



GEOLOGICAL SURVEY OF CANADA

OPEN FILE 3490

Index-level database for lode gold deposits of the world

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INTRODUCTION

As exploration and research are becoming more global, there is an increasing need for more comprehensive knowledge of the distribution, size and characteristics of the world's mineral deposits. In this context, an index-level database for lode gold deposits of the world was developed jointly between the Geological Survey of Canada (GSC) and Inmet Mining Corporation (IMC) under GSC's Industrial Partnership Program (IPP). The database was compiled from publicly-available data on gold deposits world-wide. The bulk of the compilation of index-level information was performed by the first author over a period of eight months while based at the GSC in Ottawa. This work was completed in July, 1995 and is released after a two-year confidentiality clause in the IPP agreement.

It was decided at the outset that the database should contain summary, or "index-level", information on as many lode gold deposits around the world as possible, with a maximum range of geographic coverage. This strategy reflects a compromise between the level of detail achieved and the time and resources available to complete the work. Accordingly, the database contains information on the geographic and geologic locations of the deposits, their sizes, those selected geological characteristics requiring only minimal interpretation such as the style of mineralization and the age of host rocks, and on aspects of the mining operation such as status and mining and processing methods. The type of information contained in the database is considered to be of universal interest and will satisfy the basic needs of most users. This database can be used as an umbrella to which other existing databases can be linked, or as a core to which new types of information can be added by the users to satisfy specific needs.

The database contains information on lode gold deposits of all types and ages, with the exclusion of modern placer deposits. Because the number of deposits to consider increases exponentially with decreasing deposit sizes, only deposits containing more than three metric tonnes (~100,000 ounces) of gold were compiled. In addition, given the compositional continuum between gold and base metal (particularly copper) end-members in a number of deposit types, such as porphyry Cu-Au and volcanogenic massive sulphide (VMS) deposits, the following arbitrary filter was applied: deposits included in the database have concentrations of gold in ppm that are equal to or exceed the percentage concentration of combined base metals (i.e. $[\text{ppm Au}] \geq [\% \text{Cu} + \% \text{Zn} + \% \text{Pb}]$).

Although the database contains information on slightly over 1000 world-wide gold deposits, the list of deposits meeting the above criteria is not complete. The greatest impediment was the difficulty of obtaining information (most commonly location and size) on gold deposits in some parts of the world, for example the Community of Independent States. As a result, emphasis was placed on including deposits covering the widest possible geographic diversity, as opposed to including *all* deposits in selected areas and leaving other areas untouched. For this reason, the user should be aware that it is possible that major deposits or areas have been omitted or overlooked.

Not all the fields contained in the database are filled for all deposits; certain fields were considered essential and others optional. A deposit was entered in the database only if the information pertaining to the essential fields was available, in which case, information pertaining to optional fields was also included if available. The type of information considered to be essential for the creation of a new record includes: latitude-longitude and general geographic location, geologic location, age of host rocks, style of mineralization, and grade-tonnage data.

In building this database, efforts have been made to use the most accurate (up-to-date?) and reliable data available. As much as possible, the information contained in the database has been verified; however, errors in the location and sizes of the deposit may still remain. The sources of latitude-longitude and grade-tonnage data are indicated, and "Compiler's comments" fields were used to provide additional information on the quality or the nature of such data. Finally, in order to minimize typing errors, the use of pre-defined lists, in the form of tables, was maximized. Despite its limitations and its incomplete nature, this database is viewed as a reliable starting point or

framework which users can continually upgrade as new information becomes available.

ACKNOWLEDGEMENTS

The staff at the GSC's book and map libraries are acknowledged for their excellent services, without which this database would not have as much completeness and diversity. Compilations provided by the staff of Inmet U.S. Inc. in Sparks, Nevada (a wholly-owned subsidiary of IMC) and of IMC in Rouyn-Noranda, Quebec are gratefully acknowledged as part of this database. The authors would like to thank in general the scientific community at the GSC in Ottawa who, in one way or another, helped with supplying documents or first-hand information on various deposits. Thanks are also extended to D. Richardson for his careful and thorough review of this document.

OPEN FILE COMPONENTS

The Open File release of the database includes the following components: (1) explanatory notes, (2) digital release of the data in the form of a pair of flat files (deposits and mines) in ASCII Microsoft Excel® 3.0 and dBase III® formats, (3) digital release of the data in Microsoft Access® format, included as an *example* of a relational database structure for manipulating the data, as designed for the purpose of this project, and (4) a color map at 1:35,000,000 showing the global distribution of the gold deposits in the database.

The explanatory notes in this report comprise three parts. Part I explains the type of information contained in the database and explains some