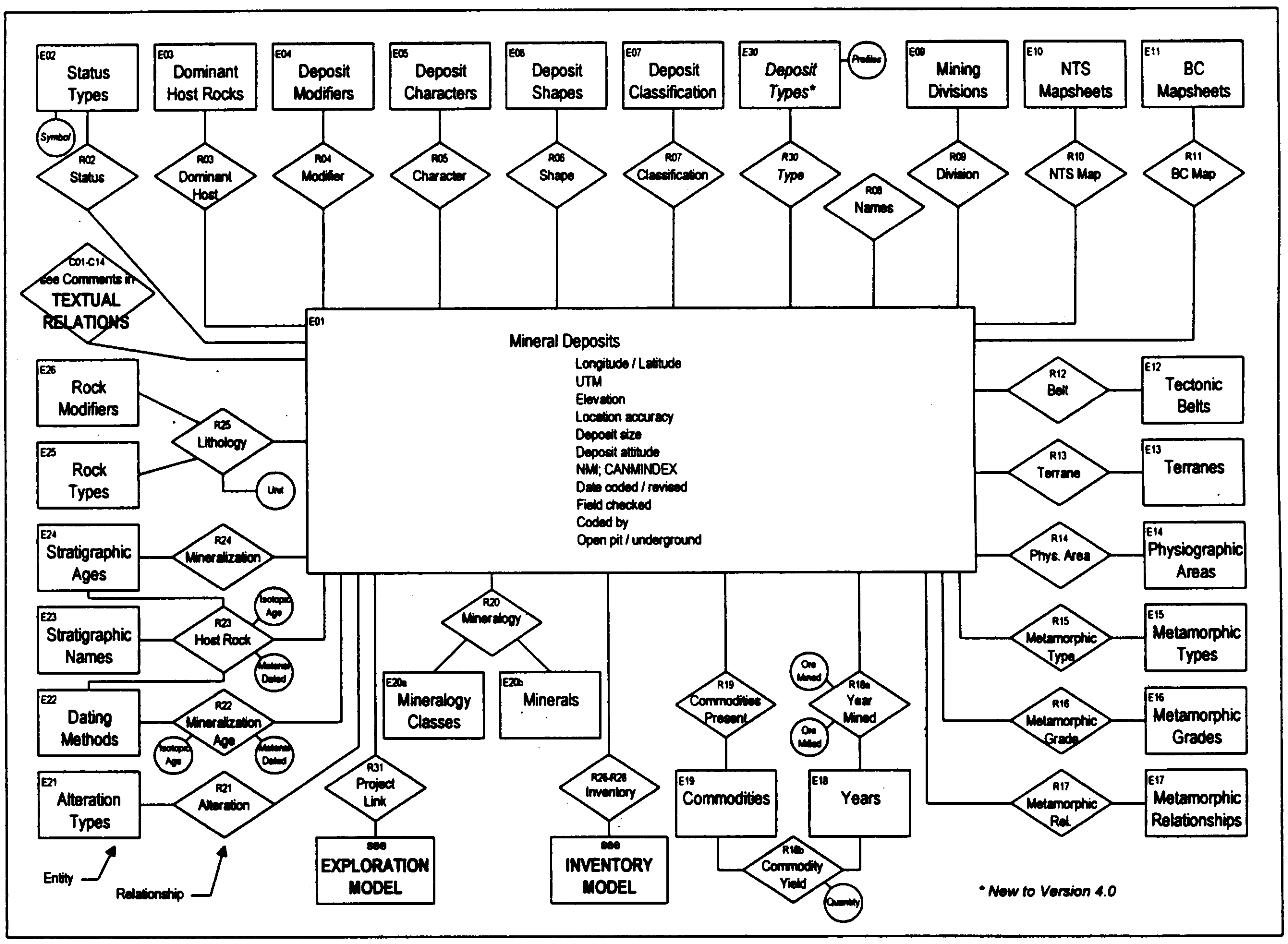
# MINFILE/pc 4.0 DATABASE STRUCTURE

## COMMENT FILES:

| File | Field | Size | Alias |
|---|---|---|---|
| C01 | MINFILNO | 9 | MINFILE_NUMBER |
| | IDENT_T | 70 | IDENTIFICATION_COMMENT |
| C02 | MINFILNO | 9 | MINFILE_NUMBER |
| | SIGMIN_T | 70 | SIGNIFICANT_MINERALS_COMMENT |
| C03 | MINFILNO | 9 | MINFILE_NUMBER |
| | ASSMIN_T | 70 | ASSOCIATED_MINERALS_COMMENT |
| C04 | MINFILNO | 9 | MINFILE_NUMBER |
| | ALTMIN_T | 70 | ALTERATION_MINERALS_COMMENT |
| C05 | MINFILNO | 9 | MINFILE_NUMBER |
| | STRUCT_T | 70 | STRUCTURAL_COMMENT |
| C06 | MINFILNO | 9 | MINFILE_NUMBER |
| | HSTRCK_T | 70 | HOST_ROCK_COMMENT |
| C07 | MINFILNO | 9 | MINFILE_NUMBER |
| | META_T | 70 | METAMORPHISM_COMMENT |
| C08 | MINFILNO | 9 | MINFILE_NUMBER |
| | CAPSUL_T | 70 | CAPSULE_GEOLOGY_COMMENT |
| C09 | MINFILNO | 9 | MINFILE_NUMBER |
| | BIBLIO_T | 70 | BIBLIOGRAPHY_COMMENT |
| C10 | MINFILNO | 9 | MINFILE_NUMBER |
| | YEAR | 4 | YEAR |
| | PROD_T | 66 | PRODUCTION_COMMENT |
| C11 | MINFILNO | 9 | MINFILE_NUMBER |
| | OREZON_C | 5 | ORE_ZONE_CODE |
| | RESCAT_C | 2 | RESERVE_CATEGORY_CODE |
| | A_OR_B | 1 | A_OR_B |
| | RESERV_T | 70 | RESERVES_COMMENT |
| C12 | MINFILNO | 9 | MINFILE_NUMBER |
| | OREZON_C | 5 | ORE_ZONE_CODE |
| | RESCAT_C | 2 | RESERVE_CATEGORY_CODE |
| | A_OR_B | 1 | A_OR_B |
| | RESREF_T | 70 | RESERVES_REFERENCE |
| *C13* | *MINFILNO* | *9* | *MINFILE_NUMBER* |
| | *CONF_NOTE* | *70* | *CONFIDENTIAL_NOTE* |
| *C14* | *PROJ_NO* | *7* | *PROJECT_NUMBER* |
| | *EXPL_T* | *70* | *EXPLORATION_COMMENT* |

**NOTE:** All fields are character.
*New to Version 4.0*

## MINFILE ENTITY/RELATIONSHIP DATA MODEL



C:\MINFILE\DATA\METADATA.DBF
Printed: 05/27/94 16:34

# MINFILE METADATA

| File Name | ER Name | Rowcount | Index Name | Field Name | Field Type | Field Length | Field Decimal | Parcel Flag | Expl Flag |
|---|---|---|---|---|---|---|---|---|---|
| E01 | MINERAL_DEPOSITS | 49 | E01 | MINFILNO | C | 9 | 0 | T | F |
| E01 | | 0 | | LAT_DEG | C | 2 | 0 | T | F |
| E01 | | 0 | | LAT_MIN | C | 2 | 0 | T | F |
| E01 | | 0 | | LAT_SEC | C | 2 | 0 | T | F |
| E01 | | 0 | | LONG_DEG | C | 3 | 0 | T | F |
| E01 | | 0 | | LONG_MIN | C | 2 | 0 | T | F |
| E01 | | 0 | | LONG_SEC | C | 2 | 0 | T | F |
| E01 | | 0 | | UTM_ZONE | C | 2 | 0 | T | F |
| E01 | | 0 | | UTM_EAST | C | 6 | 0 | T | F |
| E01 | | 0 | | UTM_NORT | C | 7 | 0 | T | F |
| E01 | | 0 | | ELEV | C | 4 | 0 | T | F |
| E01 | | 0 | | LOC_ACC | C | 1 | 0 | T | F |
| E01 | | 0 | | DEPSIZEL | C | 4 | 0 | T | F |
| E01 | | 0 | | DEPSIZEB | C | 4 | 0 | T | F |
| E01 | | 0 | | DEPSIZEW | C | 4 | 0 | T | F |
| E01 | | 0 | | DIP | C | 3 | 0 | T | F |
| E01 | | 0 | | STRIKE | C | 3 | 0 | T | F |
| E01 | | 0 | | PLUNGE | C | 6 | 0 | T | F |
| E01 | | 0 | | NATMINNO | C | 18 | 0 | T | F |
| E01 | | 0 | | CANMINNO | C | 6 | 0 | T | F |
| E01 | | 0 | | CODED | C | 8 | 0 | T | F |
| E01 | | 0 | | REVISED | C | 8 | 0 | T | F |
| E01 | | 0 | | GREVISED | C | 4 | 0 | T | F |
| E01 | | 0 | | FREVISED | C | 1 | 0 | T | F |
| E01 | | 0 | | FCHECKED | C | 1 | 0 | T | F |
| E01 | | 0 | | GNAME | C | 4 | 0 | T | F |
| E01 | | 0 | | OPENPIT | C | 1 | 0 | T | F |
| E01 | | 0 | | UGROUND | C | 1 | 0 | T | F |
| E02 | STATUS_TYPES | 6 | E02 | STATUS_C | C | 4 | 0 | F | F |
| E02 | | 0 | | STATUS_D | C | 20 | 0 | F | F |
| E03 | DOMINANT_HOST_ROCKS | 7 | E03 | DOMHRK_C | C | 1 | 0 | F | F |
| E03 | | 0 | | DOMHRK_D | C | 15 | 0 | F | F |
| E04 | DEPOSIT_MODIFIERS | 5 | E04 | DEPMOD_C | C | 1 | 0 | F | F |
| E04 | | 0 | | DEPMOD_D | C | 15 | 0 | F | F |
| E05 | DEPOSIT_CHARACTERS | 15 | E05 | DEPCHR_C | C | 2 | 0 | F | F |
| E05 | | 0 | | DEPCHR_D | C | 20 | 0 | F | F |
| E06 | DEPOSIT_SHAPE_TYPES | 5 | E06 | DEPSHA_C | C | 2 | 0 | F | F |
| E06 | | 0 | | DEPSHA_D | C | 12 | 0 | F | F |
| E07 | DEPOSIT_CLASSIFICATIONS | 22 | E07 | DEPCLA_C | C | 2 | 0 | F | F |
| E07 | | 0 | | DEPCLA_D | C | 15 | 0 | F | F |
| E09 | MINING_DIVISIONS | 31 | E09 | MINDIV_C | C | 4 | 0 | F | F |
| E09 | | 0 | | MINDIV_D | C | 15 | 0 | F | F |
| E10 | NTS_MAPSHEETS | 2285 | | NTSMAP_C | C | 7 | 0 | F | F |
| E11 | BC_MAPSHEETS | 7055 | E11 | BCMAP_C | C | 7 | 0 | F | F |
| E12 | TECTONIC_BELTS | 5 | E12 | TECBLT_C | C | 2 | 0 | F | F |
| E12 | | 0 | | TECBLT_D | C | 18 | 0 | F | F |
| E13 | TERRANES | 39 | E13 | TERRAN_C | C | 3 | 0 | F | F |
| E13 | | 0 | | TERRAN_D | C | 30 | 0 | F | F |
| E14 | PHYSIOGRAPHIC_AREAS | 66 | E14 | PHYSIO_C | C | 4 | 0 | F | F |
| E14 | | 0 | | PHYSIO_D | C | 30 | 0 | F | F |
| E15 | METAMORPHIC_TYPES | 2 | E15 | META_T_C | C | 1 | 0 | F | F |
| E15 | | 0 | | META_T_D | C | 10 | 0 | F | F |
| E16 | METAMORPHIC_GRADES | 14 | E16 | META_G_C | C | 2 | 0 | F | F |
| E16 | | 0 | | META_G_D | C | 15 | 0 | F | F |
| E17 | METAMORPHIC_RELATIONSHIPS | 3 | E17 | META_R_C | C | 1 | 0 | F | F |
| E17 | | 0 | | META_R_D | C | 20 | 0 | F | F |
| E18 | YEARS | 126 | E18 | YEAR | C | 4 | 0 | F | F |
| E19 | COMMODITIES | 151 | E19 | COMMOD_C | C | 2 | 0 | F | F |
| E19 | | 0 | | COMMOD_D | C | 30 | 0 | F | F |
| E20A | MINERALOGY_CLASSES | 3 | E20A | MINCLA_C | C | 1 | 0 | F | F |
| E20A | | 0 | | MINCLA_D | C | 15 | 0 | F | F |
| E20B | MINERALS | 551 | E20B | MINERL_C | C | 4 | 0 | F | F |
| E20B | | 0 | | MINERL_D | C | 20 | 0 | F | F |
| E21 | ALTERATION_TYPES | 25 | E21 | ALTER_C | C | 4 | 0 | F | F |
| E21 | | 0 | | ALTER_D | C | 12 | 0 | F | F |
| E22 | DATING_METHODS | 12 | E22 | DATMET_C | C | 2 | 0 | F | F |
| E22 | | 0 | | DATMET_D | C | 30 | 0 | F | F |
| E23 | STRATIGRAPHIC_NAMES | 721 | E23 | STNAME_C | C | 6 | 0 | F | F |

| File Name | ER Name | Rowcount | Index Name | Field Name | Field Type | Field Length | Field Decimal | Parcel Flag | Expl Flag |
|---|---|---|---|---|---|---|---|---|---|
| E23 | | 0 | | STNAME_D | C | 30 | 0 | F | F |
| E23 | | 0 | | STINFORM | C | 1 | 0 | F | F |
| E23 | | 0 | | STIGMETA | C | 1 | 0 | F | F |
| E23 | | 0 | | STGROUP | C | 1 | 0 | F | F |
| E23 | | 0 | | STFORM | C | 1 | 0 | F | F |
| E24 | STRATIGRAPHIC_AGES | 80 | E24 | ST_AGE_C | C | 3 | 0 | F | F |
| E24 | | 0 | | ST_AGE_D | C | 20 | 0 | F | F |
| E25 | ROCK_TYPES | 243 | E25 | ROCK_T_C | C | 4 | 0 | F | F |
| E25 | | 0 | | ROCK_T_D | C | 30 | 0 | F | F |
| E26 | ROCK_MODIFIERS | 679 | E26 | ROCK_M_C | C | 4 | 0 | F | F |
| E26 | | 0 | | ROCK_M_D | C | 30 | 0 | F | F |
| E27 | ORE_ZONES | 3462 | E27 | OREZON_C | C | 5 | 0 | F | F |
| E27 | | 0 | | OREZON_D | C | 30 | 0 | F | F |
| E28 | SAMPLE_TYPES | 6 | E28 | SAMPLE_C | C | 4 | 0 | F | F |
| E28 | | 0 | | SAMPLE_D | C | 30 | 0 | F | F |
| E29 | RESERVE_CATEGORIES | 10 | E29 | RESCAT_C | C | 2 | 0 | F | F |
| E29 | | 0 | | RESCAT_D | C | 30 | 0 | F | F |
| R02 | STATUS | 49 | R02A | MINFILNO | C | 9 | 0 | T | F |
| R02 | | 0 | | STATUS_C | C | 4 | 0 | T | F |
| R03 | DOMINANT_HOST | 48 | R03 | MINFILNO | C | 9 | 0 | T | F |
| R03 | | 0 | | DOMHRK_C | C | 1 | 0 | T | F |
| R04 | MODIFY | 35 | R04 | MINFILNO | C | 9 | 0 | T | F |
| R04 | | 0 | | DEPMOD_C | C | 1 | 0 | T | F |
| R05 | CHARACTERIZE | 71 | R05A | MINFILNO | C | 9 | 0 | T | F |
| R05 | | 0 | | DEPCHR_C | C | 2 | 0 | T | F |
| R06 | SHAPE | 25 | R06 | MINFILNO | C | 9 | 0 | T | F |
| R06 | | 0 | | DEPSHA_C | C | 2 | 0 | T | F |
| R07 | ORIGIN | 86 | R07A | MINFILNO | C | 9 | 0 | T | F |
| R07 | | 0 | | DEPCLA_C | C | 2 | 0 | T | F |
| R08 | ALIAS | 81 | R08B | MINFILNO | C | 9 | 0 | T | F |
| R08 | | 0 | | NAME | C | 30 | 0 | T | F |
| R09 | FALL_INTO | 49 | R09B | MINFILNO | C | 9 | 0 | T | F |
| R09 | | 0 | | MINDIV_C | C | 4 | 0 | T | F |
| R10 | HAS_NTS | 67 | R10B | MINFILNO | C | 9 | 0 | T | F |
| R10 | | 0 | | NTSMAP_C | C | 7 | 0 | T | F |
| R11 | HAS_BC | 0 | R11 | MINFILNO | C | 9 | 0 | T | F |
| R11 | | 0 | | BCMAP_C | C | 7 | 0 | T | F |
| R12 | TECTONIC_BELT_SETTING | 48 | R12B | MINFILNO | C | 9 | 0 | T | F |
| R12 | | 0 | | TECBLT_C | C | 2 | 0 | T | F |
| R13 | TERRANE_SETTING | 51 | R13B | MINFILNO | C | 9 | 0 | T | F |
| R13 | | 0 | | TERRAN_C | C | 3 | 0 | T | F |
| R14 | PHYSIOGRAPHIC_SETTING | 48 | R14B | MINFILNO | C | 9 | 0 | T | F |
| R14 | | 0 | | PHYSIO_C | C | 4 | 0 | T | F |
| R15 | TYPE_OF_METAMORPHISM | 20 | R15 | MINFILNO | C | 9 | 0 | T | F |
| R15 | | 0 | | META_T_C | C | 1 | 0 | T | F |
| R16 | GRADE_OF_METAMORPHISM | 16 | R16 | MINFILNO | C | 9 | 0 | T | F |
| R16 | | 0 | | META_G_C | C | 2 | 0 | T | F |
| R17 | RELATIONSHIP_OF_METAMORPHISM | 15 | R17 | MINFILNO | C | 9 | 0 | T | F |
| R17 | | 0 | | META_R_C | C | 1 | 0 | T | F |
| R18A | MATERIAL_MINED | 9 | R18A | MINFILNO | C | 9 | 0 | T | F |
| R18A | | 0 | | YEAR | C | 4 | 0 | T | F |
| R18A | | 0 | | MINED | C | 12 | 0 | T | F |
| R18A | | 0 | | MILLED | C | 12 | 0 | T | F |
| R18B | COMMODITY_YIELD | 9 | R18B | MINFILNO | C | 9 | 0 | T | F |
| R18B | | 0 | | YEAR | C | 4 | 0 | T | F |
| R18B | | 0 | | COMMOD_C | C | 2 | 0 | T | F |
| R18B | | 0 | | QUANTITY | C | 12 | 0 | T | F |
| R19 | ARE_PRESENT | 81 | R19B | MINFILNO | C | 9 | 0 | T | F |
| R19 | | 0 | | COMMOD_C | C | 2 | 0 | T | F |
| R20 | MINERALOGY | 102 | R20AB | MINFILNO | C | 9 | 0 | T | F |
| R20 | | 0 | | MINCLA_C | C | 1 | 0 | T | F |
| R20 | | 0 | | MINERL_C | C | 4 | 0 | T | F |
| R21 | ALTER | 5 | R21 | MINFILNO | C | 9 | 0 | T | F |
| R21 | | 0 | | ALTER_C | C | 4 | 0 | T | F |
| R22 | AGE_OF_MINERALIZATION | 38 | R22 | MINFILNO | C | 9 | 0 | T | F |
| R22 | | 0 | | DATMET_C | C | 2 | 0 | T | F |
| R22 | | 0 | | ISOAGE | C | 20 | 0 | T | F |
| R22 | | 0 | | MATERIAL | C | 30 | 0 | T | F |
| R23 | HOST_ROCK | 111 | R23C | MINFILNO | C | 9 | 0 | T | F |
| R23 | | 0 | | ST_AGE_C | C | 3 | 0 | T | F |
| R23 | | 0 | | STNAME_C | C | 6 | 0 | T | F |
| R23 | | 0 | | DATMET_C | C | 2 | 0 | T | F |
| R23 | | 0 | | ISOAGE | C | 20 | 0 | T | F |

| File Name | ER Name | Rowcount | Index Name | Field Name | Field Type | Field Length | Field Decimal | Parcel Flag | Expl Flag |
|---|---|---|---|---|---|---|---|---|---|
| R23 | | 0 | | MATERIAL | C | 30 | 0 | T | F |
| R24 | ARE_ASSIGNED | 49 | R24A | MINFILNO | C | 9 | 0 | T | F |
| R24 | | 0 | | ST_AGE_C | C | 3 | 0 | T | F |
| R25 | LITHOLOGIC_HOST | 189 | R25E | MINFILNO | C | 9 | 0 | T | F |
| R25 | | 0 | | ROCK_T_C | C | 4 | 0 | T | F |
| R25 | | 0 | | ROCK_M_C | C | 4 | 0 | T | F |
| R25 | | 0 | | LITHUNIT | C | 11 | 0 | T | F |
| R26 | TONNAGES | 17 | R26ABC | MINFILNO | C | 9 | 0 | T | F |
| R26 | | 0 | | OREZON_C | C | 5 | 0 | T | F |
| R26 | | 0 | | RESCAT_C | C | 2 | 0 | T | F |
| R26 | | 0 | | A_OR_B | C | 1 | 0 | T | F |
| R26 | | 0 | | YEAR | C | 4 | 0 | T | F |
| R26 | | 0 | | QUANTITY | C | 12 | 0 | T | F |
| R27 | BEST_ASSAY | 12 | R27AB | MINFILNO | C | 9 | 0 | T | F |
| R27 | | 0 | | OREZON_C | C | 5 | 0 | T | F |
| R27 | | 0 | | A_OR_B | C | 1 | 0 | T | F |
| R27 | | 0 | | YEAR | C | 4 | 0 | T | F |
| R27 | | 0 | | SAMPLE_C | C | 4 | 0 | T | F |
| R28 | RECOVERABLES | 41 | R28 | MINFILNO | C | 9 | 0 | T | F |
| R28 | | 0 | | OREZON_C | C | 5 | 0 | T | F |
| R28 | | 0 | | RESCAT_C | C | 2 | 0 | T | F |
| R28 | | 0 | | A_OR_B | C | 1 | 0 | T | F |
| R28 | | 0 | | COMMOD_C | C | 2 | 0 | T | F |
| R28 | | 0 | | GRADE | C | 9 | 0 | T | F |
| C01 | IDENTIFICATION_COMMENTS | 113 | C01 | MINFILNO | C | 9 | 0 | T | F |
| C01 | | 0 | | IDENT_T | C | 70 | 0 | T | F |
| C02 | SIGNIFICANT_MINERALS_COMMENTS | 10 | C02 | MINFILNO | C | 9 | 0 | T | F |
| C02 | | 0 | | SIGMIN_T | C | 70 | 0 | T | F |
| C03 | ASSOCIATED_MINERALS_COMMENTS | 0 | C03 | MINFILNO | C | 9 | 0 | T | F |
| C03 | | 0 | | ASSMIN_T | C | 70 | 0 | T | F |
| C04 | ALTERATION_MINERALS_COMMENTS | 0 | C04 | MINFILNO | C | 9 | 0 | T | F |
| C04 | | 0 | | ALTMIN_T | C | 70 | 0 | T | F |
| C05 | STRUCTURAL_COMMENTS | 30 | C05 | MINFILNO | C | 9 | 0 | T | F |
| C05 | | 0 | | STRUCT_T | C | 70 | 0 | T | F |
| C06 | HOST_ROCK_COMMENTS | 24 | C06 | MINFILNO | C | 9 | 0 | T | F |
| C06 | | 0 | | HSTRCK_T | C | 70 | 0 | T | F |
| C07 | METAMORPHISM_COMMENTS | 27 | C07 | MINFILNO | C | 9 | 0 | T | F |
| C07 | | 0 | | META_T | C | 70 | 0 | T | F |
| C08 | CAPSULE_GEOLOGY_COMMENTS | 924 | C08 | MINFILNO | C | 9 | 0 | T | F |
| C08 | | 0 | | CAPSUL_T | C | 70 | 0 | T | F |
| C09 | BIBLIOGRAPHY_COMMENTS | 271 | C09 | MINFILNO | C | 9 | 0 | T | F |
| C09 | | 0 | | BIBLIO_T | C | 70 | 0 | T | F |
| C10 | PRODUCTION_COMMENTS | 0 | C10 | MINFILNO | C | 9 | 0 | T | F |
| C10 | | 0 | | YEAR | C | 4 | 0 | T | F |
| C10 | | 0 | | PROD_T | C | 66 | 0 | T | F |
| C11 | RESERVES_COMMENTS | 2 | C11ABCD | MINFILNO | C | 9 | 0 | T | F |
| C11 | | 0 | | OREZON_C | C | 5 | 0 | T | F |
| C11 | | 0 | | RESCAT_C | C | 2 | 0 | T | F |
| C11 | | 0 | | A_OR_B | C | 1 | 0 | T | F |
| C11 | | 0 | | RESERV_T | C | 70 | 0 | T | F |
| C12 | RESERVES_REFERENCES | 3 | C12ABC | MINFILNO | C | 9 | 0 | T | F |
| C12 | | 0 | | OREZON_C | C | 5 | 0 | T | F |
| C12 | | 0 | | RESCAT_C | C | 2 | 0 | T | F |
| C12 | | 0 | | A_OR_B | C | 1 | 0 | T | F |
| C12 | | 0 | | RESREF_T | C | 70 | 0 | T | F |
| C13 | CONFIDENTIAL COMMENTS | 3 | C13 | MINFILNO | C | 9 | 0 | F | F |
| E30 | DEPOSIT TYPE CLASS | 69 | E30 | DEPTYP_C | C | 3 | 0 | F | F |
| R30 | IS_TYPE | 1 | R30 | MINFILNO | C | 9 | 0 | T | F |
| C14 | EXPLORATION NOTES | 90 | C14 | PROJ_NO | C | 7 | 0 | F | T |
| E31 | EXPLORATION PROPERTIES | 12 | E31 | PROJ_NO | C | 7 | 0 | F | T |
| E33 | PROJECT TYPE | 3 | E33 | PRJTYP_C | C | 1 | 0 | F | F |
| E34 | MDAP STAGE | 6 | E34 | STAGE_C | C | 1 | 0 | F | F |
| R31 | HAS_OCCURRENCE | 7 | R31 | PROJ_NO | C | 7 | 0 | F | T |
| R33 | IS PROJECT TYPE | 11 | R33 | PROJ_NO | C | 7 | 0 | F | T |
| R34 | AT_MDAP_STAGE | 3 | R34 | PROJ_NO | C | 7 | 0 | F | T |
| R35 | FALL_INTO | 12 | R35 | PROJ_NO | C | 7 | 0 | F | T |
| R36 | ON_MAP | 12 | R36 | PROJ_NO | C | 7 | 0 | F | T |
| R32A | HAS NOTICE | 10 | R32A | PROJ_NO | C | 7 | 0 | F | T |
| R32B | HAS NOTICE DESCRIPTIONS | 10 | R32B | PROJ_NO | C | 7 | 0 | F | T |
| E32 | NOTICE TYPE | 5 | E32 | NOTIC_TYP | C | 1 | 0 | F | F |
| E32 | | 0 | | NOTIC_DESC | C | 20 | 0 | F | F |

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# RELATIONSHIPS

| ENTFL_NM | CODE_NM | RELFL_NM |
|---|---|---|
| E02 | STATUS_C | R02 |
| E03 | DOMHRK_C | R03 |
| E04 | DEPMOD_C | R04 |
| E05 | DEPCHR_C | R05 |
| E06 | DEPSHA_C | R06 |
| E07 | DEPCLA_C | R07 |
| E09 | MINDIV_C | R09 |
| E09 | MINDIV_C | R35 |
| E10 | NTSMAP_C | R10 |
| E10 | NTSMAP_C | R36 |
| E12 | TECBLT_C | R12 |
| E13 | TERRAN_C | R13 |
| E14 | PHYSIO_C | R14 |
| E15 | META_T_C | R15 |
| E16 | META_G_C | R16 |
| E17 | META_R_C | R17 |
| E18 | YEAR | R18A |
| E18 | YEAR | R18B |
| E19 | COMMOD_C | R18B |
| E19 | COMMOD_C | R28 |
| E20A | MINCLA_C | R20 |
| E20B | MINERL_C | R20 |
| E21 | ALTER_C | R21 |
| E22 | DATMET_C | R22 |
| E22 | DATMET_C | R23 |
| E23 | STNAME_C | R23 |
| E24 | ST_AGE_C | R23 |
| E24 | ST_AGE_C | R24 |
| E25 | ROCK_T_C | R25 |
| E26 | ROCK_M_C | R25 |
| E27 | OREZON_C | R26 |
| E27 | OREZON_C | R27 |
| E28 | SAMPLE_C | R27 |
| E29 | RESCAT_C | R28 |
| E30 | DEPTYP_C | R30 |
| E32 | NOTIC_TY | R32A |
| E33 | PRJTYP_C | R33 |
| E34 | STAGE_C | R34 |

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# MINFILE Project Management

## PROJECT ELEMENTS

- Concept, designing, planning (budget, staff)

⇒ **Database Design and Data Dictionary**

- System Testing and Quality Assurance
- Database Administration and Maintenance (documentation and manuals)
- Data Acquisition and Processing Procedures (coding procedures)
- Training and Client Support
- Marketing and Distribution of Data
- New Technology and Future Planning
- Designing and Producing Computer Generated Products for Users

# BASIC STEPS OF DATA MODELLING

1. Determine scope of model
2. Determine business rules
3. Identify entities
4. Identify relationships between entities
5. Identify attributes
6. Determine primary key
7. Determine foreign keys
8. Identify constraints
9. Validate model

*Iterate steps 2 through 9, adding more level of detail*

10. Review and user sign-off

HIERARCHY STRUCTURES 7 MARCH 1986

QUEEN CHARLOTTE GROUP
- SKIDEGATE FORMATION
- HONNA FORMATION
- HAIDA FORMATION

VANCOUVER GROUP
- KUNGA FORMATION
- PARSONS BAY FORMATION
- SUTTON FORMATION
- QUATSINO FORMATION
- KARMUTSEN FORMATION

SICKER GROUP
- BUTTLE LAKE FORMATION
- MYRA FORMATION
- NITINAT FORMATION

COAL HARBOUR GROUP
- BLUMBERG FORMATION

KYUQUOT GROUP
- LONGARM FORMATION
- ONE TREE FORMATION
- KAPOOSE FORMATION

CARMANHA GROUP
- SOOKE FORMATION
- HESQUIAT FORMATION
- ESCALANTE FORMATION

NANAIMO GROUP
- GABRIOLA FORMATION
- SPRAY FORMATION
- GEOFFREY FORMATION
- NORTHUMBERLAND FORMATION
- DECOURCY FORMATION
- CEDAR DISTRICT FORMATION
- EXTENSION - PROTECTION FORMATION
- HASLAM FORMATION
- COMOX FORMATION

LAIB GROUP
- REEVES FORMATION

WINDERMERE GROUP
- MONK FORMATION
- HORSETHIEF CREEK FORMATION
- IRENE FORMATION
- TOBY FORMATION

SUSTUT GROUP
- TANGO CREEK FORMATION
- BROTHERS PEAK FORMATION

BOWSER LAKE GROUP
- ASHMAN FORMATION

HAZELTON GROUP
- SMITHERS FORMATION
- NILKITKWA FORMATION
- TELKWA FORMATION

CACHE CREEK GROUP
- KEDAHDA FORMATION
- TESLIN FORMATION
- FRENCH RANGE FORMATION
- HORSEFEED FORMATION
- NAKINA FORMATION
- MARBLE CANYON FORMATION

KAMLOOPS GROUP
- COLDWATER FORMATION

SPENCES BRIDGE GROUP
- KINGSVALE FORMATION

INGENIKA ATAN GROUP
- ROSELLA FORMATION
- BOYA FORMATION
- STELKUZ FORMATION
- ESPEE FORMATION
- TSAYDIZ FORMATION
- SWANNELL FORMATION

ANARCHIST/KOBAU GROUP
- KNOB HILL FORMATION
- ATTWOOD FORMATION

ROSSLAND GROUP
- ELISE FORMATION
- ARCHIBALD FORMATION

HAMILL GROUP
- RENO FORMATION
- QUARTZITE FORMATION
- THREE SISTERS FORMATION
- MARSH ADAMS FORMATION
- MOUNT GAINER FORMATION

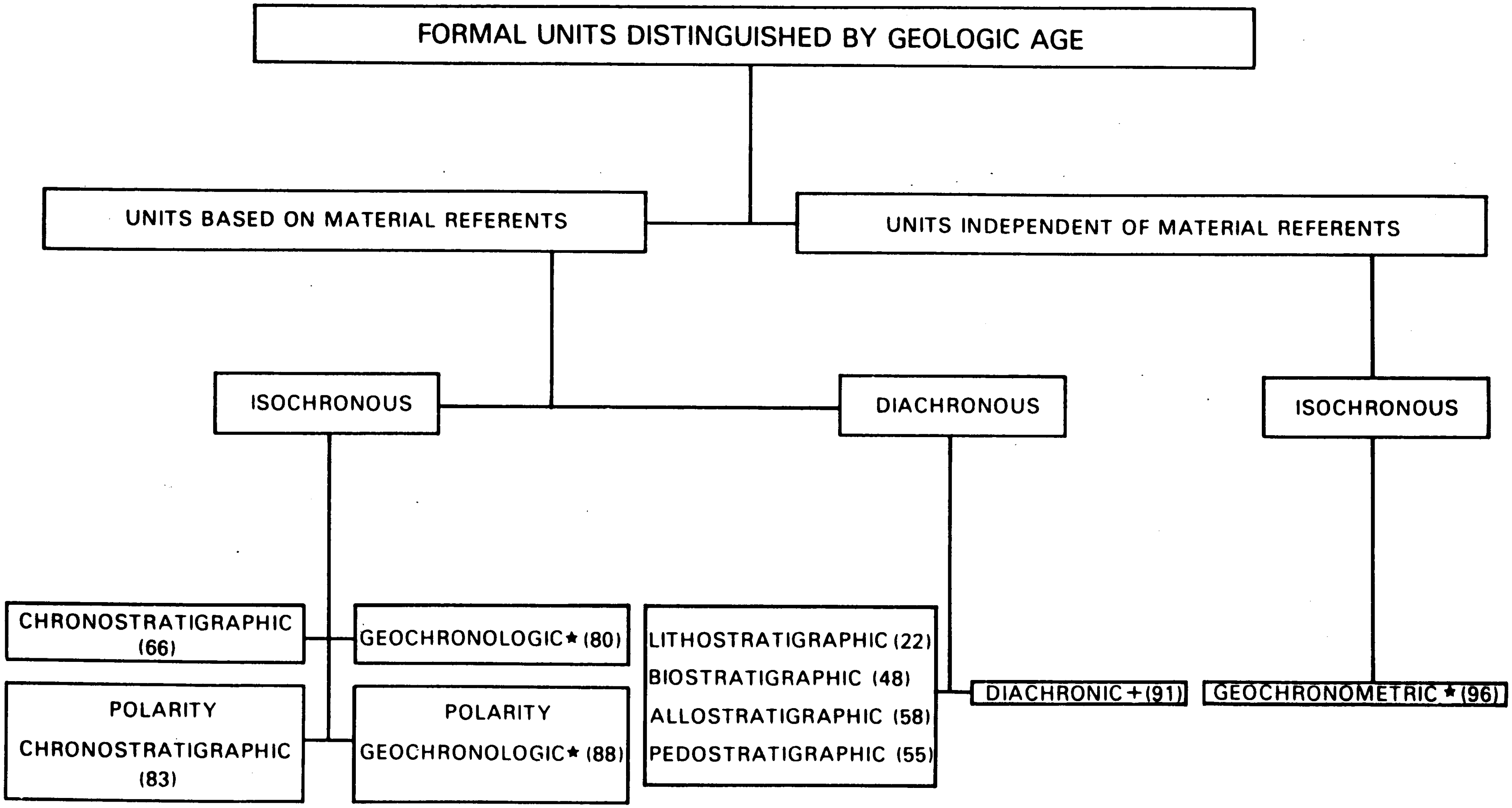
...../2

# STRATIGRAPHIC AGE CODES

| Era | Period | Epoch | Code |
|---|---|---|---|
| 1 Cenozoic | 0 | 0 | 100 |
| | 1 Quaternary | 0 | 110 |
| | | 1 Recent | 111 |
| | | 2 Pleistocene | 112 |
| | | 9 Pliocene-Pleistocene | 119 |
| | 2 Tertiary | 0 | 120 |
| | | 1 Pliocene | 121 |
| | | 2 Miocene | 122 |
| | | 3 Oligocene | 123 |
| | | 4 Eocene | 124 |
| | | 5 Paleocene | 125 |
| | | 9 Cretaceous-Tertiary | 129 |
| | Mesozoic-Cenozoic | | 199 |
| 2 Mesozoic | | 0 | 200 |
| | 1 Cretaceous | 0 | 210 |
| | | 1 Upper | 211 |
| | | 4 Middle | 214 |
| | | 7 Lower | 217 |
| | | 9 Jurassic-Cretaceous | 219 |
| | 2 Jurassic | 0 | 220 |
| | | 1 Upper | 221 |
| | | 4 Middle | 224 |
| | | 7 Lower | 227 |
| | | 9 Triassic-Jurassic | 229 |
| | 3 Triassic | 0 | 230 |
| | | 1 Upper | 231 |
| | | 4 Middle | 234 |
| | | 7 Lower | 237 |
| | | 9 Permian-Triassic | 239 |
| | Paleozoic-Mesozoic | | 299 |
| 3 Paleozoic | 0 | 0 | 300 |
| | Upper Paleozoic | | 301 |
| | 1 Permian | 0 | 310 |
| | | 1 Upper | 311 |
| | | 4 Middle | 314 |
| | | 7 Lower | 317 |
| | | 9 Pennsylvan.-Permian | 319 |
| | 2 Pennsylvanian | 0 | 320 |
| | | 1 Upper | 321 |
| | | 4 Middle | 324 |
| | | 7 Lower | 327 |
| | | 9 Carboniferous | 329 |
| | 3 Mississippian | 0 | 330 |
| | | 1 Upper | 331 |
| | | 4 Middle | 334 |
| | | 7 Lower | 337 |
| | | 9 Devonian-Mississipp. | 339 |
| | 4 Devonian | 0 | 340 |
| | | 1 Upper | 341 |

# STRATIGRAPHIC AGE CODES

| Era | Period | Epoch | Code |
|---|---|---|---|
| | | 4 Middle | 344 |
| | | 7 Lower | 347 |
| | | 9 Silurian-Devonian | 349 |
| | 5 Silurian | 0 | 350 |
| | | 1 Upper | 351 |
| | | 4 Middle | 354 |
| | | 7 Lower | 357 |
| | | 9 Ordovician-Silurian | 359 |
| | 6 Ordovician | 0 | 360 |
| | | 1 Upper | 361 |
| | | 4 Middle | 364 |
| | | 7 Lower | 367 |
| | | 9 Cambrian-Ordovician | 369 |
| | 7 Cambrian | 0 | 370 |
| | | 1 Upper | 371 |
| | | 4 Middle | 374 |
| | | 7 Lower | 377 |
| | | 9 Proterozoic-Cambrian | 379 |
| | Proterozoic-Paleoz. | | 399 |
| 4 Proterozoic | 0 | 0 | 400 |
| | 1 Upper | 0 | 410 |
| | 2 Hadrynian | 0 | 420 |
| | 4 Middle | 0 | 440 |
| | 5 Helikian | 0 | 450 |
| | 7 Lower | 0 | 470 |
| | 8 Aphebian | 0 | 480 |
| 5 Archean | 0 | 0 | 500 |
| | 1 Upper | 0 | 510 |
| | 4 Middle | 0 | 540 |
| | 7 Lower | 0 | 570 |
| UNKNOWN | | | *** |




★ Applicable world-wide.

+Applicable only where material referents are present.

( )Number of article in which defined.

**FIG. 1.—Relation of geologic time units to the kinds of rock-unit referents on which most are based.**

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# GEOLOGIC TIME SCALE - BRITISH COLUMBIA GEOLOGICAL SURVEY BRANCH

Phanerozoic data derived from:
1) W.B.Harland et al. (1990)
PreCambrian data from:
1) Lumbers & Card (Geology, Vol. 20 1991)

## PHANEROZOIC

### CENOZOIC

| PERIOD | | EPOCH / STAGE | | Ma Age |
|---|---|---|---|---|
| QUATER-NARY | | Holocene | | 0.01 |
| | | Pleistocene | Calabrian | 1.64 |
| TERTIARY | NEOGENE | PLIOCENE L | Piacenzian | 3.40± 1.35 |
| | | PLIOCENE E | Zanclian | 5.2 ± 1.5 |
| | | MIOCENE L | Messinian | 6.7 ± 2.3 |
| | | MIOCENE L | Tortonian | 10.4 ± 1.5 |
| | | MIOCENE M | Serravallian | 14.2 ± 1.8 |
| | | MIOCENE M | Langhian | 16.3 ± 1 |
| | | MIOCENE E | Burdigalian | 21.5 ± 1.8 |
| | | MIOCENE E | Aquitanian | 23.3 ± 1 |
| | PALEOGENE | OLIGOCENE L | Chattian | 29.3 ± 1.5 |
| | | OLIGOCENE E | Rupelian | 35.4 ± 1.4 |
| | | EOCENE L | Priabonian | 38.6 ± 1.5 |
| | | EOCENE M | Bartonian | 42.1 ± 1.8 |
| | | EOCENE M | Lutetian | 50 ± 1.5 |
| | | EOCENE E | Ypresian | 56.5 ± 1.4 |
| | | PALEOCENE L | Thanetian | 60.5 ± 2.3 |
| | | PALEOCENE E | Danian | 65 ± 2 |

### MESOZOIC

| PERIOD | EPOCH | STAGE | Ma Age |
|---|---|---|---|
| CRETACEOUS | Late | | 65.0 ± 2 |
| | | Maastrichtian | 74.0 ± 3 |
| | | Campanian | 83 ± 4 |
| | | Santonian | 86.6 ± 3 |
| | | Coniacian | 88.5 ± 2 |
| | | Turonian | 90.4 ± 2 |
| | | Cenomanian | 97.0 ± 2 |
| | Early | Albian | 112 ± 2 |
| | | Aptian | 124.5 ± 13 |
| | | Barremian | 131.8 ± 8 |
| | | Hauterivian | 135.0 ± 8 |
| | | Valanginian | 140.7 ± 13 |
| | | Berriasian | 145.6 ± 9.5 |
| JURASSIC | Late | Tithonian | 152.1 ± 11.5 |
| | | Kimmeridgian | 154.7 ± 6.5 |
| | | Oxfordian | 157.1 ± 8 |
| | Middle | Callovian | 161.3 ± 7 |
| | | Bathonian | 166.1 ± 7 |
| | | Bajocian | 173.5 ±11.5 |
| | | Aalenian | 178 ±11 |
| | Early | Toarcian | 187 ± 15 |
| | | Pliensbachian | 194.5 ± 5 |
| | | Sinemurian | 203.5 ± 6.5 |
| | | Hettangian | 208 ± 7.5 |
| TRIASSIC | Late | Norian | 223.4 ± 9.5 |
| | | Carnian | 235 ± 4 |
| | Middle | Ladinian | 239.5 ± 6.5 |
| | | Anisian | 241.1 ± 8 |
| | Early | Spathian | (242) |
| | | Smithian | (243) |
| | | Dienerian | (244) |
| | | Griesbachian | 245 ± 9.5 |

### PALEOZOIC

| PERIOD | | EPOCH | STAGE | Ma Age |
|---|---|---|---|---|
| PERMIAN | | Late | | 245 ± 9.5 |
| | | | Changhsingian | 247.5 ± 11 |
| | | | Dzhulfian | 250 ± 12 |
| | | | Capitanian | 252.5 ± 13 |
| | | | Wordian | 255 ± 12 |
| | | Early | Roadian | 260 ± 11 |
| | | | Artinskian | 269 ± 11 |
| | | | Sakmarian | 281.5 ± 13 |
| | | | Asselian | 290 ± 9 |
| CARBONIFEROUS | PENNSYLVANIAN | Late | Gzhelian | 295 ± 6.5 |
| | | | Kasimovian | 303 ± 5 |
| | | | Moscovian | 311.5 ± 9.5 |
| | | | Bashkirian | 323 ± 9 |
| | MISSISSIPPIAN | Early | Serpukhovian | 333 ± 8 |
| | | | Visean | 349.5 ± 4.5 |
| | | | Tournaisian | 362.5 ± 5.5 |
| DEVONIAN | | Late | Famennian | 367 ± 5 |
| | | | Frasnian | 377.5 ± 10 |
| | | Middle | Givetian | |
| | | | Eifelian | |
| | | Early | Emsian | 381 ± 11 |
| | | | Siegenian/Pragian | 386 ± 5.3 |
| | | | | 390.5 ± 12 |
| | | | Gedinnian/Lochkovian | 396.3 ± 11 |
| | | | | 408.5 ± 4.5 |
| SILURIAN | | Late | Pridolian | 411 ± 4 |
| | | | Ludlovian | 424 ± 4 |
| | | Early | Wenlockian | 430.4 ± 9 |
| | | | Llandoverian | 439 ± 7 |
| ORDOVICIAN | | Late | Gamachian | (445) |
| | | | Richmondian | (452) |
| | | | Maysvillian | (458) |
| | | | Edenian | 464 ± 7.5 |
| | | Middle | Trentonian | (467) |
| | | | Blackriverian | (470) |
| | | | Chazyan | (473) |
| | | | Whiterockian | 476 ± 7.5 |
| | | Early | Canadian | 510 ± 9.5 |
| CAMBRIAN | | Late | Trempealeauan | (512) |
| | | | Franconian | (515) |
| | | | Dresbachian | 517.2 ± 17 |
| | | Middle | | 536 ± 5.5 |
| | | Early | Waucoban | (553) |
| | | | Placentian | 570 ± 15 |

### PRECAMBRIAN

| EON | ERA | | PERIOD | Ma Age |
|---|---|---|---|---|
| PROTEROZOIC | | | | 570 |
| | Hadrynian (late) | Neoproterozoic | Neoproterozoic III | 650 |
| | | | Cryogenian | 850 |
| | | | Tonian | 1000 |
| | Helikian (middle) | Mesoproterozoic | Stenian | 1200 |
| | | | Ectasian | 1400 |
| | | | Calymmian | 1600 |
| | Aphebian (early) | Paleoproterozoic | Statherian | 1800 |
| | | | Orosirian | 2050 |
| | | | Rhyacian | 2300 |
| | | | Siderian | 2500 |
| ARCHEAN | Neoarchaean (late) | | | 2800 |
| | Mesoarchaean (middle) | | | 3200 |
| | Paleoarchaean (early) | | | 3600 |
| | Eoarchaean (earliest) | | | base not defined |

208 ± 18 isotopic age for stage boundary & uncertainty; (239) interpolated isotopic age for stage boundary

SRO-1992

## Table 2. Categories and Ranks of Units Defined in This Code*

### A. Material Units

| LITHOSTRATIGRAPHIC | LITHODEMIC | | MAGNETOPOLARITY | BIOSTRATIGRAPHIC | PEDOSTRATIGRAPHIC | ALLOSTRATIGRAPHIC |
|---|---|---|---|---|---|---|
| Supergroup | Supersuite | Complex | | | | |
| Group | Suite | | Polarity Superzone | | | Allogroup |
| *Formation* | *Lithodeme* | | *Polarity zone* | *Biozone* (Interval, Assemblage or Abundance) | *Geosol* | *Alloformation* |
| Member (or Lens, or Tongue) | | | Polarity Subzone | Subbiozone | | Allomember |
| Bed(s) or Flow(s) | | | | | | |

### B. Temporal and Related Chronostratigraphic Units

| CHRONO-STRATIGRAPHIC | GEOCHRONOLOGIC GEOCHRONOMETRIC | POLARITY CHRONO-STRATIGRAPHIC | POLARITY CHRONOLOGIC | DIACHRONIC | |
|---|---|---|---|---|---|
| Eonothem | Eon | Polarity Superchronozone | Polarity Superchron | | |
| Erathem (Supersystem) | Era (Superperiod) | | | | |
| *System* (Subsystem) | *Period* (Subperiod) | *Polarity Chronozone* | *Polarity Chron* | | *Episode* |
| Series | Epoch | | | Diachron | Phase |
| Stage (Substage) | Age (Subage) | Polarity Subchronozone | Polarity Subchron | | Span |
| Chronozone | Chron | | | | Cline |

*Fundamental units are italicized.

# Mineral Exploration Databases

## OUTLINE:

Introduction

Organization of Data and Codes

Exploration and Development - *MINFILE example*

Drill Hole Data - *COALFILE example*

Geochemical Data - *RGS example*

Field Data - *GSB-GDS, GEOF examples*

Summary

**Lecture by:** L. Jones
19 November 1993

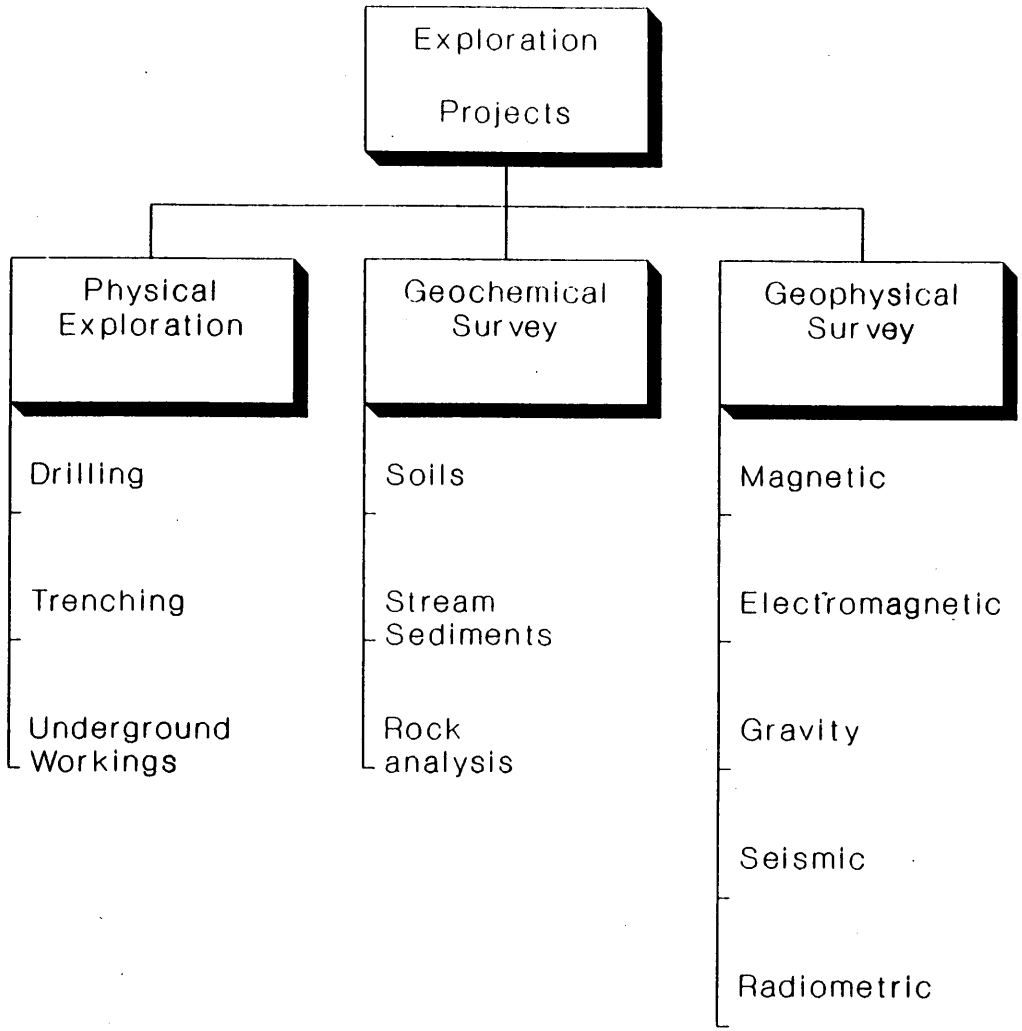
**References:** TECDOC Section 4.5, Annex 6.5

# Mineral Exploration Databases

## GENERAL:

- Exploration projects generate most or all of the **detailed geologic information** in an area of interest.
- Exploration project databases contain **collected data**, such as field measurements, and calculated data, such as analytical work on samples.
- Data **presentation methods** help to evaluate regional trends and locate anomalies.
- **Good record keeping** and **proper indexing** are essential if the raw data is to be reinterpreted at a later time.
- **Modeling and interpretation** methods help to filter, reduce or enhance data.
- **Data-sets are grouped** according to the type of work performed, commonly prospecting, geological, geophysical, geochemical, physical and drilling.
- Global Positioning Systems (**GPS**) are useful for accurately locating sample sites.

# ORGANIZATION OF EXPLORATION PROJECT DATA



# Mineral Exploration Databases

## TYPICAL CONTENTS:

- **Title of project**
- **Jurisdiction**
- **Location** (longitude/latitude)
- **Project Type** (major, minor)
- The **managing company or organization**
- The name, address and telephone of the **project coordinator or manager**
- **Date and type of work done**
- **Exploration budget and cost** of the completed exploration program
- **Notes on pertinent information** such as geological descriptions, plans for the following year, assays, references, etc.

# Structure for EXPLRTN.DBF

| FIELD | FIELD NAME | TYPE | WIDTH | DEC | START | END |
|---|---|---|---|---|---|---|
| 1 | ID_NO | Character | 9 | | 1 | 9 |
| 2 | PROJECT_TITLE | Character | 60 | | 10 | 69 |
| 3 | PROVINCE | Character | 30 | | 70 | 99 |
| 4 | DISTRICT | Character | 30 | | 100 | 29 |
| 5 | LATITUDE | Number | 7 | 5 | 30 | 36 |
| 6 | LONGITUDE | Number | 8 | 5 | 37 | 44 |
| 7 | PROP_TYPE | Character | 1 | | 45 | 45 |
| 8 | ID_NO2 | Character | 9 | | 46 | 54 |
| 9 | ID_NO3 | Character | 9 | | 55 | 63 |
| 10 | EXPAC_DATE | Date | 8 | | 64 | 71 |
| 11 | REV_MAP_NO | Character | 10 | | 72 | 81 |
| 12 | WORK_TYPE | Character | 4 | | 82 | 85 |
| 13 | COMPANY | Character | 30 | | 86 | 115 |
| 14 | MANAGER | Character | 30 | | 116 | 145 |
| 15 | MANAG_TEL | Character | 14 | | 146 | 159 |
| 16 | EXP_BUDGET | Numeric | 13 | 2 | 160 | 172 |
| 17 | PRO_BUDGET | Numeric | 13 | 2 | 173 | 185 |
| 18 | COMPLETED | Logical | 1 | | 186 | 186 |
| 19 | DISCUSSED | Logical | 1 | | 187 | 187 |
| 20 | MDSCREVIEW | Logical | 1 | | 188 | 188 |
| 21 | MDSC_STAGE | Character | 20 | | 189 | 208 |
| 22 | EXPL_NOTES | Memo | 10 | | 209 | 218 |

# Work Type Codes

| TYPE | DESCRIPTION | CATEGORY | D/A UNITS | NUM. UNITS |
|---|---|---|---|---|
| BHDR | Becker Hammer | DRIL | m | hole(s) |
| BIOG | Biogeochemistry | GEOC | | sample(s) |
| CHUD | Churn | DRIL | m | hole(s) |
| DIAD | Diamond surface | DRIL | m | hole(s) |
| DIPN | Dip needle | GEOP | km | |
| EMAB | Electromagnetic, airborne | GEOP | km | |
| EMGR | Electromagnetic, ground | GEOP | km | |
| ETCH | Fission track etch | GEOC | | sample(s) |
| FOTO | Photo | GEOL | ha | |
| GEOL | Geological | GEOL | ha | |
| GRAV | Gravity | GEOP | km | |
| GRSA | Gamma ray spectrometer, airborne | GEOP | km | |
| GRSG | Gamma ray spectrometer, ground | GEOP | km | |
| HMIN | Heavy minerals | GEOC | | sample(s) |
| HYDG | Water | GEOC | | sample(s) |
| INFR | Infra-red | GEOP | km | |
| IPOL | Induced Polarization | GEOP | km | |
| LINE | Line/grid | PHYS | km | |
| LSUR | Legal surveys | PHYS | km | |
| MAGA | Magnetic, airborne | GEOP | km | |
| MAGG | Magnetic, ground | GEOP | km | |
| MALM | Mise-a-la-masse | GEOP | m | |
| META | Metallurgic | GEOC | | sample(s) |
| MNGR | Mineralographic | GEOL | | sample(s) |
| OBDR | Overburden | DRIL | m | hole(s) |
| PERD | Percussion | DRIL | m | hole(s) |
| PETR | Petrographic | GEOL | | sample(s) |
| PITS | Pits | PHYS | | pit(s) |
| PROS | Prospecting | PROS | ha | |
| RADA | Radiometric, airborne | GEOP | km | |
| RADG | Radiometric, ground | GEOP | km | |
| RADP | Radiometric drill hole probing | GEOP | m | |
| RADR | Radar | GEOP | km | |
| RECL | Reclamation | PHYS | ha | |
| REST | Resistivity (alone) | GEOP | km | |
| RGAS | Radon gas scintillometry | GEOP | km | |
| ROAD | Road, local access | PHYS | km | |
| ROCK | Rock | GEOC | | sample(s) |
| ROTD | Rotary | DRIL | m | hole(s) |
| SAMP | Sampling/assaying | GEOC | | sample(s) |
| SCAB | Scintillometer, airborne | GEOP | km | |
| SCGR | Scintillometer, ground | GEOP | km | |
| SEIS | Seismic | GEOP | km | |
| SILT | Silt | GEOC | | sample(s) |
| SOIL | Soil | GEOC | | sample(s) |
| SPOT | Self potential | GEOP | km | |
| STRI | Stripping | PHYS | ha | |
| TOPO | Topographic/photogrammetric | PHYS | ha | |
| TRAL | Trail | PHYS | km | |
| TREN | Trench | PHYS | m | trench(es) |
| UNDD | Diamond underground | DRIL | m | hole(s) |
| UNDV | Underground development | PHYS | m | |
| USUR | Underground surveys | PHYS | m | |

| FIELD | FIELD NAME | TYPE | WIDTH | DEC | MANDATORY |
| --- | --- | --- | --- | --- | --- |
| 1 | PROJ_NO* | Char | 6 | | Y |
| 2 | NOW_NO* | Char | 7 | | Y |
| 3 | NOTIC_DATE | Date | 8 | | Y |
| 3 | OPERATOR | Char | 30 | | Y |
| 4 | MANAGER | Char | 30 | | |
| 5 | MGR_TEL | Char | 14 | | |
| 7 | DEP_TARGET | Char | 70 | | |
| 8 | WORK_TODO | Char | 70 | | |
| 9 | WORK_DONE | Char | 70 | | |
| 10 | WORK_START | Date | 8 | | |
| 11 | WORK_END | Date | 8 | | |
| 12 | EXP_BUD | Num | 13 | 2 | |
| 13 | PROD_BUD | Num | 13 | 2 | |
| 14 | COMPLETED | Logic | 1 | | |
| 15 | DISCUSSED | Logic | 1 | | |
| 16 | MDAPREV | Logic | 1 | | |
| 17 | MDAP_STAGE | Char | 1 | | |
| * | key fields | | | | |

| FIELD | FIELD NAME | TYPE | WIDTH | DEC | MANDATORY |
| --- | --- | --- | --- | --- | --- |
| 1 | PROJ_NO* | Char | 7 | | Y |
| 2 | PROPERTY | Char | 30 | | Y |
| 3 | PROPERTY_2 | Char | 30 | | |
| 4 | OWNER | Char | 30 | | Y |
| 5 | OWNER_2 | Char | 30 | | |
| 6 | OPERATOR | Char | 30 | | Y |
| 7 | PROJ_TYPE | Char | 1 | | Y |
| 8 | MINDIV_C | Char | 4 | | Y |
| 9 | NTSMAP_C | Char | 9 | | Y |
| 10 | DIST_SEQNO | Char | 3 | | |
| 11 | DIST_MAPNO | Char | 3 | | |
| 12 | LAT_DEG | Num | 2 | | Y |
| 13 | LAT_MIN | Num | 2 | | Y |
| 14 | LAT_SEC | Num | 2 | | |
| 15 | LON_DEG | Num | 3 | | Y |
| 16 | LON_MIN | Num | 2 | | Y |
| 17 | LON_SEC | Num | 2 | | |
| 18 | LOC_ACC | Char | 1 | | |
| 19 | CR_DATE | Date | | | |
| 20 | RV_DATE | Date | | | |
| 21 | CHECKED_BY | Char | 5 | | |

* Key field

```
 PROJECT       SCREEN      EDIT      PRINT     OCCURRENCE       HELP
DENT5010                           MINFILE / pc                              30/05/94
                             Exploration Data  | 104B   008 |                  10:57
            Ministry of Energy, Mines and                    ources

                           ---------Projects---------
Project No. :  0100073                   Name:  ESKAY CREEK
                           --------------------------
Project Type:  Major property                 Mining Divs.:    Skeena
Owner       :  PRIME RESOURCES GROUP INC.     NTS Map No. :    104B09W
Operator    :  PRIME RESOURCES GROUP INC.     Latitude    :     56 37 00
                                              Longitude   :    130 27 00
                                              Loc. Cert.  :    Within 500 m
                           --------------------------
Minfile No.          :  104B   008   ESKAY CREEK
District Seq. No.    :  40                           Create date: 24/05/94
District Map No.     :  122                        Revision date: 30/05/94
                                                      Checked by:
                           ---Exploration Notes---
 24/05/94  Project created from Notice of work in MIS interface.

Browse applies only to multiple fields                  | Projects :  143
```

```
DENT5020                           MINFILE / pc                              30/05/94
                              Exploration Data Entry                           11:01
            Ministry of Energy, Mines and Petroleum Resources                REVISE

                           ---------Notices---------
Project No. :  0100073                   Name:  ESKAY CREEK
N.O.W. No.  :  1994-0001  Mineral              Recvd Date :  05/01/94
                           -------------------------
Operator    :  PRIME RESOURCES GROUP INC.      Apprvd Date:  07/01/94
Manager     :  PRIME RESOURCES GROUP INC.      Mgr. Phone :  (604) 684-2345
                           -----------Work----------
Depst Target:  Epithermal
ToDo: Drilling, mapping
Done:
Work start  :  15/01/94   Finish :  31/01/94   Completed   :  N
                           -------------------------
Expl. budget:     $1,000,000                   Discussed   :  N
Prod. budget:                                  Dev. Review:  N
                                               Dev. Stage  :  Prospectus

Cursor to field to change, press enter to modify        | Projects :  143
```

RUN DATE: 05/30/94
RUN TIME: 10:57:40

MINFILE / pc
EXPLORATION MASTER REPORT
GEOLOGICAL SURVEY BRANCH - MINERAL RESOURCES DIVISION
MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES

PAGE: 1
REPORT: RGEN5000

PROJECT NUMBER: **0100073**

PROJECT TYPE: Major property

NAME(S): **ESKAY CREEK**

OWNER(S): PRIME RESOURCES GROUP INC.
NTS MAP: 104B09W
MINING DIVISION: Skeena
DISTRICT MAP NO: 122
SEQUENCE NO: 40

LATITUDE: 56 37 00
LONGITUDE: 130 27 00
LOCATION ACCURACY: Within 500 m

DATE CODED: 05/24/94
DATE REVISED: 05/30/94
CHECKED BY:

NOTICES OF WORK: 1994-0001
MINFILE OCC.'S: 104B 008

NOTICES

NOTICE NUMBER: **1994-0001** Mineral

RECEIVED DATE: 01/05/94
APPROVAL DATE: 01/07/94

OPERATOR: PRIME RESOURCES GROUP INC.
MANAGER: PRIME RESOURCES GROUP INC.

TELEPHONE: (604) 684-2345

DEPOSIT TARGET: Epithermal
WORK TO DO: Drilling, mapping
WORK DONE:

WORK STARTED: 01/15/94 WORK FINISHED: 01/31/94

EXPL. BUDGET: $1,000,000.00
PROD. BUDGET:

COMPLETED: N
DISCUSSED: N
DEVELOPMENT REVIEW: N
DEVELOPMENT STAGE: Prospectus

EXPLORATION NOTES

24/05/94 Project created from Notice of work in MIS interface.
24/05/94 New Notice of work 1994-0001 received in MIS interface.

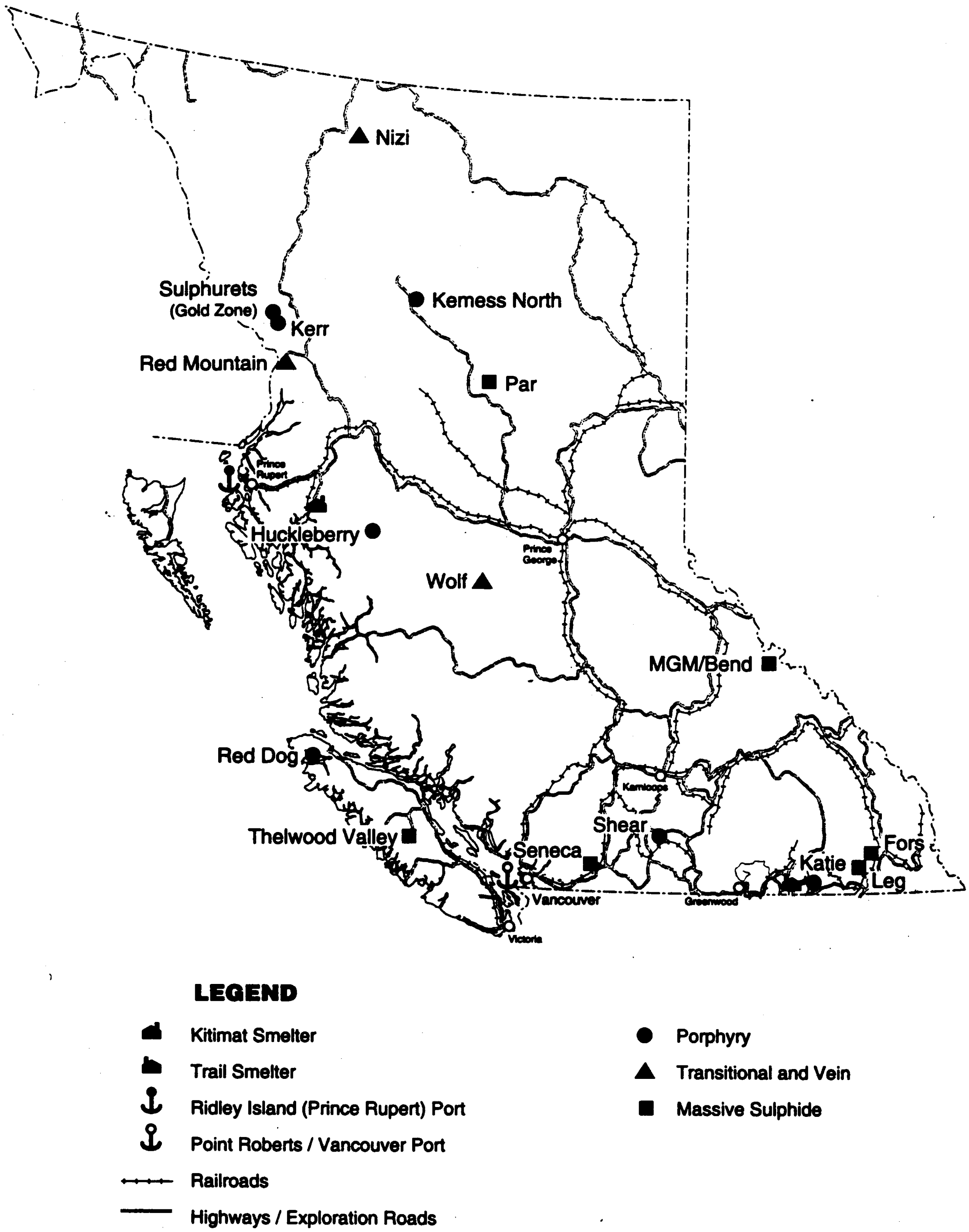
# DATABASE STRUCTURE OF EXPORTED FILES

## QUICKMAP.DBF Template for plotting MINFILE data in QUIKMap.

| Field | Field Name | Type | Width | Description | Example |
|---|---|---|---|---|---|
| 1 | DATA_TYPE | Char | 1 | Data type | S |
| 2 | KEY | Char | 10 | Relational key | 104B 008 |
| 3 | MN_ZONE | Num | 2 | UTM zone | 9 |
| 4 | MN_NORTH | Num | 7 | UTM northing | 6277299 |
| 5 | MN_EAST | Num | 6 | UTM easting | 411052 |
| 6 | MN_LAT_DEG | Num | 2 | Latitude degrees | 56 |
| 7 | MN_LAT_MIN | Num | 2 | Latitude minutes | 38 |
| 8 | MN_LAT_SEC | Num | 2 | Latitude seconds | 0 |
| 9 | MN_LON_DEG | Num | 3 | Longitude degrees | 130 |
| 10 | MN_LON_MIN | Num | 2 | Longitude minutes | 27 |
| 11 | MN_LON_SEC | Num | 2 | Longitude seconds | 0 |
| 12 | SYM_LN_TYP | Num | 2 | Symbol type | 0 |
| 13 | SIZE_THICK | Num | 3 | Symbol size | 5 |
| 14 | DATA_COLOR | Num | 3 | Symbol colour | 15 |
| 15 | HATCH_PATT | Num | 2 | Fill pattern | 0 |
| 16 | LBL_TEXT | Char | 30 | Label text | ESKAY CREEK |
| 17 | LBL_SIZE | Num | 3 | Label size | 5 |
| 18 | LBL_COLOR | Num | 3 | Label colour | 15 |
| 19 | LBL_FONT | Char | 8 | Label font | |
| 20 | LBL_ANGLE | Num | 5,1 | Label rotation | 0.0 |
| 21 | OPERATION | Char | 5 | Operation field | |
| 22 | MAP_INDEX | Char | 6 | NTS map | 104B |
| 23 | STATION | Char | 3 | Map number | 008 |
| 24 | STATUS | Char | 4 | Deposit status code | DEPR |
| 25 | NAME | Char | 30 | MINFILE name | ESKAY CREEK |
| 26 | COMMODITYS | Char | 30 | Commodities | AU,AG,PB,ZN,CU |
| 27 | DEP_TYPE | Char | 5 | Deposit type code | I1 |
| 28 | NTS_MAPNO | Char | 7 | NTS map | 104B09W |

## QUICKPRJ.DBF Template for plotting Project data in QUIKMap.

| Field | Field Name | Type | Width | Description | Example |
|---|---|---|---|---|---|
| 1 | DATA_TYPE | Char | 1 | Data type | S |
| 2 | KEY | Char | 7 | Relational key | 0100073 |
| 3 | MN_LAT_DEG | Num | 2 | Latitude degrees | 56 |
| 4 | MN_LAT_MIN | Num | 2 | Latitude minutes | 37 |
| 5 | MN_LAT_SEC | Num | 2 | Latitude seconds | 0 |
| 6 | MN_LON_DEG | Num | 3 | Longitude degrees | 130 |
| 7 | MN_LON_MIN | Num | 2 | Longitude minutes | 27 |
| 8 | MN_LON_SEC | Num | 2 | Longitude seconds | 0 |
| 9 | SYM_LN_TYP | Num | 2 | Symbol type | 1 |
| 10 | SIZE_THICK | Num | 3 | Symbol size | 5 |
| 11 | DATA_COLOR | Num | 3 | Symbol colour | 15 |
| 12 | HATCH_PATT | Num | 2 | Fill pattern | 0 |
| 13 | LBL_TEXT | Char | 30 | Label text | ESKAY CREEK |
| 14 | LBL_SIZE | Num | 3 | Label size | 5 |
| 15 | LBL_FONT | Char | 8 | Label font | |
| 16 | LBL_ANGLE | Num | 5,1 | Label rotation | 0.0 |
| 17 | LBL_COLOR | Num | 3 | Label colour | 15 |
| 18 | OPERATION | Char | 5 | Operation field | |
| 19 | PROPERTY | Char | 30 | Project name | ESKAY CREEK |
| 20 | OWNER | Char | 30 | Property owner | PRIME RESOURCES |
| 21 | OPERATOR | Char | 30 | Property operator | PRIME RESOURCES |
| 22 | PROJTYPE_C | Char | 1 | Project type code | 1 |
| 23 | PROJTYPE_D | Char | 20 | Project type desc. | Major property |
| 24 | DIST_SEQNO | Char | 3 | Sequence number | 40 |
| 25 | DIST_MAPNO | Char | 3 | Map number | 122 |
| 26 | MINDIV_C | Char | 4 | Mining Division | SKEE |
| 27 | NTSMAP_C | Char | 7 | NTS map | 104B09W |
| 28 | NOW_NO | Char | 9 | Notice of Work number | 1994-0001 |
| 29 | DEP_TARGET | Char | 60 | Deposit target | Epithermal |
| 30 | STAGE_C | Char | 1 | MDAP stage code | 1 |
| 31 | STAGE_D | Char | 15 | MDAP stage description | Prospectus |
| 32 | MINFILENO | Char | 9 | MINFILE number | 104B 008 |
| 33 | NAME | Char | 30 | MINFILE name | ESKAY CREEK |
| 34 | COMMODITYS | Char | 30 | Commodities | AU,AG,PB,ZN,CU |
| 35 | DEP_TYPE | Char | 5 | Deposit type | I1 |
| 36 | STATUS | Char | 4 | Deposit status | DEPR |




*1992*

**Figure 3**
**Exploration Highlight Projects**

| Company Name | Project Name | Commodity | Estimated Tonnes (000s) | Estimated Grade |
|---|---|---|---|---|
| **Porphyry deposits** | | | | |
| Placer Dome Inc. | Kerr | Cu, Au | 126 000 | 0.62% Cu, 0.274 g/t Au |
| Placer Dome Inc. | Sulphurets Gold (Sulphside) | Au, Cu | 18 000 | 0.35% Cu, 0.823 g/t Au |
| New Canamin Res. Ltd. | Huckleberry | Cu, Au | 78 000 | 0.401% Cu, 0.025% MoS2 |
| El Condor Res. Ltd. | Kemess North | Cu, Au | 116 109 | 0.19% Cu, 0.377 g/t Au |
| Placer Dome Inc. | Shear | Cu, Au | n/a | n/a |
| Yellowack Res. Ltd. | Katie | Cu, Au | n/a | n/a |
| Crew Natural Res. Ltd. | Red Dog | Cu, Au, Mo | 25 000 | 0.35% Cu, 0.44g/t Au, 0.006% Mo |
| **Massive Sulphide deposits** | | | | |
| Cominco Ltd. | Par | Pb, Zn, Ag, Ba | n/a | n/a |
| Teck Explorations Ltd. Cominco Ltd. | MGM/Bend | Zn, Pb, Ag | n/a | n/a |
| Kokanee Explorations Ltd., Chapleau Res. Ltd., Barkhor Res. Inc. | Fors | Ag, Pb, Zn | n/a | n/a |
| Kokanee Explorations Ltd., Legion Res. Ltd. | Leg | Zn, Ag, Ba | n/a | n/a |
| Minnova Inc. International Curator Res. Ltd. | Seneca | Zn, Cu, Au, Ag | 533 | 0.91% Cu, 0.22% Pb, 7.06% Zn, 68.8 g/t Ag, 1.44 g/t Au |
| Westmin Resources Ltd. | Thelwood Valley (Myra Falls) | Cu, Pb, Zn, Ag, Au | n/a | n/a |
| **Transitional & Vein deposits** | | | | |
| Lac Minerals Ltd. | Red Mountain (Marc Zone) | Au | 840 | 12.68 g/t Au |
| Gold Fields Canadian Mining Ltd. | Nizi | Au, Ag | n/a | n/a |
| Minnova Inc. | Wolf | Au | n/a | n/a |

*1992*

## Table B
## Exploration Highlight Projects


**LEGEND**

- Kitimat Smelter
- Trail Smelter
- Ridley Island (Prince Rupert) Port
- Point Roberts / Vancouver Port
- Railroads
- Highways / Exploration Roads
- ● Advanced Exploration.
- ▲ Development
- ★ Permitted in 1992

*1992*

**Figure 2**
**Advanced Exploration / Development Highlights**

| COMPANY NAME | PROJECT NAME | COMMODITY | ESTIMATED TONNES (000s) | ESTIMATED GRADE |
|---|---|---|---|---|
| **PORPHYRY DEPOSITS** | | | | |
| Taseko Mines Ltd. | Fish Lake | Cu, Au | 1 080 000 | 0.23% Cu, 0.41 g/t Au |
| El Condor Resources Ltd. | Kemess South | Cu, Au | 207 000 | 0.23% Cu, 0.64 g/t Au |
| St Philips Resources Inc. | | | | |
| Jordex Resources Inc. | Expo/Hushamu | Cu, Au, Mo | 173 260 | 0.25% Cu, 0.31 g/t Au, 0.01% Mo |
| Imperial Metals Corp. | Mount Polley | Cu, Au | 49 000 | 0.38% Cu, 0.55 g/t Au |
| Gibraltar Mines Ltd. | Gibraltar North | Cu | 50 000+ | 0.4% Cu |
| CMP Resources Ltd. | Q R | Au | 1 200 | 5.2 g/t Au |
| Placer Dome Inc. | Mount Milligan | Cu, Au | 284 000 | 0.2% Cu, 0.58 g/t Au |
| **MASSIVE SULPHIDE DEPOSITS** | | | | |
| Westmin Resources Ltd. | Battle Zone/ Myra Falls | Cu, Pb, Zn, Ag, Au | 3 018 | 2.9% Cu, 0.4% Pb, 14.0% Zn, 24.0 g/t Ag, 1.0 g/t Au |
| Geddes Resources Ltd. | Windy Craggy | Cu, Au, Ag, Co | 297 440 | 1.38% Cu, 0.2 g/t Au, 3.83 g/t Ag, 0.069% Co |
| Curragh Resources Ltd | Stronsay | Pb, Zn, Ag | 22 080 | 2.8% Pb, 9.4% Zn, 60 g/t Ag |
| Homestake Canada Ltd. | Eskay Creek 21B | Au, Ag | 1 190 | 59.41 g/t Au, 2659.3 g/t Ag |
| Redfern Resources Ltd. | Tulsequah Chief | Cu, Pb, Zn, Au, Ag | 7 800 | 1.6% Cu, 1.18% Pb, 6.47% Zn, 2.74 g/t Au, 109.72 g/t Ag |
| **TRANSITIONAL & VEIN DEPOSITS** | | | | |
| Equity Silver Mines Ltd. | North Waterline Zone | Cu, Au, Ag | 750 | 0.68% Cu, 209 g/t Ag 4.18 g/t Au |
| Cheni Gold Mines Ltd. | Mets | Au | 53.5 | 11.62 g/t Au |
| Golden Rule Resources Ltd. | | | | |
| Manson Creek Resources Ltd. | | | | |
| Canarc Resources Corp. | Polaris-Taku | Au | 2 590 | 14.74 g/t Au |
| Suntac Minerals Corp. | | | | |
| Newhawk Gold Mines Ltd. | Brucejack Lake | Au, Ag | 749.3 | 15.43 g/t Au, 647.2 g/t Ag |
| Granduc Gold Mines Ltd. | (Bruceside) | | (West Zone) | |
| Fairfield Minerals Ltd. | Elk | Au | 308.4 | 22.18 g/t Au, 24.68 g/t Ag |

***1992***

## Table A
## Advanced Exploration / Development Projects

# Mineral Exploration Databases

## DRILL HOLE DATA:

### Contents:

- Drill hole name, collar location and elevation, and total length of hole
- Downhole survey data
- Lithological descriptions or stratigraphic units
- Sampling and assay data

### Drilling Types:

- Becker hammer, churn, diamond - surface, diamond - underground, overburden, percussion and rotary.

# Drill Hole Data

- four tables
- connected with a unique key (HOLE-ID)
- ASCII or spreadsheet format

1. Drill hole name, collar location and total length of hole
2. Downhole survey data
3. Lithological descriptions
4. Sampling and assay data

Examples of tables:

## Table 14a: Header

| | HOLE-ID | X-COORD | Y-COORD | Z-COORD | LENGTH |
|---|---|---|---|---|---|
| ... | ...... | ...... | | | |
| | KAM-15 | 6684.37 | 456.39 | 118.42 | 185.93 |
| | KAM-16 | 6345.87 | 395.38 | 120.45 | 178.65 |
| | KAM-17 | 7522.26 | 520.15 | 116.72 | 135.58 |
| | KAM-18 | 7254.84 | 486.35 | 123.95 | 215.14 |
| ... | ...... | ...... | | | |

## Table 14b: Survey Data

| HOLE-ID | DISTANCE | AZIMUTH | DIP |
|---|---|---|---|
| ... | ... | ... | ... |
| KAM-16 | 0.00 | 135.0 | 47.1 |
| KAM-16 | 10.00 | 135.3 | 47.0 |
| KAM-16 | 20.00 | 135.4 | 46.8 |
| ... | ... | ... | ... |
| KAM-17 | 0.00 | 127.2 | 60.0 |
| KAM-17 | 25.00 | 127.0 | 59.4 |
| KAM-17 | 50.00 | 126.7 | 59.1 |
| | ... | ... | ... |

## Table 14c: Lithology

| HOLE-ID | FROM | TO | ROCK-TYPE | REMARKS |
|---|---|---|---|---|
| ... | ... | ... | ... | ... |
| KAM-16 | 28.20 | 42.30 | Chlorite schist | Fine-grained, brecciated |
| KAM-16 | 42.30 | 46.50 | Biotite schist | Specks of pyrrhotite |
| KAM-16 | 46.50 | 53.25 | Quartzite | Medium-grained |
| ... | ... | ... | ... | ... |
| KAM-17 | 36.45 | 44.32 | Granite | Coarse-grained |
| KAM-17 | 44.32 | 55.85 | Metagreywacke | Chloritized |
| KAM-17 | 55.85 | 68.56 | Granite gneiss | Fractured |
| | ... | ... | ... | ... |

## Table 14d: Assays

| HOLE-ID | FROM | TO | SAMPLE NO | U-PPM | CU % | etc. |
|---|---|---|---|---|---|---|
| ... | ... | ... | ... | ... | ... | |
| KAM-16 | 42.30 | 43.00 | Ra-654 | 160 | 0.02 | |
| KAM-16 | 43.00 | 44.00 | Ra-655 | 390 | 0.08 | |
| KAM-16 | 44.00 | 45.00 | Ra-656 | 750 | 0.12 | |
| KAM-16 | 45.00 | 46.00 | Ra-657 | 440 | 0.04 | |
| ... | ... | ... | ... | ... | ... | |
| KAM-17 | 45.00 | 46.00 | Ra-713 | 275 | 0.06 | |
| KAM-17 | 46.00 | 47.00 | Ra-714 | 645 | 0.12 | |
| ... | ... | ... | ... | ... | ... | |

# Mineral Exploration Databases

## GEOPHYSICAL DATA:

### Contents:

- Surveyor
- Instruments used
- Analog or digital records
- Area covered
- Station location
- Data measurements and calculations dependent on geophysical method

### Geophysical Types:

- Dip needle, electromagnetic - airborne, electromagnetic - ground, gamma ray spectrometer - airborne, gamma ray spectrometer - ground, gravity, induced polarization, infra-red, magnetic - airborne, magnetic - ground, mise-a-la-masse, radar, radiometric - airborne, radiometric - ground, radiometric - drill hole probing, radon gas scintillometry, resistivity (alone), scintillometer - airborne, scintillometer - ground, seismic, self potential.

# Mineral Exploration Databases

## GEOCHEMICAL DATA:

### Contents:

- ⇒ Source of geochemical data
- ⇒ Sample number
- ⇒ Location of sample site, elevation
- ⇒ Sample material (sediment, soil, water)
- ⇒ Site information (stream parameters, rock type, sample description)
- ⇒ Analytical values for each sample

### Geochemical Types:

- ⇒ Biogeochemistry, fission track etch, heavy minerals, metallurgic, rock, sampling/assaying, silt, soil, water.

# British Columbia
# Regional Geochemical Survey Data

**NTS Map sheet 92N - Mount Waddington : BC RGS 34**

## DATA FILES

**92N.DAT** **- Listings of field and analytical data:**

The field and analytical data for each sample are stored in single, fixed length fields as a flat ASCII file.

## DOCUMENT FILES

**README.DOC** **- The file you are currently reading.**

**FORMAT.DOC** **- Data format for recorded field observations and analytical results.**

Explanation of codes for field variables.

**92N.DOC** **- A description of sample collection, analysis, and preparation details**

Codes for geological formations.

# Format Specification for Regional Geochemical Survey Data (RGS)

| FIELD | DESCRIPTION | COLUMNS | TYPE | LENGTH | EXAMPLE |
|---|---|---|---|---|---|
| 01 | NTS Map-Sheet | 001-006 | A | 6 | 104N16 |
| 02 | ID (Year,Crew,Number) | 007-012 | N | 6 | 841102 |
| 03 | UTM Zone | 013-014 | N | 2 | 10 |
| 04 | UTM East (Metres) | 015-020 | N | 6 | 544654 |
| 05 | UTM North (Metres) | 021-027 | N | 7 | 5911939 |
| 06 | Elevation (Metres) | 028-031 | N | 4 | 1500 |
| 07 | Sample Material | 032 | N | 1 | 8 |
| 08 | Replicate Status | 033-034 | N | 2 | 10 |
| 09 | Formation | 035-038 | A | 4 | lJBv |
| 10 | Rock Type | 039-042 | A | 4 | GRNT |
| 11 | Age | 043-044 | N | 2 | 64 |
| 12 | Source of Water | 045 | N | 1 | 2 |
| 13 | Stream Order | 046 | N | 1 | 1 |
| 14 | Stream Type | 047 | N | 1 | 2 |
| 15 | Physiography | 048 | N | 1 | 3 |
| 16 | Drainage Pattern | 049 | N | 1 | 2 |
| 17 | Contamination | 050 | N | 1 | 3 |
| 18 | Stream Width (metres) | 051-054 | N | 4 (1) | 10.5 |
| 19 | Stream Depth (cm) | 055-57 | N | 3 | 220 |
| 20 | Stream Flow Rate | 058 | N | 1 | 1 |
| 21 | Water Colour | 059 | N | 1 | 3 |
| 22 | Bank Type | 060 | N | 1 | 3 |
| 23 | Bank Precipitate | 061 | N | 1 | 2 |
| 24 | Sediment Composition | 062-064 | N | 3 | 111 |
| 25 | Sediment Colour | 065 | N | 1 | 5 |
| 26 | Sediment Precipitate | 066 | N | 1 | 2 |
| 27 | Channel Bed Type | 067 | N | 1 | 3 |
| 28 | Channel Pattern | 068 | N | 1 | 4 |
| 29 | Moss-mat Position | 069-071 | N | 3 (1) | 2.5 |
| 30 | Moss-mat Colour | 072 | N | 1 | 2 |
| 31 | Moss-mat Health | 073 | N | 1 | 1 |
| 32 | Moss-mat Host | 074 | N | 1 | 3 |
| 33 | Thickness of Moss-mat | 075 | N | 1 | 10 |
| 34 | Blanks | 076-080 | N | 5 | ? |
| 34 | pH of stream waters | 081-085 | N | 5 (1) | 7.0 |
| 35 | Uranium in waters (ppb) | 086-090 | N | 5 (2) | 0.12 |
| 36 | Fluorine in waters (ppb) | 091-095 | N | 5 | 34 |
| 37 | Zinc (ppm) | 096-100 | N | 5 | 47 |
| 38 | Copper (ppm) | 101-105 | N | 5 | 79 |
| 39 | Lead (ppm) | 106-110 | N | 5 | 12 |
| 40 | Nickel (ppm) | 111-115 | N | 5 | 26 |
| 41 | Cobalt (ppm) | 116-120 | N | 5 | 33 |
| 42 | Silver (ppm) | 121-125 | N | 5 (1) | 1.7 |
| 43 | Manganese (ppm) | 126-130 | N | 5 | 310 |
| 44 | Iron (%) | 131-135 | N | 5 (2) | 3.80 |
| 45 | Molybdenum (ppm) | 136-140 | N | 5 | 10 |
| 46 | Uranium (ppm) | 141-145 | N | 5 (1) | 4.5 |
| 47 | Tungsten (ppm) | 146-150 | N | 5 | 6 |
| 48 | Tin (ppm) | 151-155 | N | 5 | 5 |
| 49 | Mercury (ppm) | 156-160 | N | 5 | 30 |
| 50 | Arsenic (ppm) | 161-165 | N | 5 | 14 |
| 51 | Antimony (ppm) | 166-170 | N | 5 (1) | 0.3 |
| 52 | Barium (ppm) | 171-175 | N | 5 | 754 |
| 53 | Cadmium (ppm) | 176-180 | N | 5 (1) | 0.7 |
| 54 | Vanadium (ppm) | 181-185 | N | 5 | 310 |
| 55 | Bismuth (ppm) | 186-190 | N | 5 (1) | 0.6 |
| 56 | Chromium (ppm) | 191-195 | N | 5 | 88 |
| 57 | LOI (%) | 196-200 | N | 5 (1) | 8.3 |
| 58 | Fluorine (ppm) | 201-205 | N | 5 | 400 |
| 59 | Gold(1st analysis) (ppb) | 206-210 | N | 5 | 78 |
| 60 | Sample Weight Au1 (gm) | 211-215 | N | 5 (1) | 10.0 |
| 61 | Gold (Repeat) (ppb) | 216-220 | N | 5 | 2000 |
| 62 | Sample Weight Au2 (gm) | 221-225 | N | 5 (1) | 10.0 |

## TABLE 6-2-2.
## RECORD FORMAT FOR INDIVIDUAL SAMPLES

### Record 1: Field Information

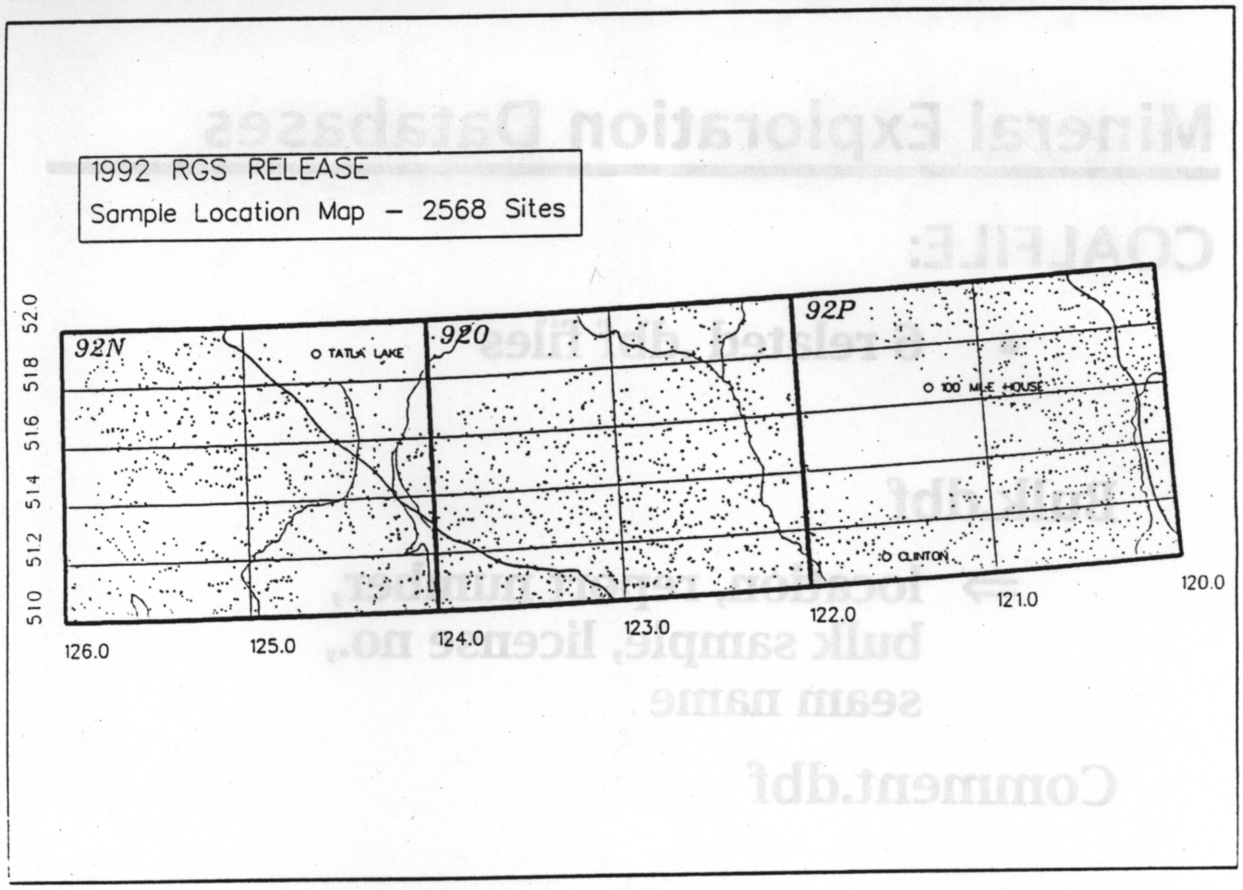
| Field | Description | | Record | Columns | Length | Example |
|---|---|---|---|---|---|---|
| 01 | Map Sheet | | 1 | 01-06 | 6 | 104N16 |
| 02 | ID | (Year, Crew, Number) | 1 | 07-12 | 6 | 841102 |
| 03 | UTM Zone | | 1 | 14-15 | 2 | 10 |
| 04 | UTM Easting | (Metres) | 1 | 16-21 | 6 | 544654 |
| 05 | UTM Northing | (Metres) | 1 | 22-28 | 7 | 5911939 |
| 06 | Rock Type | | 1 | 30-33 | 4 | GRNT |
| 07 | Stratigraphic Age | | 1 | 34-35 | 2 | 36 |
| 08 | Stream Width | (Decimetres) | 1 | 37-39 | 3 | 35 |
| 09 | Stream Depth | (Decimetres) | 1 | 40-42 | 3 | 3 |
| 10 | Elevation | (Metres) | 1 | 43-46 | 4 | 750 |
| 11 | Sample Material | | 1 | 47 | 1 | 6 |
| 12 | Replicate Status | | 1 | 48-49 | 2 | 00 |
| 13 | Contamination | | 1 | 51 | 1 | 1 |
| 14 | Bank Type | | 1 | 52 | 1 | 3 |
| 15 | Water Colour | | 1 | 53 | 1 | 2 |
| 16 | Water Flow Rate | | 1 | 54 | 1 | 2 |
| 17 | Sediment Colour | | 1 | 55 | 1 | 6 |
| 18 | Sediment Composition | | 1 | 56-58 | 3 | 013 |
| 19 | Stream Precipitate | | 1 | 60 | 1 | 2 |
| 20 | Local Precipitate | | 1 | 61 | 1 | 3 |
| 21 | Physiography | | 1 | 62 | 1 | 2 |
| 22 | Drainage Pattern | | 1 | 63 | 1 | 2 |
| 23 | Stream Type | | 1 | 64 | 1 | 1 |
| 24 | Stream Class | | 1 | 65 | 1 | 3 |
| 25 | Stream Source | | 1 | 66 | 1 | 4 |
| 26 | Date Collected | (Day, Month) | 1 | 68-71 | 4 | 1908 |

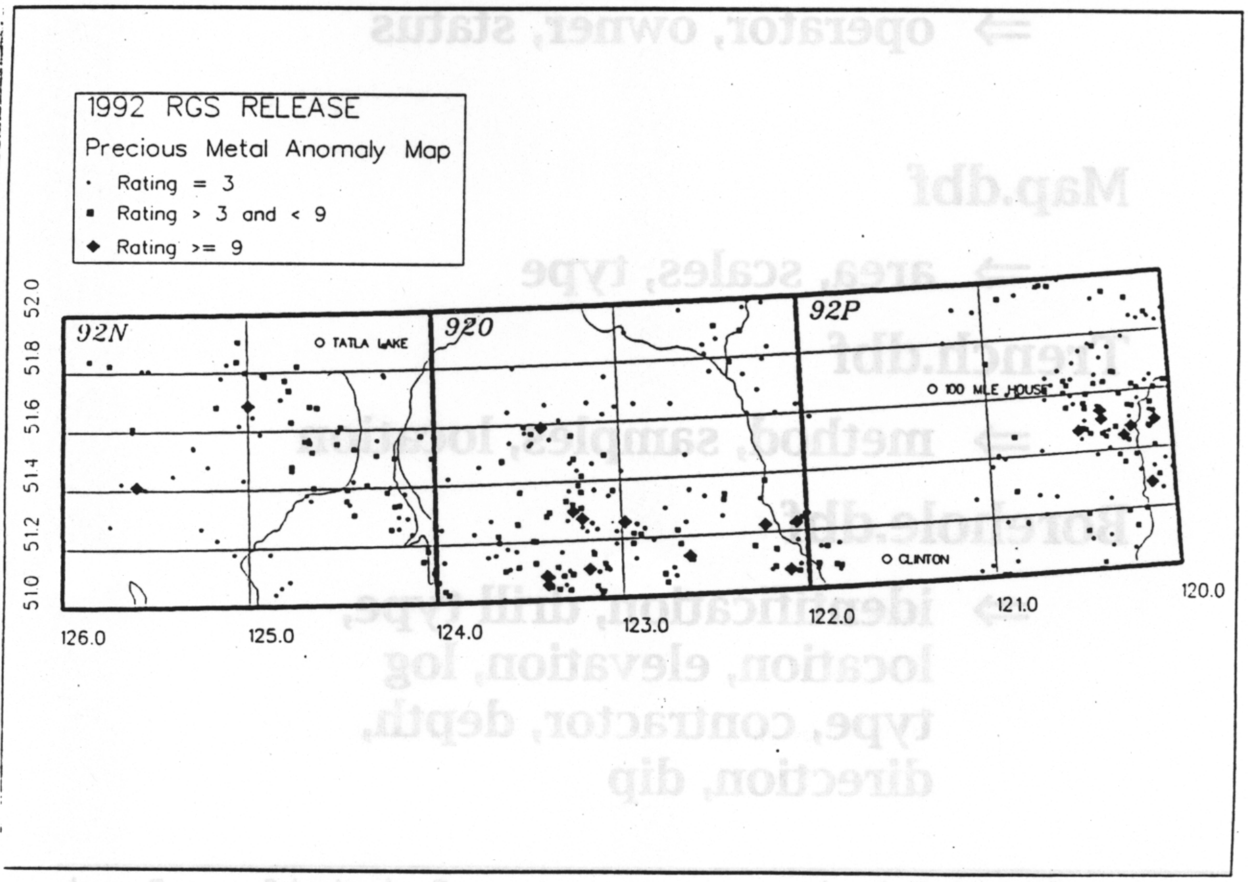
### Record 2: (Map Sheet) ID and Analytical Data

| Field | Description | | Record | Columns | Length | Example |
|---|---|---|---|---|---|---|
| 01 | Map Sheet | | 2 | 01-06 | 6 | 104N16 |
| 02 | ID | (Year, Crew, Number) | 2 | 07-12 | 6 | 841102 |
| 03 | Zinc | (PPM) | 2 | 16-20 | 5 | 70 |
| 04 | Copper | (PPM) | 2 | 21-25 | 5 | 39 |
| 05 | Lead | (PPM) | 2 | 26-30 | 5 | 2 |
| 06 | Nickel | (PPM) | 2 | 31-35 | 5 | 50 |
| 07 | Cobalt | (PPM) | 2 | 36-40 | 5 | 19 |
| 08 | Silver | (PPM) | 2 | 41-45 | 5 | 0.1 |
| 09 | Manganese | (PPM) | 2 | 46-50 | 5 | 680 |
| 10 | Iron | (PCT) | 2 | 51-55 | 5 | 3.00 |
| 11 | Molybdenum | (PPM) | 2 | 56-60 | 5 | 2 |
| 12 | Tungsten | (PPM) | 2 | 61-65 | 5 | 10 |
| 13 | Tin | (PPM) | 2 | 66-70 | 5 | 4 |
| 14 | Barium | (PPM) | 2 | 71-75 | 5 | 250 |
| 15 | Loi | (PCT) | 2 | 76-79 | 4 | 23.2 |

### Record 3: (Map Sheet) ID and Remainder of the Analytical Data

| Field | Description | | Record | Columns | Length | Example |
|---|---|---|---|---|---|---|
| 01 | Map Sheet | | 3 | 01-06 | 6 | 104N16 |
| 02 | ID | (Year, Crew, Number) | 3 | 07-12 | 6 | 841102 |
| 03 | Arsenic | (PPM) | 3 | 16-20 | 5 | 3.0 |
| 04 | Antimony | (PPM) | 3 | 21-25 | 5 | 4.2 |
| 05 | Mercury | (PPB) | 3 | 26-30 | 5 | 10 |
| 06 | Optional Element 1 | | 3 | 31-35 | 5 | |
| 07 | Optional Element 2 | | 3 | 36-40 | 5 | |
| 08 | Optional Element 3 | | 3 | 41-45 | 5 | |
| 09 | Optional Element 4 | | 3 | 46-49 | 4 | |
| 10 | Cadmium | (PPM) | 3 | 50-54 | 5 | 2.5 |
| 11 | Vanadium | (PPM) | 3 | 55-59 | 5 | 125 |
| 12 | Uranium | (PPM) | 3 | 60-64 | 5 | 2.0 |
| 13 | Uranium in Water | (PPB) | 3 | 65-69 | 5 | 0.46 |
| 14 | Fluorine in Water | (PPB) | 3 | 70-74 | 5 | 62 |
| 15 | pH of Stream Water | | 3 | 75-79 | 5 | 8.3 |


1992 RGS RELEASE
Sample Location Map – 2568 Sites
92N
92O
92P
TATLA LAKE
100 MILE HOUSE
CLINTON
52.0
51.8
51.6
51.4
51.2
51.0
126.0
125.0
124.0
123.0
122.0
121.0
120.0


1992 RGS RELEASE
Precious Metal Anomaly Map
Rating = 3
Rating > 3 and < 9
Rating >= 9
92N
92O
92P
TATLA LAKE
100 MILE HOUSE
CLINTON
52.0
51.8
51.6
51.4
51.2
51.0
126.0
125.0
124.0
123.0
122.0
121.0
120.0

# Mineral Exploration Databases

## COALFILE:

- 6 related .dbf files

### Bulk.dbf

⇒ location, report number, bulk sample, license no., seam name

### Comment.dbf

### Explore.dbf

⇒ operator, owner, status

### Map.dbf

⇒ area, scales, type

### Trench.dbf

⇒ method, samples, location

### Borehole.dbf

⇒ identification, drill type, location, elevation, log type, contractor, depth, direction, dip

# Mineral Exploration Databases

## FIELD DATA:

### Recommended Features for a Field Data System:

- √ Easy retrieval, sorting and manipulation of field data to assist in map compilation and plotting.
- √ Ability to create page size to map size plots at any scale.
- √ Ability to retrieve data and create reports and tables.
- √ Consistency in the way field data is collected and reported.
- √ Geologic databases created can be incorporated into a GIS and automated map plotting system.
- √ Ability to use dBASE files that are related to each other by station number.

# Mineral Exploration Databases

## FIELD DATA (cont.):

### Contents:

- ⇒ Station location, longitude/latitude, traverse, map area
- ⇒ Structural measurements
- ⇒ Mineral occurrence data
- ⇒ Rock types and alteration data
- ⇒ Descriptive notes
- ⇒ Analytical results of geochemical data
- ⇒ Radiometric age dates
- ⇒ Fossil name and age
- ⇒ Isotope analyses
- ⇒ Photo number
- ⇒ Petrographic data
- ⇒ Date and coder

### Field Data Types:

- ⇒ **Geological**: geological, petrographic, photo.
- ⇒ **Physical**: legal surveys, line/grid, pits, reclamation, road, local access, stripping, topographic/ photogrammetric, trail, trench, underground development, underground surveys.

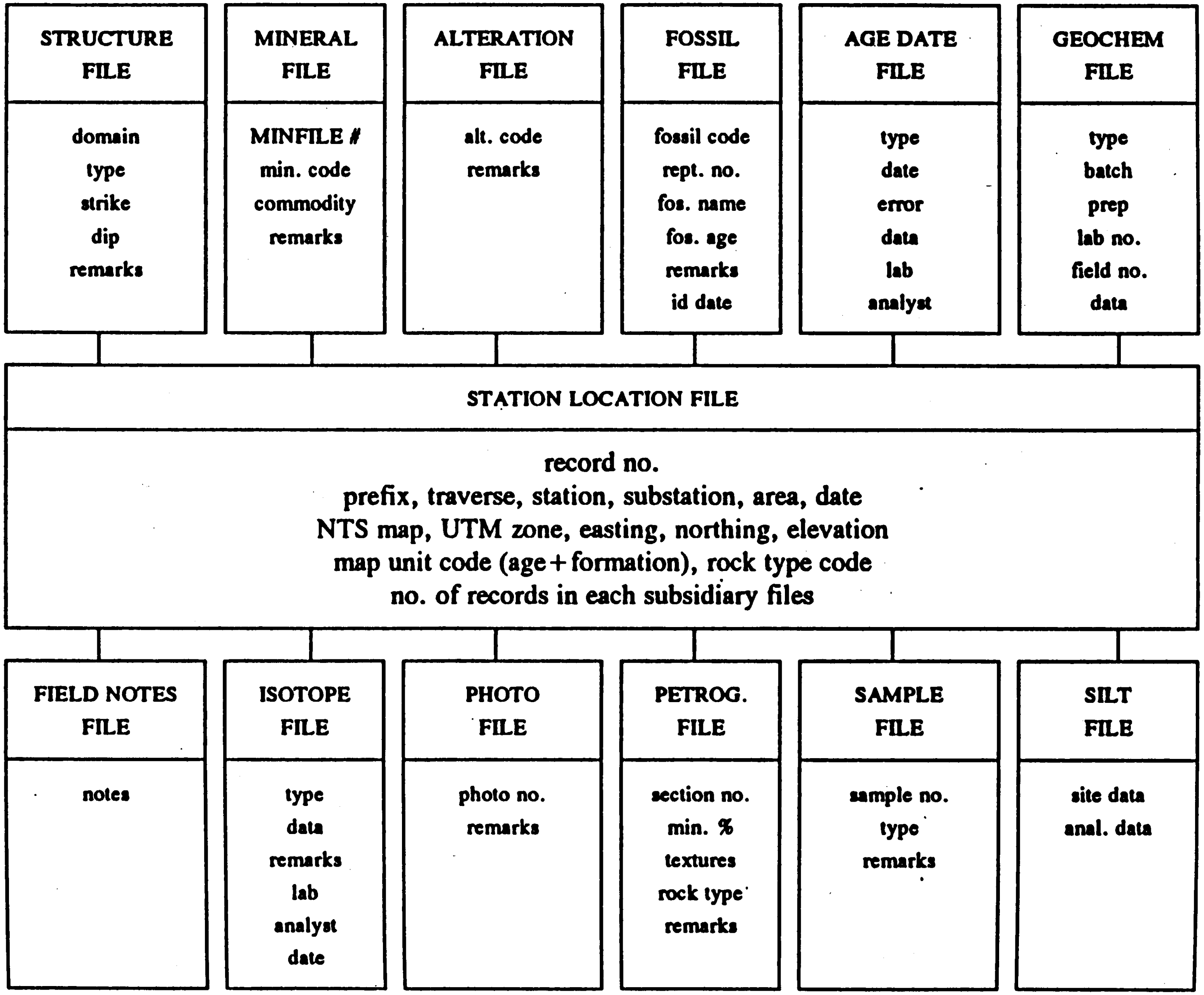



**Figure 1.** Relational structure of the Geological Database System. Records in related files are linked to the station location file by station number. Related files also contain location coordinates and can "stand alone" for plotting purposes.

GEOLOGICAL SURVEY OF CANADA COMMISSION GÉOLOGIQUE DU CANADA

# GEOF

## A COMPUTER PROGRAM TO TRANSLATE ORGANIZED ASCII COMPUTER GEOLOGICAL FIELDNOTES TO DATABASE READABLE STRUCTURE

GEOF (Geological Editor Of Fieldnotes)
Copyright November 1, 1991.

A. Atrens[1], L.C. Struik[2] and A. Haynes[2]

1993

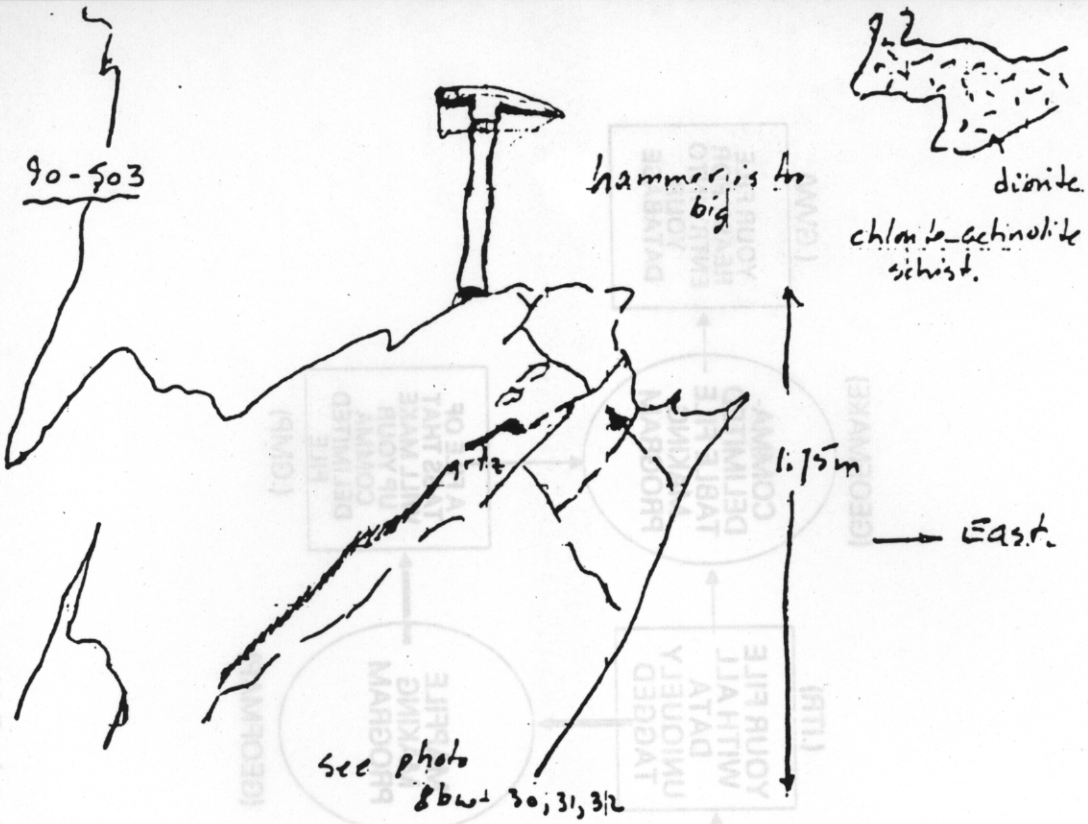
Open File 2618

[1]Statistics Canada
Ottawa

[2]Geological Survey of Canada, Cordilleran Division
Vancouver

Énergie, Mines et Ressources Canada
Energy, Mines and Resources Canada

Canada




```
90-503
E473580
N6110675
1470
!to here have flattened diorite and
actinolite_schist;
o/c
!sos;
#
quartzite
white, lite_grey;
-qtz mm0.3-0.5;
...
BEDG cm40-80;
!thickness of the quartzite bed.  The
schist (metatuff?) is thicker on either
side, and is intruded by diorite;
..
@90-503 quartzite;
F1 340/09;
S1 162/50w;
diag;
PIC 8bw-30,31,32 !of anticline of
quartzite and schist.  Looking to the
northwest with hammer at the top, pick
point to the east;
```

**Figure 1.** A sample set of field notes as typed onto the Atari Portfolio editor.

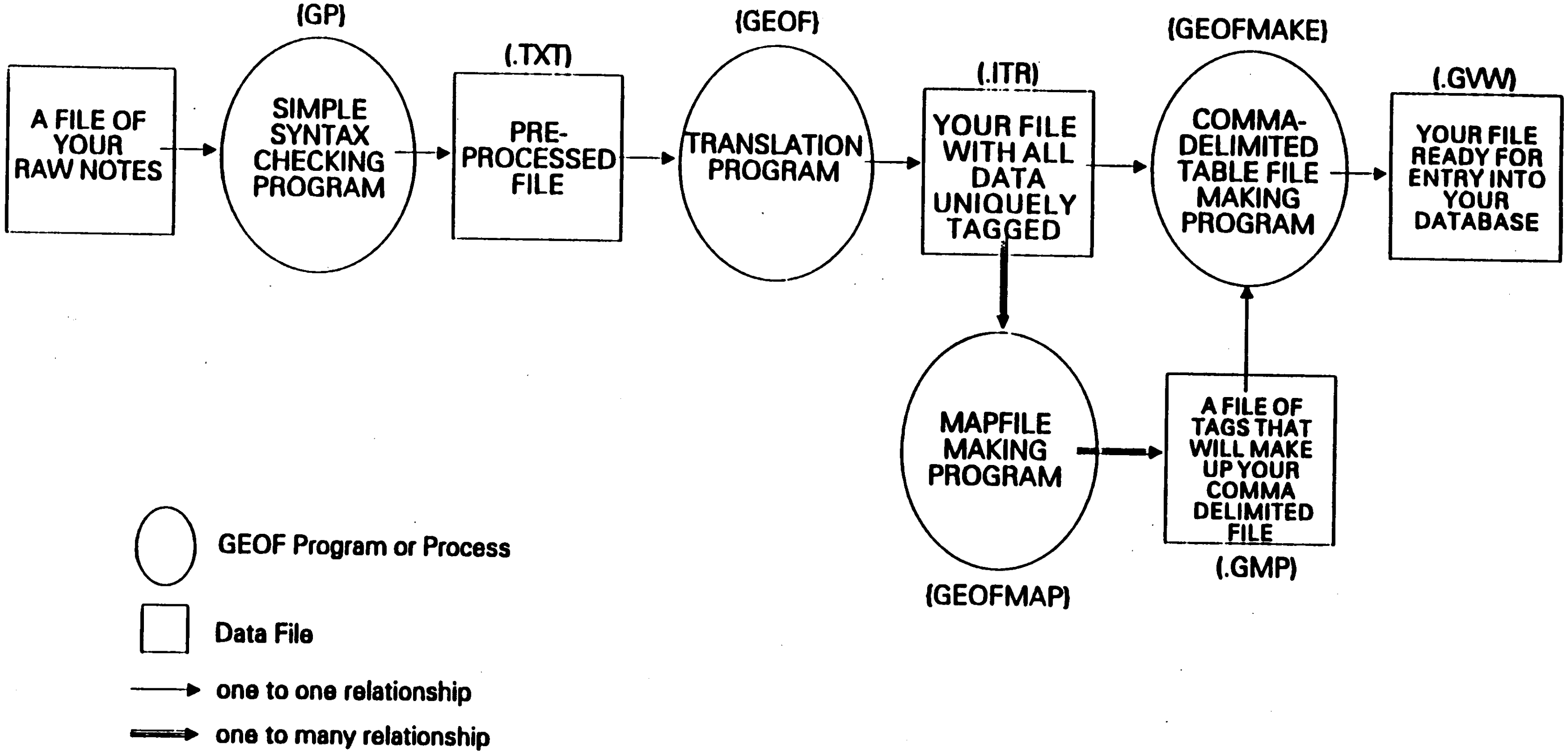



Figure 2. This flow-diagram shows the steps in the GEOF system of translating the field notes to comma-delimited files of data.

# Earth Science Information Databases

## OUTLINE:

Introduction

Indexes

Codes and Key Terms

Published Systems - *GEOSCAN, GEOREF*

PC-based Systems - *PROCITE*

Un-published Systems - *GSB Index, ARIS*

Summary

**Lecture by:** L. Jones
19 November 1993

**References:** TECDOC Section 4.3, Annexes 6.2 and 6.3

# ORGANIZATION OF EARTH SCIENCE DATABASES

**Data Directory**
(Master database)

- **Earth Science Bibliographies**
- **Index of Geological Mapping**
- **Index of Air Photography**
- **Index of Geohysical Mapping**
- **Index of Geochemical Mapping**
- **Index of Drill Holes**

# Earth Science Information Databases

## BIBLIOGRAPHIES:

⇒ **Published** geoscience material is collected systematically by several organizations on a global scale.

⇒ A **thesaurus** is a guide to the usage of keywords (indexing terms), their hierarchical relationships and synonyms.

⇒ **Unpublished** bibliographic data on geoscience material includes reports and maps in the archives of geological surveys and exploration and mining companies.

# Earth Science Information Databases

## EXAMPLE OF DATA ELEMENTS FOR UNPUBLISHED REPORTS:

- Title of report
- Name(s) of author(s)
- Name of source organization
- Name of report series
- Serial number or code of report
- Number or range of pages
- Notes on illustrations, appendices, maps
- Year of report
- Types and scales of maps in the report
- Language of report
- Subject keywords
- Geographic names
- Longitude/ latitude
- Text of abstract
- Free field for comments
- Location of document
- Name and date of recorder

# Earth Science Information Databases

## INDEXES

Data Elements for **Geological**, **Geophysical**, **Geochemical** and **Topographic Map** Indexes:

- **Title** and **year** of publication
- Name(s) of **author**(s)
- Name and address of **organization** that serves as repositories for data
- Name of **report** series
- **Serial** and number of publication
- **Map projection** and **scale**
- **Country and geographic area**
- **Area** covered in square kilometers
- **Longitude/ latitude** of the boundaries of map coverage and center of map
- **Form of data release** (hard copy: paper; digital: file type and size, media format, hardware and software compatibility)
- **Availability**
- Free field for **comments**

# Earth Science Information Databases

## INDEXES (cont.)

### Geological map indexes

⇒ typically contain mappable rock units, structural elements observed and type of samples taken

### Geophysical map indexes

⇒ typically contain the kind of geophysical data and its characteristics and details about the survey, such as spacing of flight lines and flight characteristics

### Geochemical map indexes

⇒ typically contain the type of sample and analytical methodologies used for each sample type

### Topographic map indexes

⇒ typically contain contour interval and features

# Earth Science Information Databases

## INDEXES (cont.)

Data Elements for **Air Photography Indexes**:

- ⇒ Listing of organizations that provide air photos
- ⇒ Agency code
- ⇒ Date of coverage
- ⇒ Scale of photography
- ⇒ Focal length of lens used
- ⇒ Type of film
- ⇒ Cloud cover
- ⇒ Location, such as coordinates of the corners of each photograph

# Earth Science Information Databases

## INDEXES (cont.)

Data Elements for **Drill Hole Indexes**:

⇒ Record number
⇒ Name of organization or project
⇒ Identification number
⇒ Location
⇒ Bearing and inclination
⇒ Total length
⇒ Location of drill core
⇒ Location of drill hole log or report

# COUNTRY CODES

| MAP-CODE | COMPLETE COUNTRY NAME |
|---|---|
| AFG | Afghanistan |
| ALG | Algeria |
| ANG | Angola |
| ARG | Argentina |
| AUL | Australia |
| AUS | Austria |
| BEN | Benin |
| BGD | Bangladesh |
| BOL | Bolivia |
| BOT | Botswana |
| BRA | Brazil |
| BUL | Bulgaria |
| BUR | Burma |
| BDI | Burundi |
| CMR | Cameroon |
| CAN | Canada |
| CAR | Central African Republic |
| CHD | Chad |
| CHI | Chile |
| CPR | People's Republic of China |
| COL | Columbia |
| PRC | Congo |
| COS | Costa Rica |
| CUB | Cuba |
| CZE | Czechoslovakia |
| ECU | Ecuador |
| EGY | Egypt |
| ETH | Ethiopia |
| FIN | Finland |
| FRA | France |
| GAB | Gabon |
| GMY | Germany |
| GHA | Ghana |
| GRE | Greece |
| GRN | Greenland |
| GUA | Guatemala |
| GUI | Guinea |
| HUN | Hungary |
| IND | India |
| INS | Indonesia |
| IRA | Iran, Islamic Republic of |
| ISR | Israel |
| ITA | Italy |
| JPN | Japan |
| JOR | Jordan |
| ROK | Korea, Republic of |
| LES | Lesotho |
| MAG | Madagascar |
| MLW | Malawi |
| MAL | Malaysia |
| MLI | Mali |
| MAU | Mauritania |
| MEX | Mexico |
| MOR | Morocco |
| MOZ | Mozambique |
| NAM | Nambia |
| NZE | New Zealand |
| NER | Niger |
| NIR | Nigeria |
| NOR | Norway |
| PAK | Pakistan |
| PAR | Paraguay |
| PER | Peru |
| PHI | Philippines |
| POL | Poland |
| POR | Portugal |
| ROM | Romania |
| RWA | Rwanda |
| SAU | Saudi Arabia |
| SEN | Senegal |
| SOM | Somalia |
| SAF | South Africa |
| SPA | Spain |
| SUD | Sudan |
| SWA | Swaziland |
| SWE | Sweden |
| THA | Thailand |
| TOG | Togo |
| TUN | Tunisia |
| TUR | Turkey |
| UGA | Uganda |
| UK | United Kingdom |
| TNZ | United Republic of Tanzania |
| URU | Uruguay |
| USA | United States of America |
| SSR | USSR |
| VEN | Venezuela |
| YUG | Yugoslavia |
| ZAI | Zaire |
| ZAM | Zambia |
| ZIM | Zimbabwe |

## LANGUAGE CODES

| LANGUAGE | ABBREVIATION | LANGUAGE | ABBREVIATION |
|---|---|---|---|
| Afrikaans | AF | Korean | KO |
| Albanian | AL | Kurdish | KU |
| Arabic | AR | Laotian | LO |
| Armenian | AM | Latin | LA |
| Azerbaijani | AZ | Latvian | LV |
| Basque | BA | Lithuanian | LI |
| Belorussian | BE | Macedonian | MC |
| Bengali | BN | Malagasy | ML |
| Bulgarian | BU | Malaysian | MA |
| Burmese | BR | Moldavian | MD |
| Cambodian | CM | Mongol | MG |
| Catalan | CA | Norwegian | NO |
| Chinese | CH | Panjabi | PJ |
| Croatian | CR | Perisan | PE |
| Czech | CZ | Polish | PO |
| Danish | DA | Portuguese | PR |
| Dutch | DU | Provencal | PV |
| English | EN | Romanian | RO |
| Eskimo | EK | Romansh | RH |
| Estonian | ES | Russian | RU |
| Faroese | FA | Serbian | SE |
| Finnish | FI | Sinhalese | SI |
| Flemish | FL | Slovakian | SL |
| French | FR | Slovenian | SV |
| Gaelic | GL | Spanish | SP |
| Georgian | GG | Swahili | SH |
| German | GE | Swedish | SW |
| Greek | GR | Tadzhikistan | TA |
| Gujerati | GU | Tagalog | TG |
| Hebrew | HE | Tamil | TM |
| Hindi | HI | Thai | TH |
| Hungarian | HU | Turkish | TU |
| Icelandic | IC | Turkmenistan | TR |
| Indonesian | IN | Ukrainian | UK |
| Italian | IT | Urdu | UR |
| Japanese | JA | Uzbekistan | UZ |
| Kazakhstan | KZ | Vietnamese | VN |
| Kirghiz | KI | Welsh | WL |

# CLASSIFICATION CODES (AGI)

Reference

SHIMOMURA, Ruth H. (Editor), GeoRef Thesaurus and Guide to Indexing; *America Geological Institute*, (1989) 731 p.

## Category Codes

01 Mineralogy and Crystallography (mineral data, crystal structure, crystal chemistry, crystal growth, phase equilibria, etc.)

02 Geochemistry (surveys, trace elements, isotopes, cycles, instruments, etc.)

03 Geochronology (absolute age, fission-track, time scales, tephrochronology, tree rings, exposure age, etc.)

04 Extraterrestrial geology (Moon, Venus, Mars, Mercury-Planet, Jupiter, Planetology, etc.)

05 Petrology, Igneous and metamorphic (Igneous rocks, metamorphic rocks, metasomatism, metamorphism, phase equilibria, magmas, lava, intrusions, inclusions, etc.)

06 Petrology, sedimentary (sedimentary rocks, sediments, sedimentation, diagenesis, sedimentary structures, etc.)

07 Marine geology and oceanography (ocean floors, ocean basins, ocean waves, circulation, continental shelf, continental slope, etc.)

08 Paleontology, general (studies on fossil plants and animals, concepts, life origin, applications, methods, etc.)

09 Paleontology, paleobotany (fossil plants, palynology)

10 Paleontology, invertebrate (taxonomy, morphology, evolution, etc.)

11 Paleontology, vertebrate (taxonomy, morphology, evolution, etc.)

12 Stratigraphy, historical geology and paleoecology (biostratigraphy, lithostratigraphy, evolution of land masses, paleomagnetism, paleogeography, biogeography, etc.)

13 Areal geology, general (area studies dealing with more than one aspect of geology)

14 Areal geology, maps and charts (maps, cross sections, diagrams, with no separate text)

15 Miscellaneous and mathematical geology (biography, bibliography, annual reports, popular and elementary geology, mathematical principles, historical accounts, etc.)

16 Structural geology (tectonics, folds, faults, fractures, structural analysis, orogeny, etc.)

17 Geophysics, general (theoretical studies, experimental studies, models, observatories, etc.)

18 Geophysics, solid-earth (tectonophysics, plate tectonics, sea-floor spreading, crust, mantle, core, paleomagnetism, plate tectonics, etc.)

19 Geophysics, seismology (earthquakes, elastic waves, etc.)

20 Geophysics, applied (geophysical surveys, geophysical methods)

21 Hydrogeology and hydrology (ground water, drainage systems, recharge, hydrochemistry, etc.)

22 Engineering and environmental geology (foundations, earthquakes, dams, reservoirs, storage, rock mechanics, soil mechanics, pollution, conservation, reclamation, etc.)

23 Surficial geology, geomorphology (landform description, landform evolution, environment, etc.)

24 Surficial geology, Quaternary geology (glacial features, glaciation, sediments, palynology, stratigraphy, etc.)

25 Surficial geology, soils (genesis, morphology, composition, etc.)

26 Economic geology, general and mining geology (mineral resources, water resources, production, concepts)

27 Economic geology, metals

28 Economic geology, non-metals

29 Economic geology, energy sources (petroleum, gas, coal, oil shale, geothermal energy, etc.)

# CLASSIFICATION CODES (BRGM-CNRS)

Reference

PASCAL GEODE Lexique, Francais-Anglais, Sciences de la Terre - Earth Sciences, *CNRS-BRGM*, (1986) 289 p.

## Earth Sciences

**220 MINERALOGY, GEOCHEMISTRY, EXTRATERRESTRIAL GEOLOGY**

**A. Mineralogy**

01 Mineralogy: general, methodology, regional studies
02 Silicates
03 Non-silicates

**B. Geochemistry**

01 Geochemistry: general, methodology, regional studies
02 Water geochemistry
03 Soil and rock geochemistry

**C. Isotopic Geochemistry, Geochronology**

01 Isotopic geochemistry
02 Geochronology

**D. Cosmochemistry, Extraterrestrial Geology**

01 Extraterrestrial geology
02 Meteorites, Tectites, Impactites

**221 METALLIC AND NON-METALLIC DEPOSITS**

**A. Metallic and Non Metallic Deposits**

01 Geochemical exploration, methodology, general
02 Metal geology
03 Useful material except metal geology

**222 CRYSTALLINE ROCKS**

**A. Crystalline Rocks**

01 Igneous and metamorphic rocks petrology, volcanic processes, magmas
02 Experimental petrology

**223 SEDIMENTARY ROCKS AND MARINE GEOLOGY**

**A. Sedimentary Rocks**

01 Petrology of sedimentary rocks except quaternary
02 Coal
03 Hydrocarbons
04 Physical properties of sedimentary rocks

**B. Marine Geology**

**224 STRATIGRAPHY, AREAL GEOLOGY, GENERAL GEOLOGY**

**A. Stratigraphy**

**B. Areal Geology, Maps**

01 Areal geology
02 Geologic maps, cartography

**C. General Geology**

**225 TECTONICS, INTERNAL GEOPHYSICS**

**A. Tectonics, Structural Geology, Plate Tectonics**

**B. Internal Geophysics**

01 Geophysics, general, magnetic, electric and thermic methods and properties
02 Solid-earth geophysics, tectonophysics, gravimetry
03 Earthquakes, seismology
04 Applied geophysics

**226 HYDROLOGY, ENGINEERING GEOLOGY AND SUPERFICIAL GEOLOGY**

**A. Hydrology, Hydrogeology**

01 Hydrology
02 Hydrogeology
03 Water resources

# COMPUTER DATABASE SYSTEMS FOR THE EARTH SCIENCES: APPLICATIONS AND PROSPECTS IN MINERALOGY, MINERAL RESOURCES AND MUSEUM CURATION

On behalf of
The Mineral Database Workshop,
29th International Geological Congress,
Kyoto, Japan, 29-30 August 1992

By
Graham C. Wilson
Turnstone Geological Services Ltd.
P.O. Box 130, Station "B", Toronto
Ontario CANADA M5T 2T3

Tel (416)-466-3386

Mon 29-Jun-1992
TGSL Project 1992-006
1st edition, version 1
96 pages, 16 tables

Table 1. A Short List of Databases Available for Purchase / On-Line Access.

| *Database/Source* | *Reference* | *Comments* |
|---|---|---|
| **MAJOR ON-LINE SYSTEMS** | | |
| Elsevier/ Geo Abstracts | | **GEOBASE** is a major on-line service including sources such as Mineralogical Abstracts. CD-ROM option in preparation. >400,000 items. |
| American Geological Institute | | **GeoRef** is available on-line and on CD-ROM. An 'industry standard' Earth Sciences database, global in every sense. |
| Geosystems | | **GeoArchive** is available on-line and on CD-ROM. UK-based system with ≈675,000 records. Broad-based like GeoRef, covering economic geology, energy resources, hydrology, oceanography and other fields. Varied search options. Coverage from 1974 to present. |
| **MINING INDUSTRY** | | |
| Institution of Mining and Metallurgy | | The **IMMAGE** database - see text. |
| Mining Journal Ltd and Montagu Mining Finance | Anon (1989) | Worldwide metal mining - March 1990 release of gold mines in the Western world. The **Metallica 2000** system, later expanded to other metals, includes >1700 mines plus 400 major and 400 other mining and exploration firms. Reports can be output / downloaded to **Lotus 1-2-3** |
| Robertson Info-Data Inc., Vancouver | | **MIN-MET Canada v.2**, a database of >21 MB of company annual reports and other sources, with data on >2500 companies and >8700 occurrences. |

Only a glimpse of many academic- and industry- oriented databases on the market. See also notes on database systems in the text, some of which are available for purchase or selective access.

*Database summaries as cataloged in the:*

**Canadian Geoscience Database Directory**

| | | | |
|---|---|---|---|
| *Product:* | GEOSCAN<br>GEOSCAN | | |
| *Publisher:* | Geological Survey of Canada / Geoscience Information Division / National GEOSCAN Centre | | |
| *Custodian:* | David Reade<br>Head, National GEOSCAN Centre | | 613-992-8916 |
| *Scientist:* | Anthony Kopf-Johnson<br>GEOSCAN Data Base Manager | | 613-992-8916 |
| *Other:* | | | |

| | | | |
|---|---|---|---|
| *Description:* | GEOSCAN is a bibliographic data base containing approx. 120 000 | | |
| *Keywords:* | Geoscience information; Bibliography | | |
| *Coverage:* | Not uniform | *Scales:* | |
| *NTS:* | All | | |
| *Geographic references:* | NTS | | |
| *Positional accuracy:* | | *Resolution:* | |
| *Map projections:* | | | |
| *Dimensionality?:* | No | | |
| *Time period covered:* | 1970 *to:* Continues | *Status:* | Operational |
| *Present form of data:* | Digital *Hard copy form:* | | |
| *Host computer:* | HP 3000 Series 70 (Mini) | | |
| *operating systen:* | MPE | | |
| *Database software:* | MINISIS ; CDS/ISIS | | |
| *Data structure:* | Alphanumeric | *Data file size:* | 133 Mb |
| *User base:* | All | | |
| *Output formats:* | | | |
| *Output media:* | 9 Track Tape ; Floppy Disc ; Paper ; Accessible online | | |
| *GIS software:* | No | | |
| *Notes:* | | | |

*Please add your comments and opinions as to the value of this data set to the NWT CMSD and MRM project:*

A typical GEOSCAN record provides the following types of information:

Title: STRATIGRAPHY AND STRUCTURE OF THE MOUNT SELWYN AREA, ROCKY MOUNTAINS, NORTHEASTERN BRITISH COLUMBIA

Author: MCMECHAN, M E

Source: GEOLOGICAL SURVEY OF CANADA, PAPER 85-28, 34P. 1987.

Subjects: ECONOMIC GEOLOGY; PALEONTOLOGY; TECTONICS; STRATIGRAPHY; STRUCTURAL GEOLOGY

Age: PRECAMBRIAN; PROTEROZOIC; PALEOZOIC; MESOZOIC; CENOZOIC

Keywords: FOSSILS; CARBONATE ROCKS; SEDIMENTARY ROCKS; METAMORPHIC ROCKS; SEDIMENTARY STRUCTURES; METAMORPHISM; GREENSCHIST FACIES; METAMORPHISM, REGIONAL; STRUCTURAL FEATURES; FAULTS; FOLDS

Descriptors: ROCKY MOUNTAIN TRENCH, B C; ROCKY MOUNTAIN THRUST BELT; ROCKY MOUNTAIN FOLD BELT; MINNES GP; STOODART GP; KECHIKA GP; CONODONTS; TRILOBITA; BRACHIOPODA; GASTROPODA; BRYOZOA; CORALS; STROMATOPOROIDS; CHAROPHYTES; PELECYPODA; OSTRACODA; MISINCHINKA GP; GOG GP

Map Info: MAPS (1:50 000, 1:250 000);

Region: BRITISH COLUMBIA

NTS: 093O; 094B

# GeoRef™

*GeoRef is the SilverPlatter CD-ROM database that covers the fields of geology and geophysics. Produced by the American Geological Institute and based on over 3,000 journals plus books, maps, reports, and theses, GeoRef contains over 1.5 million records dating back as far as 1785.*

## Complete, Authoritative Coverage of All Aspects of Geology

References in *GeoRef* are drawn from over 3,000 journals, as well as books, maps, reports, and U.S. and Canadian Master's theses and Doctoral dissertations for geology and related degrees granted since 1965. *GeoRef* contains references to all U.S. Geological Survey publications since 1971, with references to most of the Survey publications before that date.

*GeoRef* is a comprehensive, global database that covers geology and its many related and peripheral topics worldwide. Included are citations, abstracts, and references about geophysics and structural geology, economic geology, paleontology and stratigraphy, engineering and environmental geology, geomorphology, geochemistry, sedimentary petrology, and many other relevant topics.

*GeoRef* is a powerful database that:

- covers a wide range of geoscience-related topics
- contains over 1.5 million records
- is updated frequently — four times per year
- delivers valuable information quickly

## A Powerful and Timely Research Tool

CD-ROM technology and a subscription to *GeoRef* can put up-to-date information literally at your fingertips, bringing important data in-house in a convenient and accessible form. Plus, *GeoRef* is updated four times each year with between fifteen and twenty thousand new records added each quarter.

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## Facts

| | |
|---|---|
| Title | *GeoRef* |
| Source | American Geological Institute |
| Coverage | 1785 to present (North America); since 1933 (worldwide) |
| Number of CDs | Three |
| Print Equivalent | *Bibliography and Index of Geology*; *Bibliography of North American Geology*; *Bibliography and Index of Geology Exclusive of North America*; *Geophysical Abstracts*; and *Bibliography of Theses in Geology* |
| Online Equivalent | GeoRef |
| Update Frequency | Quarterly |
| Number of Records in Database | 1.5 million |
| Approximate Number of Records Added Annually | 60,000 to 80,000 |
| Number of Journals Indexed | 3,000 |
| Format | Bibliographic |
| Abstracts Included | Yes, for approximately 10% |
| Purchase or Lease | Lease |
| Searchable Fields | Title, Author, Organizational Source, Publisher, Descriptors, Publication Year, Category Code, and others. |

SP-060-102

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## Sample Record

Title
Author
Publication Year
Category Codes
Extensive subject access
Reference Maps

```
AN ACCESSION NUMBER:  88-57107
TI TITLE:  Translated title:  Molluscan fauna and
    paleoenvironment of the Pliocene to Pleistocene Uonuma Group
    in the northwestern part of Chuetsu District, Niigata
    Prefecture, central Japan.
AU AUTHOR:  Yasui-Satoshi
OS ORGANIZATIONAL SOURCE:  OYO Corp., Tokyo, Japan
SO SOURCE:  Chishitsugaku-Zasshi-=-Journal-of-the-Geological-
    Society-of-Japan.  94, (4),243-256p.  31 Refs.
CD CODEN:  CHTZA5
YR PUBLICATION YEAR:  1988
PD PHYSICAL DESCRIPTION:  illus., 4 tables, strat. cols.,
    charts, sketch maps
LA LANGUAGE OF SUMMARY:  English
DE DESCRIPTORS:  Japan-; stratigraphy-; Pliocene-; mollusks-;
    biostratigraphy-; areal-geology; maps-; paleoecology-;
    sedimentation-; deposition-; regression-; Far-East; Asia-;
    Neogene-; Tertiary-; Pleistocene-; Quaternary-; Uonuma-
    Group; Chuetsu-District; Niigata-; central-Japan;
    sedimentary-basins; Hachikoku-oil-field; Chuo-oil-field;
    lithostratigraphy-; Shibanomata-Formation; Iwata-Formation;
    assemblages-; zoning-; shallow-water-environment;
    sublittoral-environment; brackish-water-environment;
    geologic-maps
DT DOCUMENT TYPE:  Analytic; Serial; Map
MP MAP:  geol. mpa; 1:75,000
CC CATEGORY CODES:  12-Stratigraphy-Historical-geology-and
    paleoecology
```

*Users can search* GeoRef *by title, author, organizational source, publisher, subject, descriptors, and more. Special category codes for faster searching, references to maps, and descriptions of the original documents make* GeoRef *an important research tool.*

**SilverPlatter**

**SilverPlatter Information, Inc.**
One Newton Executive Park, Newton Lower Falls, MA 02162-1449, U.S.A. • TEL: 617-969-2332 • FAX: 617-969-5554
10 Barley Mow Passage, Chiswick, London W4 4PH, England • TEL: 81-995-8242 • FAX: 81-995-5159

# Mini-micro CDS/ISIS
# REFERENCE MANUAL
# (Version 2.3)

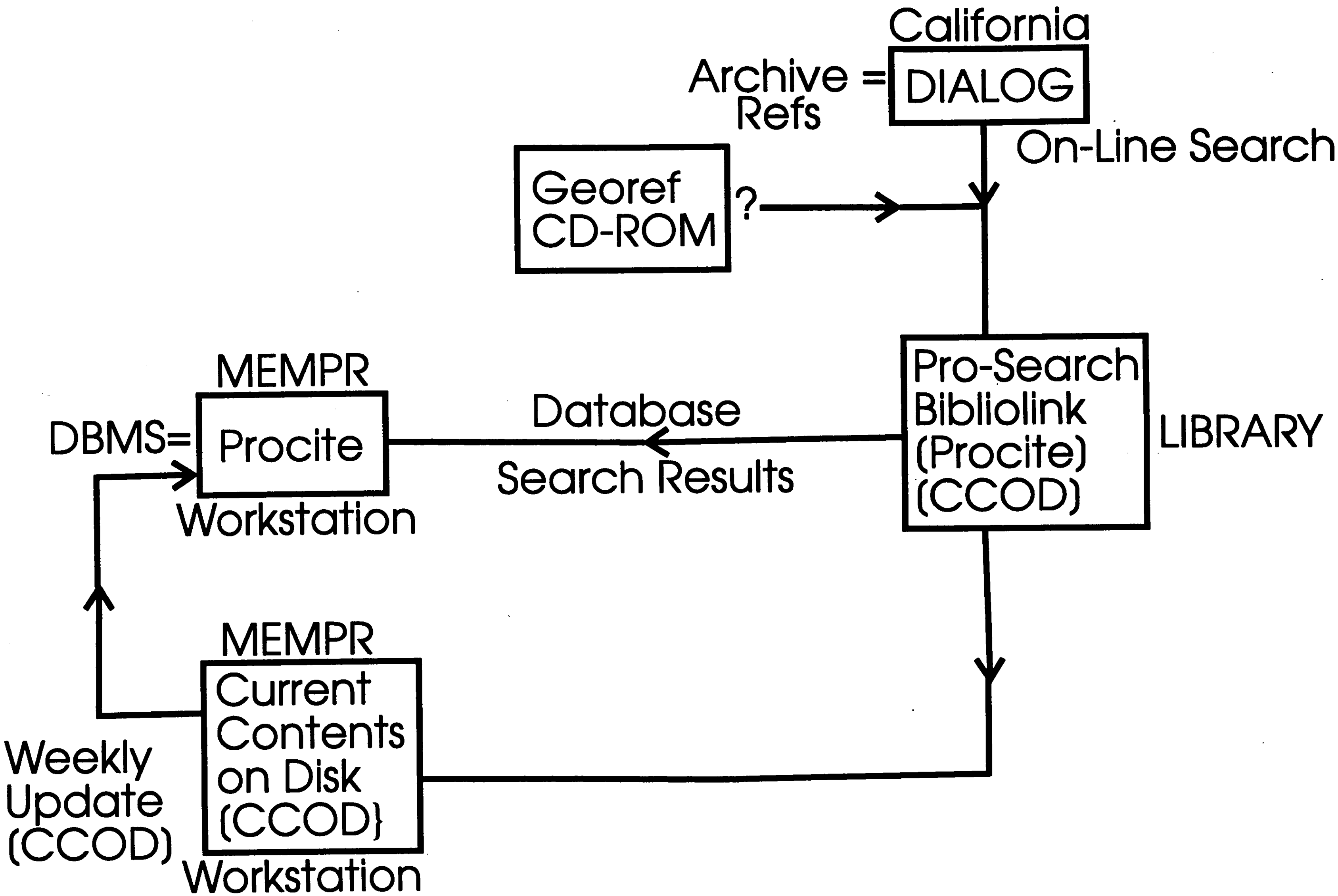
Division of Software Development and Applications
Office of Information Programmes and Services

Unesco
7, Place de Fontenoy
75700 Paris

November 1988

(c) Unesco

# Ministry of Energy, Mines and Petroleum Resources (MEMPR): Bibliographic Management System (BMS)



# Example of data elements for unpublished reports.

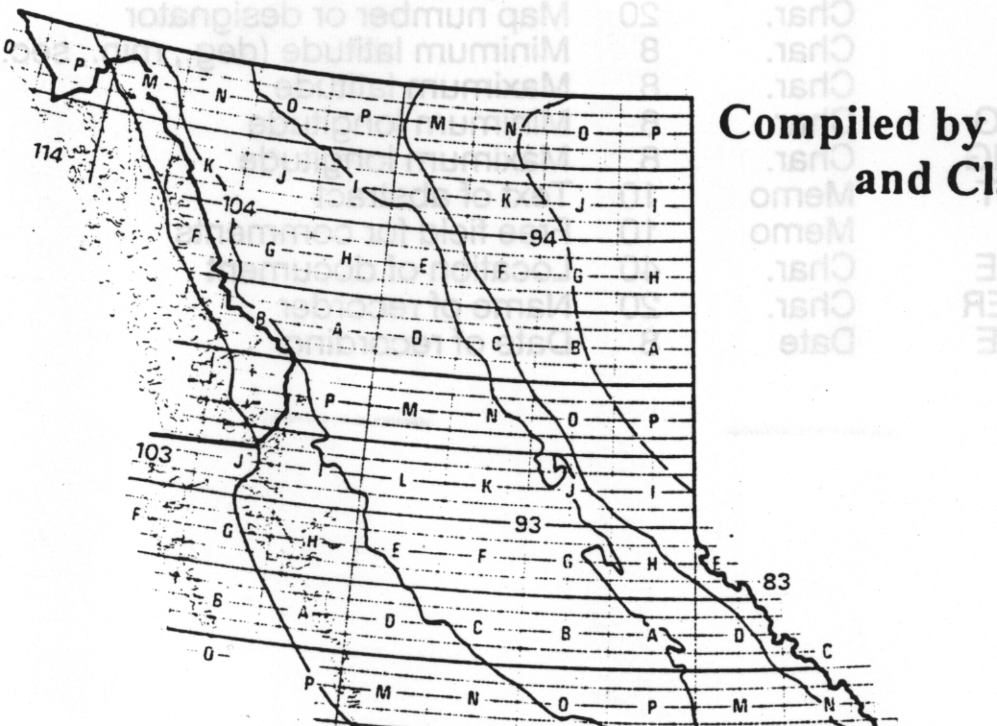
| # | Field name | Type | Width | Field description |
|---|---|---|---|---|
| 1 | ID_NO | Num. | 5 | Record number |
| 2 | TITLE | Char. | 240 | Title of report |
| 3 | AUTHOR | Char. | 160 | Name(s) of author(s) |
| 4 | ORGANIZ | Char. | 80 | Name of source organization |
| 5 | RPT_SER | Char | 60 | Name of report series |
| 6 | SER_NO | Char. | 20 | Serial number or code of report |
| 7 | PAGES | Char. | 8 | Number or range of pages |
| 8 | ILLUS | Char. | 20 | Notes on illustrations, appendices |
| 9 | YEAR | Char. | 4 | Year of report |
| 10 | MAP_TYPE | Char. | 80 | Types of maps in the report |
| 11 | MAP_SCALE | Char. | 40 | Scale of maps |
| 12 | LANGUAGE | Char. | 2 | Language of report (abbreviation) |
| 13 | KEY_WORDS | Char. | 160 | Subject keywords |
| 14 | GEOGR | Char . | 160 | Geographic names |
| 15 | MAP_NO | Char. | 20 | Map number or designator |
| 16 | MIN_LAT | Char. | 8 | Minimum latitude (deg., min., sec.) |
| 17 | MAX_LAT | Char. | 8 | Maximum latitude |
| 18 | MIN_LONG | Char. | 8 | Minimum longitude |
| 19 | MAX_LONG | Char. | 8 | Maximum longitude |
| 20 | ABSTRACT | Memo | 10 | Text of abstract |
| 21 | NOTES | Memo | 10 | Free field for comments |
| 22 | AVAILABLE | Char. | 40 | Location of document |
| 23 | RECORDER | Char. | 20 | Name of recorder |
| 24 | REC_DATE | Date | 8 | Date of recording |

BC

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources
Hon. Anne Edwards, Minister

MINERAL RESOURCES DIVISION
Geological Survey Branch

# DIGITAL BIBLIOGRAPHIC INDEX of B.C. GEOLOGICAL SURVEY BRANCH PUBLICATIONS 1874 - 1993




**Compiled by Brian Grant and Claudia Logan**

## OPEN FILE 1994-13

# EXAMPLE OF LOCATION & AUTHOR INDEX

| Field | Field Name | Type | Width |
|---|---|---|---|
| 1 | NTSA1 | Character | 4 |
| 2 | NTSA2 | Character | 3 |
| 3 | NTSB1 | Character | 4 |
| 4 | NTSB2 | Character | 3 |
| 5 | NTSC1 | Character | 4 |
| 6 | NTSC2 | Character | 3 |
| 7 | NTSD1 | Character | 4 |
| 8 | NTSD2 | Character | 3 |
| 9 | AUTHOR | Character | 20 |
| 10 | INITIAL | Character | 6 |
| 11 | TITLE1 | Character | 200 |
| 12 | AG_CODE | Character | 8 |
| 13 | PUBLICATIO | Character | 60 |
| 14 | PUB_TYPE | Character | 55 |
| 15 | PUB_NO | Character | 13 |
| 16 | PUB_YR | Numeric | 4 |
| 17 | MAPS | Character | 15 |
| 18 | SCALE | Character | 10 |
| 19 | MAJ_REF | Logical | 1 |
| 20 | IN_PRINT | Logical | 1 |
| 21 | LIB_CONG | Character | 15 |
| 22 | ISBN | Character | 15 |
| 23 | KEY1 | Character | 50 |
| 24 | KEY2 | Character | 50 |
| 25 | KEY3 | Character | 50 |
| 26 | KEY4 | Character | 50 |
| 27 | KEY5 | Character | 50 |
| 28 | KEY6 | Character | 50 |
| 29 | KEY7 | Character | 50 |
| 30 | KEY8 | Character | 50 |
| 31 | KEY9 | Character | 50 |
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| 34 | KEY12 | Character | 50 |
| 35 | KEY13 | Character | 50 |
| 36 | KEY14 | Character | 50 |
| 37 | KEY15 | Character | 50 |
| 38 | KEY16 | Character | 50 |
| 39 | PUBPAGE | Character | 18 |
| 40 | AUTHOR2 | Character | 20 |
| 41 | INITIAL2 | Character | 6 |
| 42 | AUTHOR3 | Character | 20 |
| 43 | INITIAL3 | Character | 6 |
| 44 | AUTHOR4 | Character | 10 |
| 45 | INITIAL4 | Character | 6 |
| 46 | AUTHOR5 | Character | 10 |
| 47 | INITIAL5 | Character | 6 |
| 48 | AUTHOR6 | Character | 10 |
| 49 | INITIAL6 | Character | 6 |
| 50 | AUTHOR7 | Character | 10 |
| 51 | INITIAL7 | Character | 6 |
| 52 | AUTHOR8 | Character | 10 |
| 53 | INITIAL8 | Character | 6 |
| 54 | AUTHOR9 | Character | 10 |
| 55 | INITIAL9 | Character | 6 |
| 56 | REC_NO | Numeric | 5 |
| 57 | THESIS | Character | 5 |
| ** Total ** | | | 1428 |

GRANT, B., NTS (National Topographic System) Location & Author Index to Publications of the British Columbia Geological Survey Branch, *British Columbia, Ministry of Energy, Mines and Petroleum Resources*, Information Circular 1991-7, (1991) 304p.

# **SCREEN FORMAT** for inputting data to NTS & Author Index of British Columbia publications

```
AUTHOR(S):                      INITIALS    YEAR                 NTS   MAP
XXXXXXXXXXXXXXXXXXXX             XXXXXX     XXXX              a  XXXX  XXX
XXXXXXXXXXXXXXXXXXXX             XXXXXX                       b  XXXX  XXX
XXXXXXXXXXXXXXXXXXXX             XXXXXX                       c  XXXX  XXX

TITLE:   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

AGENCY:  XXXXXXXX     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
PUB:     XXXXXXXXXXXXXXXXXXXXXXXXX  PUB.TYPE:XXXXXXXXXXXXXXXXXXXX
VOL.NO:  XXXXXXXXXXXXX               PAGE(S):XXXXXXXXXXXXXX
   MAP:  XXXXXXXXXXXXXX    SCALE:  XXXXXXXXXX

 MAP AREA:  XXXXXXXXXXXXXXXXXXXX        MAJOR REFERENCE? X   (Y/N)
                                        STILL IN PRINT?  X   (Y/N)
 KEYWORDS:
 XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX
      LIB.CONG.#:XXXXXXXXXXXXXXX          ISSN #:XXXXXXXXXXXXXXX

              Use [Cntl-End] when input complete
```

Sorted by Author;
Maximum 9

Year of Publication

Full title as cited in original publication.

LOGAN, J.M., GABITES, J.E., BROWN, D.A. (1988):
Galena-Lead Isotope Characteristics of Mineralization in Kokanee Glacier Provincial Park, Southeastern British Columbia; *B.C. Ministry of Energy, Mines & Petroleum Resources*, GEOLOGICAL FIELDWORK 1987, PAPER 1988-1, pages 535-542.
Economic Geology/ Kokanee Glacier Park/ Nelson Batholith/ Shale Curve/ Pericratonic Curve/ Bluebell Curve/ Epigenetic/ Galena-Lead Isotope
Covers NTS Map(s): 082F/11, /14

Publishing Agency in italics

First keyword identifies general category;
Maximum 16 Keywords

NTS map sheet coverage not necessarily in order of priority;
Maximum 4 sheets identified.

# B.C. ASSESSMENT REPORT INDEXING SYSTEM (ARIS)

- a library of over 22 000 assessment reports dating from 1947
- reports of assessment submitted by the mineral industry under the Mineral Tenure Act in order to maintain claims in good standing
- $56 million dollars of exploration work submitted in 1990
- information contained in the reports is a valuable reference and research tool for mineral exploration, academic studies and resource management

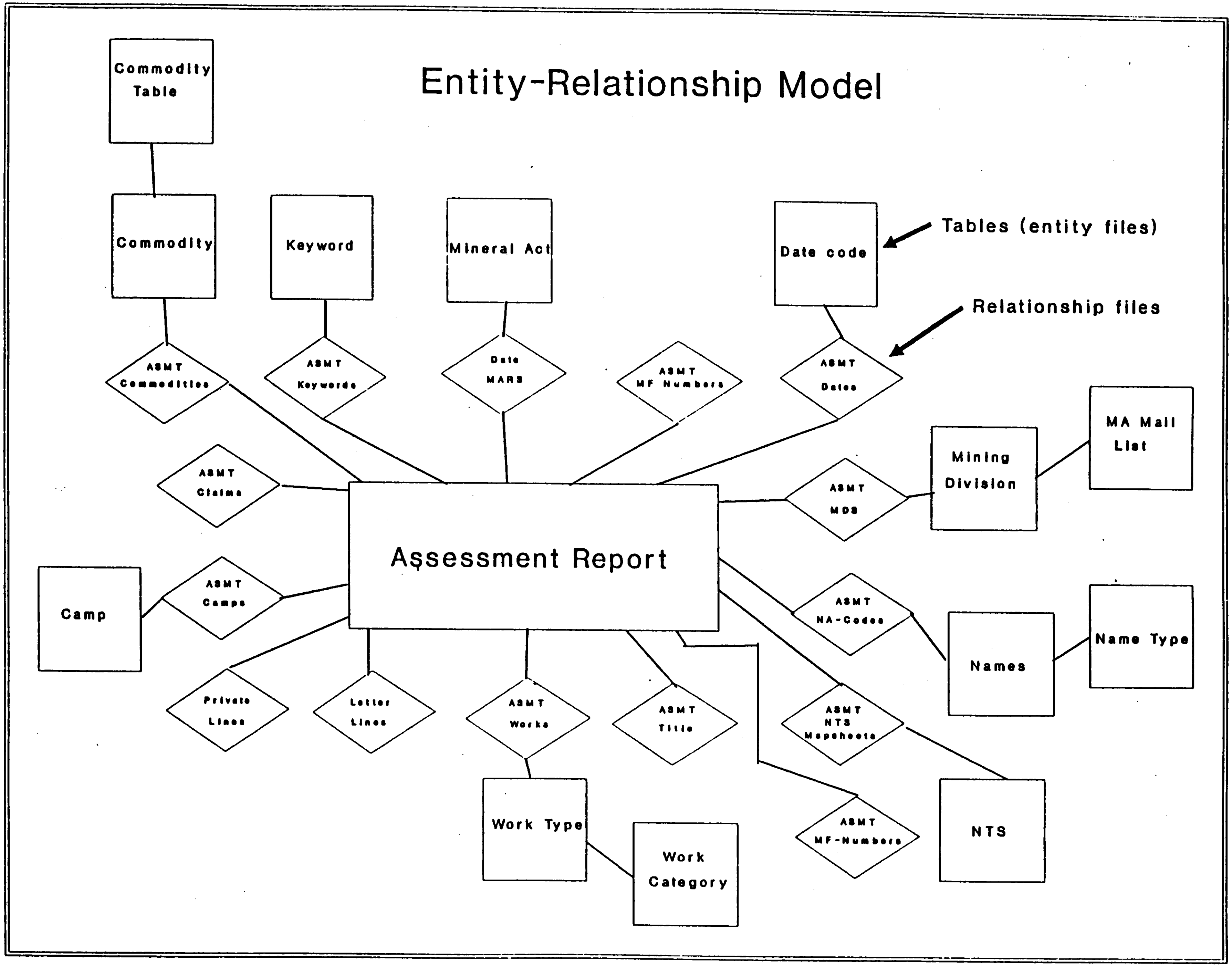
**Assessment Report Indexing System (ARIS)** designed to assist in processing a rapidly mounting volume of assessment report administration and data management.

## ARIS Database

- The ARIS system modelled after the MINFILE (Mineral Inventory File)
- The database design uses an "entity-relationship" model comprised of codes (entities), with interrelated tables of data containing common assessment report numbers
- ARIS database resides on a mainframe computer and could easily be ported to a PC-based system.

## Present Functions of ARIS:

1. Data capture
2. Administration and maintenance
3. Inquiries (ad hoc and pre-programmed)
4. Distribution functions


Entity-Relationship Model
Commodity Table
Commodity
Keyword
Mineral Act
Date code
Tables (entity files)
Relationship files
ASMT Commodities
ASMT Keywords
Date MARS
ASMT MF Numbers
ASMT Dates
ASMT Claims
Assessment Report
ASMT MDS
Mining Division
MA Mail List
Camp
ASMT Camps
ASMT NA-Codes
Names
Name Type
Private Lines
Letter Lines
ASMT Works
ASMT Title
ASMT NTS Mapsheets
Work Type
Work Category
ASMT MF-Numbers
NTS

# 1. Data Capture (ARIS)

## Data Entry

1) General Data (locational)
2) Names (author owner operator)
3) Geological Summary
4) Keywords
5) Work Data
6) Approval Information
7) Amend/Reject Information

# 2. Administration and Maintenance (ARIS)

**Reports**

1) Tables Report
2) Name & Address Table Report
3) NTS Map Index
4) ARIS Summary Sheet
5) Off Confidential Report
6) Status Report by NTS Map
7) Letters (approval, amend, rejection)
8) File to Produce Map List

**Table Maintenance**

1 ) Mining Camp Codes
2 ) Mineral Act Regulations Code
3 ) Date Codes
4 ) Commodities
5 ) Mining Divisions
6 ) NTS Mapsheet Names
7 ) Specific Work Types
8 ) General Work Types
9 ) Name & Addresses
10) Name Types
11) Keywords

**System Maintenance**

1) System Error Message Maintenance
2) System Error Message Inquiry
3) Prompter (Help) Maintenance

# 3. Inquiries (ARIS)

**Inquiries**

1) Claim Name
2) Owner Operator Author Name
3) Property Name
4) Mining Division
5) NTS (National Topographic System) Mapsheet
6) MINFILE Number
7) Latitude/Longitude

# 4. Distribution Functions (ARIS)

- contributor to GEOSCAN, a federal-provincial cooperative program. GEOSCAN is a computerized bibliographic index to geological information dealing with the Canadian landmass, and offshore areas
- produces diskettes in GEOSCAN compatible format.
- perform searches to interested clients free of charge
- complete assessment report libraries on microfiche
- copies of reports can be ordered
- ARIS available on paper, microfiche and computer diskettes. The index provides latitude, longitude, UTM co-ordinates, claim names, operator, author, type of work reported and report year. Available 14 ASCII files to facilitate access by a variety of commercial software programs, such as database management and plotting packages
- 90 index maps mainly at a scale of 1:250 000

# Computer Programs and Data Examples

| Program/Data | Description | Source/Contact |
|---|---|---|
| ARISTRAN | Routine to prepare Assessment Reports for plotting | Talis Kalnins, GSB |
| ATLAS | World database of uranium deposits | Maks Pecnik, IAEA |
| Bedrock | Bibliography database | Brian Grant, GSB |
| COALFILE | Borehole data for coal deposits | Alex Matheson, GSB |
| Georef Search Eg. | Economic geology in Tanzania | Sharon Ferris, EMPR Library |
| GSC OF 2419 | Index to GSC Open Files | GEOSCAN Centre, GSC |
| GSB-GDS | Field data program | Don MacIntyre, GSB |
| GSB OF 1994-13 | Bibliographic Index of GSB Publications | Brian Grant, GSB |
| GSC Open File 2328 | Canadian Geoscience Data Directory | GSC |
| Help Desk | Client support supplement to MINFILE/pc | Larry Jones, GSB |
| Location Index | Mineral occurrence index (first level data) | Larry Jones, GSB |
| Metadata File | Database directory | Larry Jones, GSB |
| MINERAL | Uranium mineral database | IAEA |
| MINFILE/pc | Mineral inventory database | Larry Jones, GSB |
| NEWPET | Statistical plotting of data | Daryl Clarke, Memorial Univ. |
| PKZIP | File compression routine | PKWARE Inc. |
| RGS | Regional Geochemical Survey sample data | Wayne Jackaman, GSB |
| UDEPO | Database of uranium deposits | IAEA |

**CONTACTS:**

EMPR, GSB: Ministry of Energy, Mines and Petroleum Resources, Geological Survey Branch, 5th Floor, 1810 Blanshard Street, Victoria, B.C. V8V 1X4, Tel. (604) 952 0386, Fax. (604) 952 0381.

IAEA: International Atomic Energy Agency, Wagramerstrasse 5, P.O. Box 100, A-1400 Vienna, Austria, Tel. 43 1 2360 ext. 2758, Fax 43 1 234564.

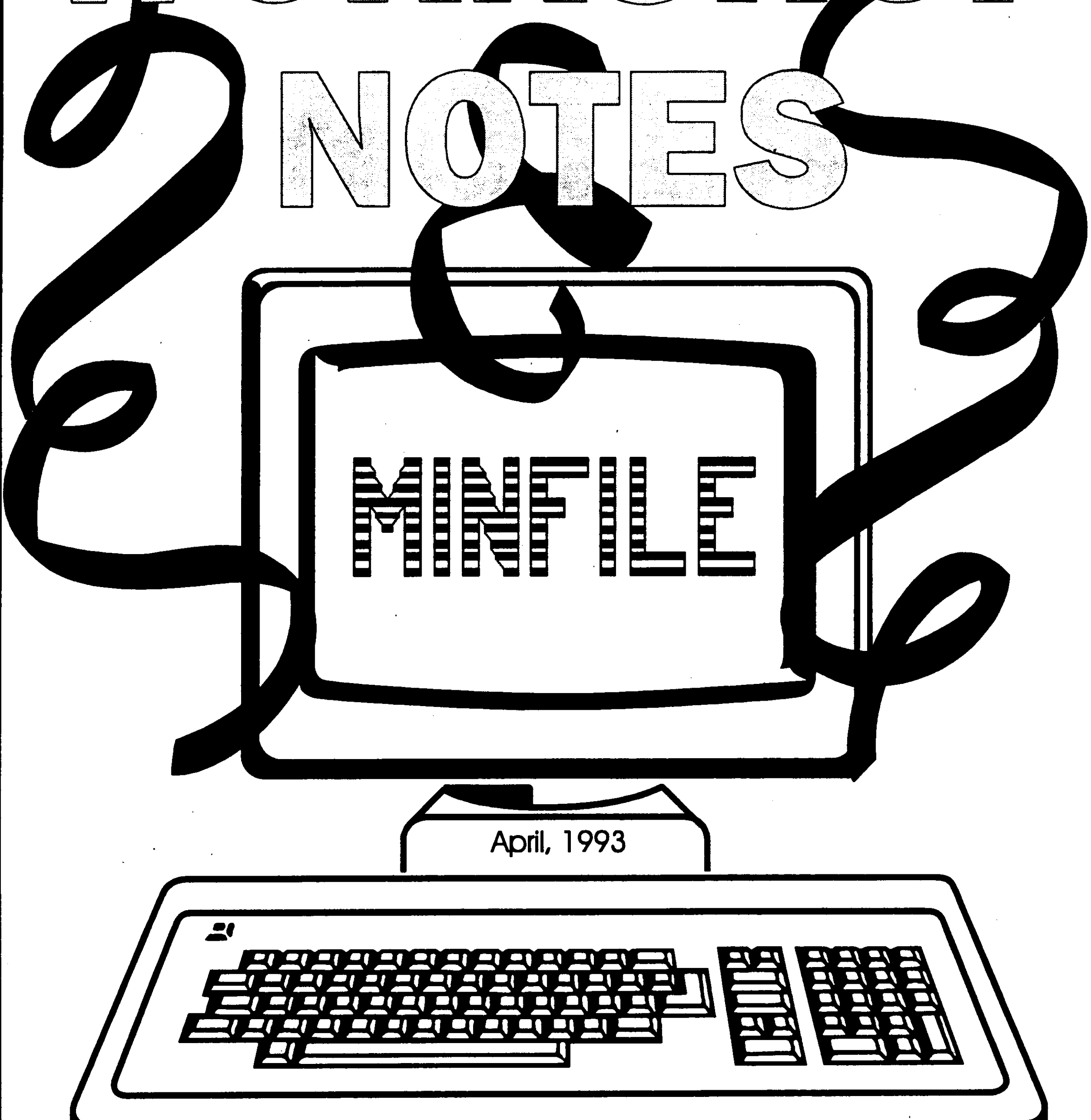
Memorial University of Newfoundland, Department of Earth Sciences, Centre for Earth Resources Research, St.John's, NFLD, Canada A1B 3X5, Tel. (709) 737 8346/8142, Fax (709) 737 2589.

National GEOSCAN Centre, Geological Survey of Canada, Natural Resources Canada, 601 Booth Street, Ottawa, Ontario, K1A 0E8, Tel. (613) 996 4157, Fax (613) 996 9990.

PKWARE, Inc., 9025 N. Deerwood Drive, Brown Deer, WI 53223.

*See also Geological Survey Branch, Geoscience Database Directory, Section 3, pages 40 - 50.*

# WORKSHOP NOTES




**GEOLOGICAL SURVEY BRANCH**
**MINERAL RESOURCES DIVISION**
**MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES**

# Workshop Agenda

- ✔ Basic DOS
- ✔ Introduction to MINFILE
- ✔ Installing the Program, Data and Notices of Work
- ✔ Searching the Data
- ✔ Data Interpretation
- ✔ Reporting
- ✔ Utilities and Data Transfer
- ✔ Data Entry: MINFILE and Project Data
- ✔ Discussion and Evaluation

## Table of Contents

## Table of Contents (continued)

# MINFILE/pc V. 4.0 User's Manual

DRAFT
April, 1994

Geological Survey Branch,
Land Management and Policy Branch
Mineral Resources Division
Ministry of Energy, Mines and Petroleum Resources

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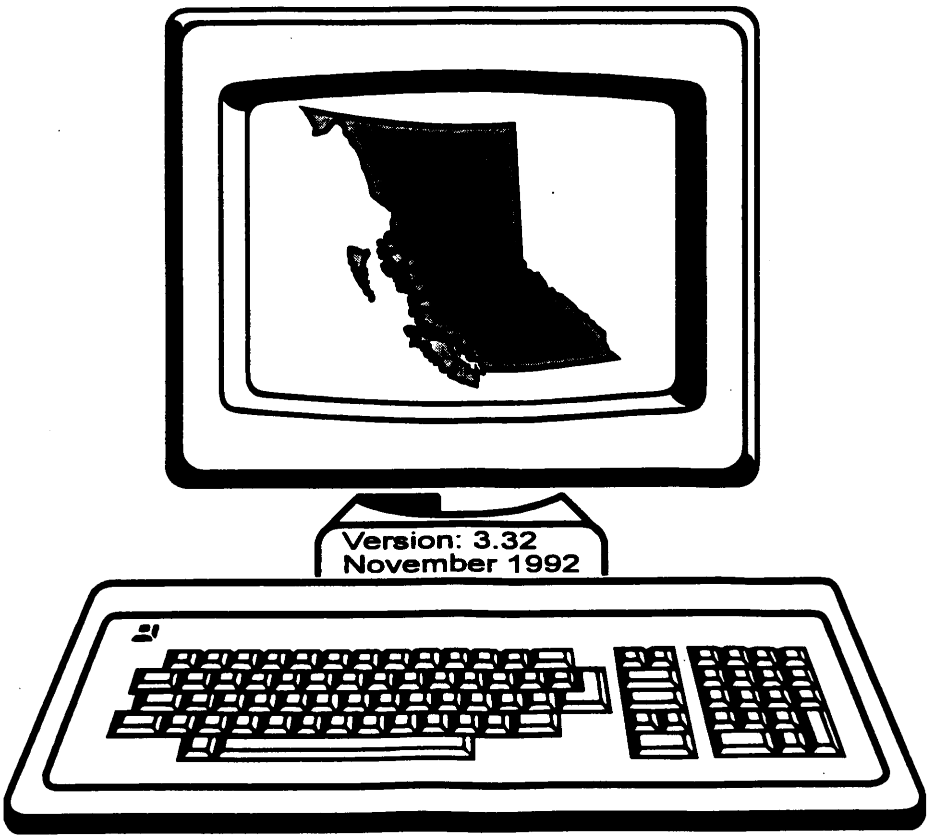
## APPENDICES

# MINFILE
# Coding Manual




BC
Geological Survey Branch
Mineral Resources Division
Ministry of Energy, Mines and Petroleum Resources

Information Circular 1992-30

# Notes

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# Notes

# Format Specification for Regional Geochemical Survey Data (RGS)

| FIELD | DESCRIPTION | COLUMNS | TYPE | LENGTH | EXAMPLE |
|---|---|---|---|---|---|
| 01 | NTS Map-Sheet | 001-006 | A | 6 | 104N16 |
| 02 | ID (Year,Crew,Number) | 007-012 | N | 6 | 841102 |
| 03 | UTM Zone | 013-014 | N | 2 | 10 |
| 04 | UTM East (Metres) | 015-020 | N | 6 | 544654 |
| 05 | UTM North (Metres) | 021-027 | N | 7 | 5911939 |
| 06 | Elevation (Metres) | 028-031 | N | 4 | 1500 |
| 07 | Sample Material | 032 | N | 1 | 8 |
| 08 | Replicate Status | 033-034 | N | 2 | 10 |
| 09 | Formation | 035-038 | A | 4 | lJBv |
| 10 | Rock Type | 039-042 | A | 4 | GRNT |
| 11 | Age | 043-044 | N | 2 | 64 |
| 12 | Source of Water | 045 | N | 1 | 2 |
| 13 | Stream Order | 046 | N | 1 | 1 |
| 14 | Stream Type | 047 | N | 1 | 2 |
| 15 | Physiography | 048 | N | 1 | 3 |
| 16 | Drainage Pattern | 049 | N | 1 | 2 |
| 17 | Contamination | 050 | N | 1 | 3 |
| 18 | Stream Width (metres) | 051-054 | N | 4 (1) | 10.5 |
| 19 | Stream Depth (cm) | 055-57 | N | 3 | 220 |
| 20 | Stream Flow Rate | 058 | N | 1 | 1 |
| 21 | Water Colour | 059 | N | 1 | 3 |
| 22 | Bank Type | 060 | N | 1 | 3 |
| 23 | Bank Precipitate | 061 | N | 1 | 2 |
| 24 | Sediment Composition | 062-064 | N | 3 | 111 |
| 25 | Sediment Colour | 065 | N | 1 | 5 |
| 26 | Sediment Precipitate | 066 | N | 1 | 2 |
| 27 | Channel Bed Type | 067 | N | 1 | 3 |
| 28 | Channel Pattern | 068 | N | 1 | 4 |
| 29 | Moss-mat Position | 069-071 | N | 3 (1) | 2.5 |
| 30 | Moss-mat Colour | 072 | N | 1 | 2 |
| 31 | Moss-mat Health | 073 | N | 1 | 1 |
| 32 | Moss-mat Host | 074 | N | 1 | 3 |
| 33 | Thickness of Moss-mat | 075 | N | 1 | 10 |
| 34 | Blanks | 076-080 | N | 5 | ? |
| 34 | pH of stream waters | 081-085 | N | 5 (1) | 7.0 |
| 35 | Uranium in waters (ppb) | 086-090 | N | 5 (2) | 0.12 |
| 36 | Fluorine in waters(ppb) | 091-095 | N | 5 | 34 |
| 37 | Zinc (ppm) | 096-100 | N | 5 | 47 |
| 38 | Copper (ppm) | 101-105 | N | 5 | 79 |
| 39 | Lead (ppm) | 106-110 | N | 5 | 12 |
| 40 | Nickel (ppm) | 111-115 | N | 5 | 26 |
| 41 | Cobalt (ppm) | 116-120 | N | 5 | 33 |
| 42 | Silver (ppm) | 121-125 | N | 5 (1) | 1.7 |
| 43 | Manganese (ppm) | 126-130 | N | 5 | 310 |
| 44 | Iron (%) | 131-135 | N | 5 (2) | 3.80 |
| 45 | Molybdenum (ppm) | 136-140 | N | 5 | 10 |
| 46 | Uranium (ppm) | 141-145 | N | 5 (1) | 4.5 |
| 47 | Tungsten (ppm) | 146-150 | N | 5 | 6 |
| 48 | Tin (ppm) | 151-155 | N | 5 | 5 |
| 49 | Mercury (ppm) | 156-160 | N | 5 | 30 |
| 50 | Arsenic (ppm) | 161-165 | N | 5 | 14 |
| 51 | Antimony (ppm) | 166-170 | N | 5 (1) | 0.3 |
| 52 | Barium (ppm) | 171-175 | N | 5 | 754 |
| 53 | Cadmium (ppm) | 176-180 | N | 5 (1) | 0.7 |
| 54 | Vanadium (ppm) | 181-185 | N | 5 | 310 |
| 55 | Bismuth (ppm) | 186-190 | N | 5 (1) | 0.6 |
| 56 | Chromium (ppm) | 191-195 | N | 5 | 88 |
| 57 | LOI (%) | 196-200 | N | 5 (1) | 8.3 |
| 58 | Fluorine (ppm) | 201-205 | N | 5 | 400 |
| 59 | Gold(1st analysis)(ppb) | 206-210 | N | 5 | 78 |
| 60 | Sample Weight Au1 (gm) | 211-215 | N | 5 (1) | 10.0 |
| 61 | Gold (Repeat) (ppb) | 216-220 | N | 5 | 2000 |
| 62 | Sample Weight Au2 (gm) | 221-225 | N | 5 (1) | 10.0 |

# SUMMARY OF PRESENTATIONS AT THE REGIONAL TRAINING COURSE ON COMPUTERIZED DATABASES IN MINERAL EXPLORATION AND DEVELOPMENT, LUSAKA, ZAMBIA, MAY 1993

L.D. Jones (British Columbia Geological Survey) and
R.B. Taylor (United States Geological Survey)

## 1. INTRODUCTION

The purpose of this report is to summarize some of the lectures presented during the first week (May 10-15) of the workshop. The lectures focused on guidelines on the organization, management and presentation of earth science data and on systematic database development using personal computers. A key reference for the presentations is the draft copy of the IAEA TECDOC entitled *Guidelines for the organization and management of earth science data on a personal computer.*

Presentations by Jones and Taylor included: the strategy and philosophy in mineral resources databases; examples of the U.S. and Canadian database management systems; hardware and software requirements; guidelines to database systems; earth science information databases; mineral deposit databases including MINFILE; and mineral exploration databases. This report will outline key points of each presentation and reference further reading.

## 2. STRATEGY AND PHILOSOPHY IN MINERAL RESOURCES DATABASES

### 2.1 Reasoning

**Some Whats:**

- **Mineral resources** are unevenly distributed throughout the earth's crust.
- Most countries enjoy some **mineral endowment**.
- Many have a **mining history** dating back hundreds of years.

**Some Whys:**

- Few countries have a well-organized, comprehensive and easily accessible **source of historic mining and geological data** relating to the nature and distribution of their mineral resources.
- Such information is the starting point in the search for **new orebodies**.
- Readily **accessible databases** are essential for effective management of the existing resource and invaluable tools in the search for new orebodies.
- Add to the country's **resource base**.
- Stimulates mineral exploration leading to discovery of new **mineral deposits**.
- Development of **new mines**.
- Contributes to the creation of **new wealth** by developers, workforce, and public treasury (profits, wages, and taxes).

**Some Hows:**

- Effective management of mineral resources requires a **knowledge** of the nature of the resources to be managed, their dimensions, where they are located, their current status, and many other factors.
- Earth Science Databases - **compile and update** this information.

## 2.2 The Mineral Exploration and Development Cycle

**Philosophy of Mineral Exploration Programs:**

- Mineral exploration and mine development ventures involve a high level of **financial risk**.
- Information gathered at each stage of a project leads to increased confidence of **discovering and developing** an orebody.
- If the data gathered at each stage of a project is accurate and complete **lower risk factors** are involved.

**Stages of Mineral Exploration Programs:**

- First stage of exploration is the **choice of area**, which is generally based on analysis of available geoscience data from general surveys and previous exploration effort.
- Ready access to this type of information will simplify the task and greatly **increase success**
- Subsequent stages include **geophysical** and **geochemical** surveys, detailed **geological mapping** and **drilling** and **underground work**.
- Costs increase at each stage, as do the spin-off **economic benefits**.
- Information generated must provide the **justification for continuing** to the next stage.
- Final stage - **ore reserves exhausted** and mine closes.
- Portion of the **profits** will be allocated to the search for new orebodies and the exploration and development cycle will be repeated.

**Mineral Exploration Program Observations and Strategy:**

- Detailed **geological information** will be collected during the life of the operation.
- These data are invaluable in the search for **new orebodies** in the same district and in other areas with similar geological setting.
- Data are often **lost** if the project is abandoned.
- Drill core and logs, assays, geophysical results, geological maps, mine plans and engineering reports may be buried in **private files** or may even be lost or destroyed.
- If the information is stored in a database where it can be readily retrieved and analyzed, it may lead to fresh **insights** and **new ideas** that rekindle interest in the project.
- New geological concepts, availability of new technology, commodity price increases, or improved transportation may **reactivate** old mining areas.
- Easy access to **historical and current geoscientific data**, which is gathered at great expense and sometimes is not reproducible, benefits new investors, which in turn will stimulate and promote mining exploration in an area.

## 2.3 Organization of Earth Science Data

- Information comprising a geoscience information system starts with a repository-type database referred to as the **master database**.
- Database subjects or **themes** describe the handling of earth science information such as bibliographies; mapping indexes (geological, geophysical and geochemical); air photography indexes; and drill hole indexes; mineral deposit information; and exploration information (drill hole, geophysical, geochemical, and field data).
- Selection of appropriate databases and their content are based on the **objectives** of an organization.
- Examples of objectives would be to **collect and store data** on the various themes; provide essential **linkages** to other databases and other levels within the same data theme; facilitate the production of various **reports and maps**; or provide an aid in **planning** future exploration programs.
- Most subject databases follow a **multi-level model**, beginning with the first-level database, which provides a **basic orientation** to the database theme.
- A second- or third-level database provides more **detailed information** on the subject data.

## 2.4 Master Database - *Database Directory*

- NAME of data set, Acronym
- Location
- Data form
- Host computer
- Data Custodian/Manager and Scientific Contact

## 2.5 System Planning

**System Cycle:**

- Establish business objectives and desired output.
- Scope document, user-requirements, fitting analysis (content and system).
- Detailing the proposal, with an action plan and resources required.
- Budgeting and project team selection.
- User-needs analysis and design details.
- Project schedule and detailed implementation plan.
- Develop universal tables, establish regional flexibility.
- Chose application development software and acceptable user-interface.
- Produce a PC-based application.
- System testing and documentation.
- User acceptance and evaluation.
- Marketing, distribution, training and support.

**Data and System Goals:**

- Quick and easy access to data.
- Detailed, high quality information.
- Data available in a wide variety of forms, such as custom and standard reports, and digital files for incorporation into other programs.
- Systematic management of data elements to improve data integrity and validity.
- An established methodology for the distribution of data.
- Allow the database to grow with increased requirements.
- Efficient and flexible model.
- Establish common data formats and system capabilities.
- Define links to geographical information systems.
- Implement a modern user-interface based on the latest technology.
- Standardize tables and definitions (e.g. commodities and work types).
- A versatile data dictionary will permit customized data content.

## 2.6 An Approach to Integrated Data Management

**Challenges:**

- Successfully integrate the various databases and mapping systems in a way that facilitates exchange of data for broader purposes.
- Maintain information in a manner which promotes data integrity and rapid retrieval.

**Data Issues - Data Models:**

- Originally recorded on paper.
- Transferred into digitally based systems.
- Data model must be constructed that provides the organizational layout of the data.
- Must serve the needs of the business application that surrounds the data.
- Many databases evolve in which model construction is minimal.
- Ad hoc database construction which occurred as technology developed.

**Technology Management Issues:**

- Development and maintenance of data requires human resources.
- Local and central responsibility of systems.
- Database managers and administrators.
- Routine and specialized maintenance - *backups, programming.*
- Inconsistencies, errors, corruption of data, and eventual abandonment of the databases and applications will result.
- Focus on future developments and planned migration strategies.
- Data static if it is collected and managed in a consistent framework.
- Data considered to be dynamic (*changing in its nature, structure, and application*) if collected and evolved over time.
- Requires a strategy that will work towards keeping data relevant and manageable.

**Procedure:**

- Establish business case and plan strategy.
- Coordinate implementation with the custodians of the databases.
- Review and recommend, where necessary, upgrading of databases.
- Manage and coordinate the exchange of data.

**Database Components:**

- Data model
- Administration
- Project staffing
- Documentation
- Database directory

## 2.7 References and Further Reading


- TECDOC: Section 4.1, 4.2, Figure 3.
- Tauchid, M.: Mineral Exploration and Development Strategy and Planning, IAEA, Paper presented at this workshop, May 1993.


# 3. COMPUTER HARDWARE AND SOFTWARE

## 3.1 Introduction

- **Custom development** of programs is expensive.
- Recommend purchase of **existing application packages**, such as spreadsheets, word processors, database systems, statistical packages and GIS programs is.
- Concentrate on the **integration and implementation** of these applications.
- Benefits include **improved functionality and reduced costs** for maintenance and support of custom-built software.
- Establish **business objectives** before selecting computing environment.
- **Evaluate software requirements first**, before hardware selection, to avoid incompatibilities.
- Consider availability of **support and local expertise**; **training** requirements; **standards** compliance; and the **size and growth** requirements of the database.

## 3.2 Hardware

- **IBM**-compatible **PC** systems (80486 processor) recommended.
- 640-kilobyte random access memory (**RAM**), with at least four megabytes of extended memory.
- Large **hard disk** (200 megabytes).
- Parallel port for a printer; two serial ports for plotter and digitizer.
- **VGA** graphics system.
- Peripheral devices: laser printer; digitizer (capable of sending data as an **ASCII** string); plotter (**HPGL**).
- **Mass storage** devices for large data sets and system backup.
- **UPS** (uninterrupted power supply) recommended in areas of erratic power supply.

## 3.3 Software

- Operating systems: **DOS** and **MS Windows**.
- Word-processing systems: capable of working in, or exporting a simple **ASCII** file (**ASCII** characters 33-127), without control characters.
- Spreadsheet format: **Lotus 1-2-3** (.WK1) format.
- Database management systems (DBMS): .DBF format of **dBASE** has become a *de facto* standard.
- Other **supporting software** packages: report writers; file compression utilities.
- **Custom development**: if funds are available; may make the organization's work process more efficient; documentation of the developed product is very important.

## 3.4 Future Trends

- LAN (Local Area Networks)
- Client/servers
- CD-ROM (compact disc-read only memory)
- GIS (Geographical information systems)

## 3.5 Reference

- TECDOC: Section 2.

# 4. GUIDELINES TO DATABASE SYSTEMS

## 4.1 Definitions

- **Database** is an organized set of related data that is drawn together to fit defined needs.
- **Database management system** (DBMS) consists of a database and a set of programs to access the database. It provides a structured environment that is both convenient and efficient to use in storing, accessing and reporting data.
- **Database file** contains data with a particular theme.
- **Record** all the data for a particular entry.
- **Field** is an item of information within a record.
- **Database structure** defines a database file.
- **Database key** uniquely identifies the sites of each record.
- **Data dictionary** contains details of the structure of the database, definitions of the contents of each field and listings of acceptable entries for fields of explicit content.
- **External interface** is defined as the mechanism in which the user captures or enters the data.
- **Data model** describes data and a set of operations used to manipulate that data.

## 4.2 Data Models

- A notation for describing data and a set of operations used to manipulate that data.

**Hierarchical:**

- Tree-structured diagram
- Record replication

**Flat-File:**

- Spreadsheet style
- Single table
- Simplicity and portability
- Example: geochemical sample database

**Relational:**

- Data in multiple files
- Complex data management
- Discrete and manageable units
- Flexible; easily modified
- Example: field geology database

**Entity-Relationship:**

- Entity is a distinct object
- Relationship is an association among several entities
- Primary key is assigned to each entity
- Increased data integrity
- Easier future modification
- Enhanced performance capabilities
- Example: mineral deposit database

## 4.3 Database System Design

- Base on an organization's **business objectives**, functions and processes, and its **available resources**.
- Conduct a **system study** to help identify **requirements for users** and implement a process to achieve efficient access to, and manipulation of, data.
- Use a **data classification hierarchy** to described data according to subject area and group.
- Good **design techniques** will include data modeling, data flow diagrams and normalization.

## 4.4 Conventions and Standards

- Store data in **ASCII** (American Standard Communication Information Interchange) format.

- **Lotus 1-2-3** (.WK1) and **dBASE** (.DBF) formats are recommended.

## 4.5 Database Administration

- Objective to maintain a **standard**, **structured** and **secure** database.

| | |
|---|---|
| **Data acquisition** | - collecting, managing and modifying data. |
| **Data integrity** | - detect errors; provide logic and range checks. |
| **Data currency** | - data values are reconfirmed or updated within an appropriate time period. |
| **Data access control** | - granting of permission for the creation, retrieval, use, modification and disposal of data. |
| **Data custodianship** | - designation of a functional responsibility for the creation, integrity and maintenance of data. |
| **Data links** | - interchange with diverse applications and needs. |

## 4.6 Project Staffing Qualifications

- Understanding of computerized **database concepts, model and design**.
- Understanding of **geoscience data** acquisition, data elements and their relationships.
- Ability to **design computerized databases** using a widely available database management system.
- Ability to **access, retrieve, and transfer** data.

## 4.7 Database Documentation

**Components of Document Planning:**

- User-needs analysis
- Purpose, scope and contents of documentation
- Document specification
- Work plan
- Organization (menu hierarchy, topic or function)

**Types of Documents:**

- Training documents (user manuals, tutorials and quick reference cards
- Reference documents (technical programmer notes)
- Marketing documents (descriptive brochures)

## 4.8 Reference

- TECDOC:  Section 3, Figure 1, 2.

# 5. GEOSCIENCE DATABASES

## 5.1 General

- **Master database** is the directory or index of all the databases in an organization.
- **Specific or theme databases** include: bibliographies; indexes on geological, geophysical and geochemical maps; air photography index; drill hole index; mineral deposit data; and exploration information, including drill hole, geophysical, geochemical and field data.
- Many of the databases follow a **multi-level model**.
- **First-level** or first-order database contain general information on common data observations, such as location of an activity or deposit, who did the work, commodities present and primary references.
- **Second- or third-level** database will provide more detailed information of the subject data.
- Organize and record data in a **systematic and consistent** manner, according to standards.

## 5.2 Master Database Example

**Name of data set, Acronym:**

- Responsible organization
- Purpose and description
- Keywords

**Data form:**

- Positional Accuracy
- Time span
- Data quality and access
- User Base

**Data Custodian/Manager and Scientific Contact**

**Location:**

- Lat. min - Lat. max; Long. min - Long max
- Coverage and scales

**Host computer:**

- Operating system
- Data Structure
- Set size
- DBMS used
- "GIS" Software
- Output formats and Output media

## 5.3 Example of British Columbia Geoscience Databases

**Assessment Report Indexing System** Acronym: **ARIS**

ARIS is a relational database that is an index and an administrative tracking system to the Geological Survey Branch's Mineral Assessment Report Library of more than 22,000 reports. Approximately 1000 new reports are added annually. The database is used to display the distribution of exploration and development activity and for research and mineral potential projects. A group of fields for each Assessment Report are extracted in 8 ASCII files from the VAX mainframe to diskettes. This data may be used on the PC within database management and small mapping projects using QUIKMap software.

| | | | |
|---|---|---|---|
| Host computer: | **VAX Mainframe; PC** | Operating system: | **VMS; DOS** |
| Data model: | **Entity-relationship** | DBMS: | **SUPRA; ASCII; dBase** |
| Data size: | **22000** records; **70 MB** | Number of files: | **15** |
| | | Fields per record (maximum/average): | **60**/**40**. |

**COALFILE** Acronym: **COALFILE**

COALFILE contains summarized coal assessment reports dating from 1900, submitted by exploration companies in compliance with the Coal Act. The data is organized in six related files - Explore, Comment, Map, Trench, Bulk and Borehole. There is a 3-year confidential period for coal exploration assessment reports and only non-confidential data is publicly available. Distribution policy and administration of the database is currently being established.

| | | | |
|---|---|---|---|
| Host computer: | **PC** | Operating system: | **DOS** |
| Data model: | **Relational** | DBMS: | **dBase** |
| Data size: | **8025** records; **3 MB** | Number of files: | **6** |
| | | Fields per record (maximum/average): | **171**/**78**. |

**NTS Bibliographic Index** Acronym: **BEDROCK**

Bibliography of BC Geological Survey publications, including author, title, type of publication and map area. The data file is used to publish a map location and author index.

| | | | |
|---|---|---|---|
| Host computer: | **PC** | Operating system: | **DOS** |
| Data model: | **Flat-File** | DBMS: | **dBase** |
| Data size: | **2800** records; **10 MB** | Number of files: | **1** |
| | | Fields per record (maximum/average): | **5/5**. |

**B.C. MINFILE** Acronym: **MINFILE**

MINFILE contains over 11,000 metallic, industrial mineral and coal occurrences for B.C. Each of these occurrences contain 84 data elements describing mineral deposits in terms of geography, geology and economics. The database is used by government, industry and academia for resource management, land-use planning, exploration and research. MINFILE/pc, Version 3.0, a menu-driven data-entry, search and report program for IBM-compatible computers, accesses the database. An exploration and development module is currently in development.

| | | | |
|---|---|---|---|
| Host computer: | **PC** | Operating system: | **DOS** |
| Data model: | **Entity-relationship** | DBMS: | **MINFILE/pc; FoxBASE+/FoxPro** |
| Data size: | **11300** records; **60 MB** | Number of files: | **69** |
| | | Fields per record (maximum/average): | **84**/**46**. |

**PROPERTY FILE** Acronym: **PROPERTY FILE**

PROPERTY FILE is a library of research material on the mineral occurrences contained in the MINFILE database. The FILE contains news clippings, field notes, company prospectuses, and historical maps, photographs and documents. The FILE is used by government, industry and academia for research. The public has access to view these paper files.

**Geological Field and Analytical Data**
**(Geological Database System)** Acronym: **GSB-GDS**

A dBase relational database contains locations for stations in UTM coordinates, structural measurements, alteration codes, mineralization, rock type and map unit, lists of fossils, age dates, geochemistry and isotopic data. Areas have been mapped at 1:50 000 scale since 1986. Data is not being marketed; available as flat ASCII files on request by interested users.

| | | | |
|---|---|---|---|
| Host computer: | **PC; Notebook PC** | Operating system: | **DOS** |
| Data model: | **Relational** | DBMS: | **GSB-GDS; dBase** |
| Data size: | **30000** records; **20 MB** | Number of files: | **15** |

Fields per record (maximum/average): **280**/**50**.

**B.C. METAL** Acronym: **BCMETAL**

BCMETAL is the historical metal production database for British Columbia. It contains mine location and name, and metal production since 1888. BCMETAL is a proto-type software, written in FoxBase, that allows query by name. location (NTS and Mining Division), year of operation, and metal type produced. Total production for any mine, year or Division may be calculated.

| | | | |
|---|---|---|---|
| Host computer: | **PC** | Operating system: | **DOS** |
| Data model: | **Relational** | DBMS: | **BCMETAL; dBase** |
| Data size: | **1452** records; **8 MB** | Number of files: | **2** |
| | | Fields per record (maximum/average): | **33**/**25**. |

**Regional Geochemical Survey** Acronym: **RGS**

RGS database contains multi-element analytical determinations, sample location information, bedrock associations and field observations of over 38,000 stream sediment and water samples in British Columbia. The database is used for exploration and development activities; geochemical, metallogenic and environment studies; and mineral potential, resource management and land-use projects. Digital data are stored in standard ASCII format.

| | | | |
|---|---|---|---|
| Host computer: | **MacIntosh; PC** | Operating system: | **Mac; DOS** |
| Data model: | **Flat-File** | DBMS: | **ASCII; dBase; .WKS** |
| Data size: | **38000** records; **10 MB** | Number of files: | **1** |
| | | Fields per record (maximum/average): | **62**/**60**. |

**Petroleum and Natural Gas/Schedule of Wells** Acronym: **PANG/WELLS**

The database contains geological and engineering data, plus production and reserve data, on all wells drilled for petroleum or natural gas in British Columbia.

| | | | |
|---|---|---|---|
| Host computer: | **VAX Mainframe** | Operating system: | **VMS** |
| Data model: | **Relational** | DBMS: | **SUPRA** |
| Data size: | **140 MB** | | |

## 5.4 Example of U.S.G.S. Geoscience Databases and Software

**MRDS - Mineral Resource Data System Contents**

Record Number and Type
Information Source
Reporter and Affiliation, and Entry Date
Site Type, Name and Synonyms
Country, State, County and District/Area
Primary Quadrangle and Scale
Latitude And Longitude
Commodities
Production
Deposit Type and Code
Host Rock Name and Lithology
Host Rock and Mineralization Age
Tectonic Setting
Associated Igneous Rock and Age
Ore Minerals and Controls
Non-Ore Mineralogy
Deposit Description
Comments
Key Words
References

**GSMAP and Associated Programs**

These programs are written for the IBM-PC and compatible microcomputers to assist workers in the Earth Sciences, in compilation and publication drafting of geologic maps and illustrations.

**GSMAP** is the main graphic program that creates the database to facilitate digital compilation of graphical elements. The program uses a digitizer and plotter for entry and plotting of digital data

**GSMUTIL** is a utility program to process GSMAP databases in either geodetic or Cartesian coordinates. A digitizer and plotter are not required.

**GSMEDIT** is a screen edit program permitting editing of databases using either geodetic or Cartesian coordinates using the keyboard of the computer.

**GSMPBLD** uses a digitizer to select specific lines from an existing database and assembles these lines into closed polygons or into lines in an output database.

**GSMPBS** uses the screen display to select specific lines from an existing database and assembles these lines into closed polygons or into lines in an output database.

**QUEIT** is a plotting utility tat uses the HPGL disk file generated by GSMAP to make plots.

**GSMROSE** is a program enabling construction of rose diagrams from linear data (lines or Polygon boundaries) in GSMAP databases to assist analysis of the trends of linear data.

**GSSECT** enables quick and accurate generation and plotting of the topographic profile for cross sections, and other profiles drawn from contour maps.

**GSDIG** makes use of a digitizer to determine geodetic (latitude, longitude) coordinates or Cartesian (X, Y) coordinates from maps or drawing and create ASCII character files containing site identifiers and geodetic coordinates (degree, minutes, seconds) or Cartesian coordinates in units from the drawing or digitizer units.

**GSPOST** is a program that takes data from a properly formatted ASCII file and plots on the screen, on a plotter, or writes to a disk file in HPGL to make maps displaying information associated with geographic sites by drawing symbols and/or posting numerical.

**GSLITH** is a program designed to organize, store, and process data that define the "vertical" sequence of rock units at locations specified by latitude/longitude coordinates. It assists in the management of drill data; the drawing of sections and plan views; and the export of ASCII files for contouring.

## 5.5 References

- TECDOC: Sections 4.1, 4.2, Figure 3, Table 1, Annex 6.1.
- Selner and Taylor, see Bibliography.

# 6. EARTH SCIENCE INFORMATION DATABASES

## 6.1 Bibliographies

- **Published** geoscience material is collected systematically by several organizations on a global scale.
- A **thesaurus** is a guide to the usage of keywords (indexing terms), their hierarchical relationships and synonyms.
- **Unpublished** bibliographic data on geoscience material includes reports and maps in the archives of geological surveys and exploration and mining companies.

**Example of Data Elements for Unpublished Reports:**

- Title of report
- Name(s) of author(s)
- Name of source organization
- Name of report series
- Serial number or code of report
- Number or range of pages
- Notes on illustrations, appendices, maps
- Year of report
- Types and scales of maps in the report
- Language of report
- Subject keywords
- Geographic names
- Longitude/latitude
- Text of abstract
- Free field for comments
- Location of document

- Name and date of recorder

## 6.2 Indexes for Earth Science Information Databases

**Data Elements for Geological, Geophysical, Geochemical and Topographic Map Indexes:**

- Title and year of publication
- Name(s) of author(s)
- Name and address of organization that serves as repositories for data
- Name of report series
- Serial and number of publication
- Projection and scale of map
- Country and geographic area
- Area covered in square kilometers
- Longitude/latitude of the boundaries of map coverage and center of map
- Form of data release (hard copy: paper; digital: file type and size, media format, hardware and software compatibility)
- Availability
- Free field for comments

- **Geological map indexes** typically contain mappable rock units, structural elements observed and type of samples taken
- **Geophysical map indexes** typically contain the kind of geophysical data and its characteristics and details about the survey, such as spacing of flight lines and flight characteristics
- **Geochemical map indexes** typically contain the type of sample and analytical methodologies used for each sample type
- **Topographic map indexes** typically contain contour interval and features

**Data Elements for Air Photography Indexes:**

- Listing of organizations that provide air photos
- Agency code
- Date of coverage
- Scale of photography
- Focal length of lens used
- Type of film
- Cloud cover
- Location, such as coordinates of the corners of each photograph

**Data Elements of Drill Hole Indexes:**

- Record number
- Name of organization or project
- Identification number
- Location
- Bearing and inclination
- Total length
- Location of drill core
- Location of drill hole log or report

## 6.3 References

- TECDOC: Section 4.3, Figure 3, Tables 2 - 3, Annexes 6.2 and 6.3.

# 7. MINERAL DEPOSIT DATABASE

## 7.1 General

- A mineral deposit database is an **organized inventory** of data related to mineral occurrences.
- A **relational data model** is functional, flexible and expandable.
- Use in a **multi-level** approach.
- Use **standard codes.**
- **Rank multiple entries**, such as the commodity, mineralogy and lithology fields, in decreasing order of importance.

## 7.2 Multi-level Approach

**First-level Data Elements:**

- Deposit identification number
- Deposit name
- Commodities or minerals present
- Point location, map area
- Administrative jurisdiction
- Geologic setting
- Current status or stage of development
- Deposit type
- Commodity economics
- Brief geological descriptions
- Primary references
- Name of the collector and date of input

**Second-level Data Elements:**

- Host rocks in terms of name, age, lithology and relationship to the economic minerals
- Size of deposit
- Regional structural-tectonic setting
- Economic, gangue and alteration minerals
- Reserves

**Third-level Data Elements:**

- Elevation & location accuracy
- Alteration type
- Deposit details
- Metamorphic type and grade
- Stratigraphic name and age
- Isotopic age, material dated and dating method
- Ore reserve category, year of calculation, quantity, grade and reference
- Year of production, ore mined, ore milled, quantity and reference

## 7.3 Data Codes (Entities or Tables)

- Keep the database small.
- Reduce errors on input.
- Help to speed up queries on the database.
- Provide the user with classification guidelines and choices.
- May be easily redefined, modified or expanded.
- Chose codes with meaning and flexibility.
- Use standard codes based on controlled vocabularies and global frequencies, such as commodities, rocks, mineral names and stratigraphic units.

## 7.4 Uses of a Mineral Deposit Database

- An inexpensive **research** tool by industry, academic researchers and government.
- Selection of areas for **exploration or research projects**.
- Assists in the analysis of the **distribution** of geology, metallogeny and mineral deposits.
- Mineral deposit distribution plots help select prospective areas for **mineral potential**.
- **Land-use planning** and **mineral resource management**.
- Data may be integrated into **geographical information systems** (GIS).

## 7.5 Mineral Deposit Database Project Management

- Budgeting, planning and staffing
- Database design and data dictionary
- Data acquisition and processing procedures (coding procedures)
- Software design, development and system testing
- Database administration and maintenance
- Documentation and manuals
- Designing and producing computer generated products for user's
- Marketing and distribution of data
- Training and client support
- New technology and future planning

## 7.6 B.C. MINFILE as an Example

**Overview of MINFILE:**

- MINFILE is the British Columbia Geological Survey's mineral inventory database management system.
- Contains information on over 11 000 metallic, industrial mineral and coal occurrences (showings to major producing mines).
- MINFILE/pc, a menu-driven data-entry, search and report program for IBM-compatible microcomputers, accesses the database.
- Data elements are organized with a set of codes (entities), within a relational database design (entity-relationship model).
- The MINFILE system helps provide solutions in mineral exploration, land-use planning and mineral resource management.
- MINFILE information may be used in other programs such as word processors, plotted using computer-aided mapping systems, and integrated with conventional geographical information systems.
- The database contains 69 files, with 96 fields and 84 data elements.
- 86 maps (1:250,000 or 1:100,000 scale) cover 950 000 square kilometres.

**MINFILE Data:**

- Location
- Commodity
- Mineralogy and alteration
- Geological setting
- Lithology and host-rock name and age
- Deposit class and character
- Assays, reserves and production, and reserves
- Textual geological description (capsule geology)
- Bibliography, citing information sources for the occurrence

**The MINFILE/pc Program:**

- A **stand-alone, menu-driven program**, operating within 640 kilobytes of RAM, in the MS-DOS environment of IBM-compatible microcomputers.
- 12 menu-driven **searches** on a variety of exploration and geological parameters.
- 12 high quality **reports** on the search results.
- **Data-entry** has a pull-down and pop-up interface for changing, updating and appending data.
- **Utility functions** assist in configuring the database, exporting and importing data, and maintaining the system.
- **Code table maintenance** allows the users to add, delete and modify the contents of the various codes and tables.
- The province wide database of over 11 000 occurrences currently occupies **60 megabytes** of space.
- Data are distributed in **ASCII files**, which are configured into searchable database (**dBASE**) files.
- **Programming language and software**: FoxBASE+/FoxPro, R&R Relational Report Writer, automatic table look-up (Proximity Technology Inc.), data compression (PkZip by PkWare Inc.).
- **Supporting documents** include a coding manual, a user's manual and technical manuals.

**Products, Distribution and Support:**

- Mineral location maps, with topography and geological base (1:250,000 or 1:100,000 scale)
- Paper print-outs of indexes and complete reports
- Data disks (map areas, provincial, commodity open files)
- MINFILE/pc software
- Coding and user's manuals
- Custom searches, reports and data
- Talks, workshops and help desk
- Over 400 users
- MINFILE technology and program are marketed for sale world-wide

## 7.7 References

- TECDOC: Section 4.4, Figure 3, Tables 9-12, Annexes 6.4.

# 8. EXPLORATION DATABASES

## 8.1 General

- Exploration projects generate most or all of the **detailed geologic information** in an area of interest.
- Exploration project databases contain **collected data**, such as field measurements, and calculated data, such as analytical work on samples.
- Data **presentation methods** help to evaluate regional trends and locate anomalies.
- **Good record keeping** and **proper indexing** are essential if the raw data is to be reinterpreted at a later time.
- **Modeling and interpretation** methods help to filter, reduce or enhance data.
- Data-**sets are grouped** according to the type of work performed, commonly prospecting, geological, geophysical, geochemical, physical and drilling.
- Global Positioning Systems (**GPS**) are useful for accurately locating sample sites.

**Typical Contents of Exploration Database:**

- Title of project
- Jurisdiction
- Location (longitude/latitude)
- Project Type (major, minor)
- The managing company or organization
- The name, address and telephone of the project coordinator or manager
- Date and type of work done
- Exploration budget and cost of the completed exploration program
- Notes on pertinent information such as geological descriptions, plans for the following year, assays, references, etc.

## 8.2 Drill Hole Data

**Contents:**

- Drill hole name, collar location and elevation, and total length of hole
- Downhole survey data
- Lithological descriptions or stratigraphic units
- Sampling and assay data

**Drilling Types:**

- Becker hammer, churn, diamond - surface, diamond - underground, overburden, percussion and rotary.

## 8.3 Geophysical Data

**Contents:**

- Surveyor
- Instruments used
- Analog or digital records
- Area covered
- Station location
- Data measurements and calculations dependent on geophysical method

**Geophysical Types:**

- Dip needle, electromagnetic - airborne, electromagnetic - ground, gamma ray spectrometer - airborne, gamma ray spectrometer - ground, gravity, induced polarization, infra-red, magnetic - airborne, magnetic - ground, mise-a-la-masse, radar, radiometric - airborne, radiometric - ground, radiometric - drill hole probing, radon gas scintillometry, resistivity (alone), scintillometer - airborne, scintillometer - ground, seismic, self potential.

## 8.4 Geochemical Data

**Contents:**

- Source of geochemical data
- Sample number
- Location of sample site, elevation
- Sample material (sediment, soil, water)
- Site information (stream parameters, rock type, sample description)
- Analytical values for each sample

**Geochemical Types:**

- Biogeochemistry, fission track etch, heavy minerals, metallurgic, rock, sampling/assaying, silt, soil, water.

## 8.5 Field Data

**Recommended Features for a Field Data System:**

- Easy retrieval, sorting and manipulation of field data to assist in map compilation and plotting.
- Ability to create page size to map size plots at any scale.
- Ability to retrieve data and create reports and tables.
- Consistency in the way field data is collected and reported.
- Geologic databases created can be incorporated into a GIS and automated map plotting system.
- Ability to use dBASE files that are related to each other by station number.

**Contents:**

- Station location, longitude/latitude, traverse, map area
- Structural measurements
- Mineral occurrence data
- Rock types and alteration data
- Descriptive notes
- Analytical results of geochemical data
- Radiometric age dates
- Fossil name and age
- Isotope analyses
- Photo number
- Petrographic data
- Date and coder

**Field Data Types:**

- **Geological**: geological, petrographic, photo.
- **Physical**: legal surveys, line/grid, pits, reclamation, road, local access, stripping, topographic/photogrammetric, trail, trench, underground development, underground surveys.

## 8.6 References

- TECDOC: Section 4.5, Figure 3, Tables 13, 14, Annexes 6.5.

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# The Strategy and Philosophy in Mineral Resources Databases

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## OUTLINE:

Introduction
Why, How, When, Where, What, Who
The Mineral Exploration and Development Cycle
Organization of Earth Science Data
Master Database - *Data Dictionary*
System Planning - *System Cycle*
An Approach to Integrated Data Managment
Summary

**References:**
TECDOC Section 4.1, 4.2, Figure 3
Green, Bill, 1991, Exploration with a Computer

**Lecture 5** by:
**L.D. Jones**, May 11, 10:00-11:00

# An Approach to Integrated Data Management

## CHALLENGES:

- successfully integrate the various databases and mapping systems in a way that facilitates exchange of data for broader purposes.

- maintain information in a manner which promotes data integrity and rapid retrieval.

## DATA ISSUES - DATA MODELS:

- originally recorded on paper.

- transferred into digitally based systems.

- data model must be constructed that provides the organizational layout of the data.

- must serve the needs of the business application that surrounds the data.

- many databases evolve in which model construction is minimal.

- ad hoc database construction which occurred as technology developed.

# An Approach to Integrated Data Management

## TECHNOLOGY MANAGEMENT ISSUES:

- development and maintenance of data requires human resources.
- local and central responsibility of systems.
- database managers and administrators.
- routine and specialized maintenance - *backups, programming.*
- inconsistencies, errors, corruption of data, and eventual abandonment of the databases and applications will result.
- focus on future developments and planned migration strategies.
- data static if it is collected and managed in a consistent framework.
- data considered to be dynamic (*changing in its nature, structure, and application*) if collected and evolved over time.
- requires a strategy that will work towards keeping data relevant and manageable.

# An Approach to Integrated Data Management

## PROCEDURE:

- establish Business Case and Plan strategy.
- coordinate implementation with the custodians of the databases.
- review and recommend, where necessary, upgrading of databases.
- manage and coordinate the exchange of data.

## DATABASE COMPONENTS:

- data model.
- administration.
- project staffing.
- documentation.
- database directory.

## An Approach to Integrated Data Management

### DATABASE COMPONENTS:

- data model.
- administration.
- project staffing.
- documentation.
- database directory.

# An Approach to
# Integrated Data Management

- Challenges
- Data Issues - Data Models
- Technology Management Issues
- Procedure
- Database Components

## Some Whats:

- mineral resources are unevenly distributed throughout the earth's crust.
- most countries enjoy some mineral endowment.
- many have a mining history dating back hundreds of years.

## Some Whys:

- few countries have a well-organized, comprehensive and easily accessible source of historic mining and geological data relating to the nature and distribution of their mineral resources.
- such information is the starting point in the search for new orebodies.
- readily accessible databases are essential for effective management of the existing resource and invaluable tools in the search for new orebodies.
- add to the country's resource base.
- stimulus to mineral exploration leading to the discovery of new mineral deposits.
- development of new mines.
- contributes to the creation of new wealth by developers, workforce, and public treasury (profits, wages, and taxes).

## Some Hows

- effective management of mineral resources requires a knowledge of the nature of the resources to be managed, their dimensions, where they are located, their current status, and many other factors.
- Earth Science Databases - compile and update this information.

## THE MINERAL EXPLORATION AND DEVELOPMENT CYCLE

**Mineral Exploration Program Observations and Strategy:**

- **detailed geological information will be collected during the life of the operation.**
- **these data are invaluable in the search for new orebodies in the same district and in other areas with similar geological setting.**
- **data are often lost if the project is abandoned.**
- **drill core and logs, assays, geophysical results, geological maps, mine plans and engineering reports may be buried in private files or may even be lost or destroyed.**
- **if the information is stored in a database where it can be readily retrieved and analyzed, it may lead to fresh insights and new ideas that rekindle interest in the project.**
- **new geological concepts, the availability of new technology, an increase in commodity prices or improved transportation may reactivate an old mining area.**
- **easy access to historical and current geoscientific data, which is gathered at great expense and sometimes is not reproducible, will be of benefit to new investors, which in turn will stimulate and promote mining exploration in an area.**

## THE MINERAL EXPLORATION AND DEVELOPMENT CYCLE

**Philosophy of Mineral Exploration Programs:**

- **mineral exploration and mine development ventures involve a high level of financial risk.**
- **information gathered at each stage of a project lead to increased confidence of discovering and developing an orebody.**
- **if the data gathered at each stage of a project is accurate and complete lower risk factors are involved.**

**Stages of Mineral Exploration Programs:**

- **first stage of exploration is the choice of area, which is generally based on analysis of available geoscience data from general surveys and previous exploration effort.**
- **ready access to this type of information will simplify the task and greatly increase success**
- **subsequent stages include geophysical and geochemical surveys, detailed geological mapping and drilling and underground work.**
- **costs increase at each stage, as do the spin-off economic benefits.**
- **information generated must provide the justification for continuing to the next stage.**
- **final stage - ore reserves exhausted and mine closes.**
- **portion of the profits will be allocated to the search for new orebodies and the exploration and development cycle will be repeated.**

## System Planning - *Data and System Goals*

- quick and easy access to data
- detailed, high quality information
- data available in a wide variety of forms, such as custom and standard reports, and digital files for incorporation into other programs
- systematic management of data elements to improve data integrity and validity
- an established methodology for the distribution of data
- allow the database to grow with increased requirementss
- efficient and flexible model
- establish common data formats and system capabilities
- define links to geographical information systems
- implement a modern user-interface based on the latest technology
- standardize tables and definitions (e.g. commodities and work types)
- a versatile data dictionary will permit customized data content

## System Planning - *System Cycle*

- **establish business objectives and desired output**
- **scope document, user-requirements, fitting analysis (content and system)**
- **detailing the proposal, with an action plan and resources required**
- **budgeting and project team selection**
- **user-needs analysis and design details**
- **project schedule and detailed implementation plan**
- **develop universal tables, establish regional flexibility**
- **chose application development software and acceptable user-interface**
- **produce a PC-based application**
- **system testing and documentation**
- **user acceptance and evaluation**
- **marketing, distribution, training and support**

# Development and Evolution of a Database Management System, a Canadian Example

## OUTLINE:

Introduction
Setting of Ore Deposits in British Columbia
B.C. Geological Survey Databases
Integration of Databases - *Mineral Potential Maps*
System Plan Development - *Example*
Summary

**References:**
TECDOC Section 4.2, Annex 6.1

**Lecture 7** by:
**L.D. Jones**, May 11, 14:00-15:30

## Data Integration/Management Unit

It is proposed that the Division establish a distinct Data Integration/Management Unit. This unit will address the issues discussed above as well as fulfilling 3 main objectives:

1. To provide an efficient and standardized means of producing maps using GIS technology. This will be achieved through the coordinated integration of databases and map data such that thematic maps and reports can be generated for specific applications. This will result in a dynamically-based system that can generate maps and reports critical for land-use issues, and will also provide thematic reports and maps imperative for mineral resource appraisal.

2. To provide a powerful, centralized land information management tool for the Geological Survey Branch databases such as Regional Geology, MINFILE, ARIS, Coal file and Regional Geochemistry, Mineral Titles, Notices of Work, Mineral Policy). These databases would exist in various formats which serve the needs of the project/programs that require them. The system will eventually comply with the SAIF (Standard Archive and Interchange Format) format which meets the specifications of the Land Information Infrastructure and would not duplicate existing databases. The following requirements will also be supported:

- compliance with the Division requirement to implement an across-the-board integrated data management strategy that fulfills the requirements of the LII;
- compliance with the requirement to carry out the mineral resource assessment program under the Corporate Resource Inventory Initiative (CRII);
- addressing the need for an upgraded geoscience data and map inventory, management and analysis system;
- providing compatibility with the publication standards for the Division;
- satisfying Land Use Assessment requirements;
- compliances and compatiblility with the Corporate Land Information Strategic Plan.

3. To provide an electronic link with the LII (Land Information Infrastructure) that will enable on-line exchange of land information data in SAIF format between the Division and other ministries. This will be devleoped in Phase III of the implementation of the LII. Data will be captured from two main sources. External data such as radiometric or aeromagnetic data will be captured using formats required or defined from the external source. This data will be imported into the GSB GIS using a number of different translators. Data derived from other BC government sources will eventually be captured via the Land Information

Infrastructure using a common set of standards that will be defined using the Standard Archive Interchange Format (SAIF). GSB mineral potential products will also be made available through the LII.

**Data Dissemination within the GSB**

Data dissemination can be achieved through networked PC and Workstation platforms by accessing a centralized database containing the core databases and integrated products. Through the use of a client-server architecture, data can be captured and managed on the server, while being accessed and analyzed on clients. The Data Integration Unit would act as the central server for the data.

**Planned Migration Strategy**

In order for the Division to comply with the LII and build a comprehensive and spatially linked database structure, it must plan an implementation and migration strategy. This strategy consists of:

- constructing and coordinating data models of all the databases within the Division that are intended to be part of the LII;
- create a plan of database linkages across the Division;
- on the completion of database lifecycles, each database should be re-engineered to conform with Division GIS linkage requirements and the LII.

This strategy requires a team of personnel comprised of those responsible for development and/or management of the various databases within the Division, and would be coordinated by the Data Integration Unit along with ISB. This team would led by a Division representative who is familiar with the LII and the goals and database structures of the Division. This team would coordinate the transition of databases to the proposed data model structure within the Division.

# Guidelines to Database Systems

## OUTLINE:

Introduction
Definitions
Data Models
Database System Design
Standards
Database Administration
Database Documentation

**References:**
TECDOC Section 3

**Lecture 10** by:
**L.D. Jones**, May 12, 9:00-10:00

## Definitions

- ⇒ **database** is an organized set of related data that is drawn together to fit defined needs
- ⇒ **database management system** (DBMS) consists of a database and a set of programs to access the database. It provides a structured environment that is both convenient and efficient to use in storing, accessing and reporting data
- ⇒ **database file** contains data with a particular theme
- ⇒ **record** all the data for a particular entry
- ⇒ **field** is an item of information within a record
- ⇒ **database structure** defines a database file
- ⇒ **database key** uniquely identifies the sites of each record
- ⇒ **data dictionary** contains details of the structure of the database, definitions of the contents of each field and listings of acceptable entries for fields of explicit content
- ⇒ **external interface** is defined as the mechanism in which the user captures or enters the data
- ⇒ **data model** describes data and a set of operations used to manipulate that data

# Earth Science Information Databases - Their Elements and Functions - Part II

## OUTLINE:

Introduction
Codes and Key Terms
Published Systems - *GEOSCAN, GEOREF*
PC-based Systems - *PROCITE*
Un-published Systems - *GSB Index, ARIS*
Summary

**References:**
TECDOC Section 4.3, Annex 6.2

**Lecture 12** by:
**L.D. Jones**, May 12, 11:15-12:15

# **SCREEN FORMAT** for inputting data to NTS & Author Index of British Columbia publications

```
AUTHOR(S):            INITIALS   YEAR                NTS  MAP
XXXXXXXXXXXXXXXXXXXX   XXXXXX    XXXX              a XXXX XXX
XXXXXXXXXXXXXXXXXXXX   XXXXXX                      b XXXX XXX
XXXXXXXXXXXXXXXXXXXX   XXXXXX                      c XXXX XXX

TITLE:  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

AGENCY: XXXXXXXX    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
PUB:    XXXXXXXXXXXXXXXXXXXXXXXXX  PUB.TYPE:XXXXXXXXXXXXXXXXXXXX
VOL.NO: XXXXXXXXXXXXX               PAGE(S):XXXXXXXXXXXXXX
   MAP: XXXXXXXXXXXXXX    SCALE: XXXXXXXXXX

 MAP AREA:  XXXXXXXXXXXXXXXXXXXX       MAJOR REFERENCE? X  (Y/N)
                                       STILL IN PRINT?  X  (Y/N)
 KEYWORDS:
 XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX
      LIB.CONG.#:XXXXXXXXXXXXXXX          ISSN #:XXXXXXXXXXXXXXX

                Use [Cntl-End] when input complete
```

# EXAMPLE OF LOCATION & AUTHOR INDEX

| Field | Field Name | Type | Width |
|---|---|---|---|
| 1 | NTSA1 | Character | 4 |
| 2 | NTSA2 | Character | 3 |
| 3 | NTSB1 | Character | 4 |
| 4 | NTSB2 | Character | 3 |
| 5 | NTSC1 | Character | 4 |
| 6 | NTSC2 | Character | 3 |
| 7 | NTSD1 | Character | 4 |
| 8 | NTSD2 | Character | 3 |
| 9 | AUTHOR | Character | 20 |
| 10 | INITIAL | Character | 6 |
| 11 | TITLE1 | Character | 200 |
| 12 | AG_CODE | Character | 8 |
| 13 | PUBLICATIO | Character | 60 |
| 14 | PUB_TYPE | Character | 55 |
| 15 | PUB_NO | Character | 13 |
| 16 | PUB_YR | Numeric | 4 |
| 17 | MAPS | Character | 15 |
| 18 | SCALE | Character | 10 |
| 19 | MAJ_REF | Logical | 1 |
| 20 | IN_PRINT | Logical | 1 |
| 21 | LIB_CONG | Character | 15 |
| 22 | ISBN | Character | 15 |
| 23 | KEY1 | Character | 50 |
| 24 | KEY2 | Character | 50 |
| 25 | KEY3 | Character | 50 |
| 26 | KEY4 | Character | 50 |
| 27 | KEY5 | Character | 50 |
| 28 | KEY6 | Character | 50 |
| 29 | KEY7 | Character | 50 |

| Field | Field Name | Type | Width |
|---|---|---|---|
| 30 | KEY8 | Character | 50 |
| 31 | KEY9 | Character | 50 |
| 32 | KEY10 | Character | 50 |
| 33 | KEY11 | Character | 50 |
| 34 | KEY12 | Character | 50 |
| 35 | KEY13 | Character | 50 |
| 36 | KEY14 | Character | 50 |
| 37 | KEY15 | Character | 50 |
| 38 | KEY16 | Character | 50 |
| 39 | PUBPAGE | Character | 18 |
| 40 | AUTHOR2 | Character | 20 |
| 41 | INITIAL2 | Character | 6 |
| 42 | AUTHOR3 | Character | 20 |
| 43 | INITIAL3 | Character | 6 |
| 44 | AUTHOR4 | Character | 10 |
| 45 | INITIAL4 | Character | 6 |
| 46 | AUTHOR5 | Character | 10 |
| 47 | INITIAL5 | Character | 6 |
| 48 | AUTHOR6 | Character | 10 |
| 49 | INITIAL6 | Character | 6 |
| 50 | AUTHOR7 | Character | 10 |
| 51 | INITIAL7 | Character | 6 |
| 52 | AUTHOR8 | Character | 10 |
| 53 | INITIAL8 | Character | 6 |
| 54 | AUTHOR9 | Character | 10 |
| 55 | INITIAL9 | Character | 6 |
| 56 | REC_NO | Numeric | 5 |
| 57 | THESIS | Character | 5 |
| ** Total ** | | | 1428 |

GRANT, B., NTS (National Topographic System) Location & Author Index to Publications of the British Columbia Geological Survey Branch, *British Columbia, Ministry of Energy, Mines and Petroleum Resources*, Information Circular 1991-7, (1991) 304p.

# B.C. ASSESSMENT REPORT INDEXING SYSTEM (ARIS)

- a library of over 22 000 assessment reports dating from 1947
- reports of assessment submitted by the mineral industry under the Mineral Tenure Act in order to maintain claims in good standing
- $56 million dollars of exploration work submitted in 1990
- information contained in the reports is a valuable reference and research tool for mineral exploration, academic studies and resource management

**Assessment Report Indexing System (ARIS)** designed to assist in processing a rapidly mounting volume of assessment report administration and data management.

## ARIS Database

- The ARIS system modelled after the MINFILE (Mineral Inventory File)
- The database design uses an "entity-relationship" model comprised of codes (entities), with interrelated tables of data containing common assessment report numbers
- ARIS database resides on a mainframe computer and could easily be ported to a PC-based system.

## Present Functions of ARIS:

1. Data capture
2. Administration and maintenance
3. Inquiries (ad hoc and pre-programmed)
4. Distribution functions

# 1. Data Capture (ARIS)

## Data Entry

1) General Data (locational)
2) Names (author owner operator)
3) Geological Summary
4) Keywords
5) Work Data
6) Approval Information
7) Amend/Reject Information

# 2. Administration and Maintenance (ARIS)

**Reports**

1) Tables Report
2) Name & Address Table Report
3) NTS Map Index
4) ARIS Summary Sheet
5) Off Confidential Report
6) Status Report by NTS Map
7) Letters (approval, amend, rejection)
8) File to Produce Map List

**Table Maintenance**

1 ) Mining Camp Codes
2 ) Mineral Act Regulations Code
3 ) Date Codes
4 ) Commodities
5 ) Mining Divisions
6 ) NTS Mapsheet Names
7 ) Specific Work Types
8 ) General Work Types
9 ) Name & Addresses
10) Name Types
11) Keywords

**System Maintenance**

1) System Error Message Maintenance
2) System Error Message Inquiry
3) Prompter (Help) Maintenance

# 3. Inquiries (ARIS)

**Inquiries**

1) Claim Name
2) Owner Operator Author Name
3) Property Name
4) Mining Division
5) NTS (National Topographic System) Mapsheet
6) MINFILE Number
7) Latitude/Longitude

# 4. Distribution Functions (ARIS)

- contributor to GEOSCAN, a federal-provincial cooperative program. GEOSCAN is a computerized bibliographic index to geological information dealing with the Canadian landmass, and offshore areas
- produces diskettes in GEOSCAN compatible format.
- perform searches to interested clients free of charge
- complete assessment report libraries on microfiche
- copies of reports can be ordered
- ARIS available on paper, microfiche and computer diskettes. The index provides latitude, longitude, UTM co-ordinates, claim names, operator, author, type of work reported and report year. Available 14 ASCII files to facilitate access by a variety of commercial software programs, such as database management and plotting packages
- 90 index maps mainly at a scale of 1:250 000

# Mineral Deposit Databases

## OUTLINE:

- Introduction
- Data Codes, Structure and Elements
- USGS Example
- MINFILE Example
    - What is MINFILE
    - Brief History
    - Data Model
    - User Examples
    - MINFILE/pc
    - Products and Distribution
- Summary

**References:**
TECDOC Section 4.4, Annex 6.4

**Lecture 15** by:
R.B. Taylor and **L.D. Jones**, May 13, 9:00-12:00

# Example of first-level mineral deposit data.

Structure for database:  C:\MINDEP\MINDEP1.DBF
Number of data records:  300
Date of last update:  07/07/91

| FIELD | FIELD NAME | TYPE | WIDTH | DEC | SAMPLE DATA |
|---|---|---|---|---|---|
| 1 | ID_NO | Character | 10 | | TVL-013 |
| 2 | DPST_NM | Character | 30 | | DOMINION REEF |
| 3 | STATUS_C | Character | 4 | | MINE |
| 4 | CMDTY1_C | Character | 2 | | UR |
| 5 | CMDTY2_C | Character | 2 | | AU |
| 6 | CMDTY3_C | Character | 2 | | AG |
| 7 | LAT | Character | 9 | | 26-52-00S |
| 8 | LONG | Character | 10 | | 026-23-00E |
| 9 | DPTYPE_C | Character | 4 | | QPEB |
| 10 | REF1 | Character | 4 | | 0012 |
| 11 | REF2 | Character | 4 | | 0066 |
| 12 | REF3 | Character | 4 | | 0109 |
| 13 | CMNT1_T | Character | 70 | | Quartzite overlying oligomictic quartz-pebble congl. |
| 14 | GEOL_NM | Character | 4 | | LDJ |
| 15 | DATE_IN | Character | 8 | | 070791 |
| ** Total ** | | | 163 | | |

# Example of second-level mineral deposit data.

Structure for database:  C:\MINDEP\MINDEP2.DBF
Number of data records:  300
Date of last update:  07/07/91

| FIELD | FIELD NAME | TYPE | WIDTH | DEC | SAMPLE DATA |
|---|---|---|---|---|---|
| 1 | ID_NO | Character | 10 | | TVL-013 |
| 2 | HOST_NM | Character | 30 | | DOMINION |
| 3 | HOST_AGE | Character | 4 | | ARCH |
| 4 | LITH1_C | Character | 4 | | CGLM |
| 5 | LITH2_C | Character | 4 | | QRTZ |
| 6 | LITH3_C | Character | 4 | | |
| 7 | MIN1_C | Character | 4 | | URAN |
| 8 | MIN2_C | Character | 4 | | PYRT |
| 9 | MIN3_C | Character | 4 | | |
| 10 | SETTING | Character | 20 | | BASIN |
| 11 | SIZE | Character | 1 | | |
| 11 | GRADE | Character | 20 | | 200 PPM |
| 12 | CMNT2_T | Character | 70 | | |
| ** Total ** | | | 179 | | |

# Example of third-level mineral deposit data.

| Field | Length | Content |
|---|---|---|
| ELEV | 4 | Elevation in metres |
| LOC_ACC | 1 | Deposit location accuracy (1=500 m, 2=1 km, 3=5 km) |
| ADMINJUR | 4 | Administrative jurisdiction (province, territory or district) |
| ALTER_C | 4 | Alteration type code |
| DEPCHR_C | 4 | Deposit character code |
| DEPCLA_C | 4 | Deposit classification code |
| DEPSIZEL | 4 | Deposit length |
| DEPSIZEB | 4 | Deposit breadth |
| DEPSIZEW | 4 | Deposit width |
| DIP | 3 | Deposit dip |
| STRIKE | 3 | Deposit strike |
| PLUNGE | 6 | Deposit plunge |
| DEPSHA_C | 1 | Deposit shape type code (1=regular, 2=tabular, etc) |
| META_T_C | 1 | Metamorphic type code (1=contact, 2=regional) |
| META_G_C | 2 | Metamorphic grade code |
| STNAME_C | 6 | Stratigraphic name code |
| ST_AGE_C | 3 | Stratigraphic age code |
| ISOAGE | 20 | Isotopic age |
| MATERIAL | 30 | Material dated |
| DATMET_C | 2 | Dating method code |
| RESCAT_C | 2 | Ore reserve category code (IN=indicated, etc) |
| RESYEAR | 4 | Year of calculation or publication |
| RESQUAN | 12 | Quantity in metric tonnes |
| RESCO_C | 2 | Recoverable commodity code |
| RESGRADE | 9 | Grade of commodity |
| RESREF_T | 70 | Reserves reference |
| PRODYEAR | 4 | Year of production |
| MINED | 12 | Ore mined |
| MILLED | 12 | Ore milled |
| PRODCO_C | 2 | Produced commodity code |
| PRODQUAN | 12 | Quantity produced |
| PRODRF_T | 66 | Production reference |

# Code table example

**FILE NAME: STATUS_C**

| CODE | DESCRIPTION | EXPLANATION |
|---|---|---|
| SHOW | Showing | A showing or occurrence with identified mineralization. |
| PROS | Prospect | A showing with development and unknown resources. |
| DEPR | Developed prospect | A prospect pending an economic evaluation. |
| ECDP | Economic deposit | A developed prospect with recoverable ore. |
| MINE | Active mine | A producing mine. |
| MINR | Inactive mine | An inactive mine with resources remaining. |
| MIND | Depleted mine | A mined-out or depleted ore deposit. |

# Mineral Exploration Databases

## OUTLINE:

Introduction
Organization of Data and Codes
Exploration and Development - *MINFILE example*
Drill Hole Data
Geochemical Data - *RGS example*
Field Data - *GSB-GDS, GEOF examples*
Summary

**References:**
TECDOC Section 4.5, Annex 6.5

**Lecture 17** by:
**L.D. Jones**, R.B. Taylor and M. Tauchid, May 14, 9:00-12:00

# Work Type Codes

| TYPE | DESCRIPTION | CATGRY. | D/A UNITS | NUM.UNITS |
|---|---|---|---|---|
| BHDR | Becker Hammer | DRIL | m | hole(s) |
| BIOG | Biogeochemistry | GEOC | | sample(s) |
| CHUD | Churn | DRIL | m | hole(s) |
| DIAD | Diamond surface | DRIL | m | hole(s) |
| DIPN | Dip needle | GEOP | km | |
| EMAB | Electromagnetic, airborne | GEOP | km | |
| EMGR | Electromagnetic, ground | GEOP | km | |
| ETCH | Fission track etch | GEOC | | sample(s) |
| FOTO | Photo | GEOL | ha | |
| GEOL | Geological | GEOL | ha | |
| GRAV | Gravity | GEOP | km | |
| GRSA | Gamma ray spectrometer, airborne | GEOP | km | |
| GRSG | Gamma ray spectrometer, ground | GEOP | km | |
| HMIN | Heavy minerals | GEOC | | sample(s) |
| HYDG | Water | GEOC | | sample(s) |
| INFR | Infra-red | GEOP | km | |
| IPOL | Induced Polarization | GEOP | km | |
| LINE | Line/grid | PHYS | km | |
| LSUR | Legal surveys | PHYS | km | |
| MAGA | Magnetic, airborne | GEOP | km | |
| MAGG | Magnetic, ground | GEOP | km | |
| MALM | Mise-a-la-masse | GEOP | m | |
| META | Metallurgic | GEOC | | sample(s) |
| MNGR | Mineralographic | GEOL | | sample(s) |
| OBDR | Overburden | DRIL | m | hole(s) |
| PERD | Percussion | DRIL | m | hole(s) |
| PETR | Petrographic | GEOL | | sample(s) |
| PITS | Pits | PHYS | | pit(s) |
| PROS | Prospecting | PROS | ha | |
| RADA | Radiometric, airborne | GEOP | km | |
| RADG | Radiometric, ground | GEOP | km | |
| RADP | Radiometric drill hole probing | GEOP | m | |
| RADR | Radar | GEOP | km | |
| RECL | Reclamation | PHYS | ha | |
| REST | Resistivity (alone) | GEOP | km | |
| RGAS | Radon gas scintillometry | GEOP | km | |
| ROAD | Road, local access | PHYS | km | |
| ROCK | Rock | GEOC | | sample(s) |
| ROTD | Rotary | DRIL | m | hole(s) |
| SAMP | Sampling/assaying | GEOC | | sample(s) |
| SCAB | Scintillometer, airborne | GEOP | km | |
| SCGR | Scintillometer, ground | GEOP | km | |
| SEIS | Seismic | GEOP | km | |
| SILT | Silt | GEOC | | sample(s) |
| SOIL | Soil | GEOC | | sample(s) |
| SPOT | Self potential | GEOP | km | |
| STRI | Stripping | PHYS | ha | |
| TOPO | Topographic/photogrammetric | PHYS | ha | |
| TRAL | Trail | PHYS | km | |
| TREN | Trench | PHYS | m | trench(es) |
| UNDD | Diamond underground | DRIL | m | hole(s) |
| UNDV | Underground development | PHYS | m | |
| USUR | Underground surveys | PHYS | m | |

# Structure for EXPLRTN.DBF

| FIELD | FIELD NAME | TYPE | WIDTH | DEC | START | END |
|---|---|---|---|---|---|---|
| 1 | ID_NO | Character | 9 | | 1 | 9 |
| 2 | PROJECT_TITLE | Character | 60 | | 10 | 69 |
| 3 | PROVINCE | Character | 30 | | 70 | 99 |
| 4 | DISTRICT | Character | 30 | | 100 | 29 |
| 5 | LATITUDE | Number | 7 | 5 | 30 | 36 |
| 6 | LONGITUDE | Number | 8 | 5 | 37 | 44 |
| 7 | PROP_TYPE | Character | 1 | | 45 | 45 |
| 8 | ID_NO2 | Character | 9 | | 46 | 54 |
| 9 | ID_NO3 | Character | 9 | | 55 | 63 |
| 10 | EXPAC_DATE | Date | 8 | | 64 | 71 |
| 11 | REV_MAP_NO | Character | 10 | | 72 | 81 |
| 12 | WORK_TYPE | Character | 4 | | 82 | 85 |
| 13 | COMPANY | Character | 30 | | 86 | 115 |
| 14 | MANAGER | Character | 30 | | 116 | 145 |
| 15 | MANAG_TEL | Character | 14 | | 146 | 159 |
| 16 | EXP_BUDGET | Numeric | 13 | 2 | 160 | 172 |
| 17 | PRO_BUDGET | Numeric | 13 | 2 | 173 | 185 |
| 18 | COMPLETED | Logical | 1 | | 186 | 186 |
| 19 | DISCUSSED | Logical | 1 | | 187 | 187 |
| 20 | MDSCREVIEW | Logical | 1 | | 188 | 188 |
| 21 | MDSC_STAGE | Character | 20 | | 189 | 208 |
| 22 | EXPL_NOTES | Memo | 10 | | 209 | 218 |

# Drill Hole Data

- four tables
- connected with a unique key (HOLE-ID)
- ASCII or spreadsheet format

1. Drill hole name, collar location and total length of hole
2. Downhole survey data
3. Lithological descriptions
4. Sampling and assay data

Examples of tables:

## Table 14a: Header

| | HOLE-ID | X-COORD | Y-COORD | Z-COORD | LENGTH |
|---|---|---|---|---|---|
| ... | ...... | ...... | | | |
| | KAM-15 | 6684.37 | 456.39 | 118.42 | 185.93 |
| | KAM-16 | 6345.87 | 395.38 | 120.45 | 178.65 |
| | KAM-17 | 7522.26 | 520.15 | 116.72 | 135.58 |
| | KAM-18 | 7254.84 | 486.35 | 123.95 | 215.14 |
| ... | ...... | ...... | | | |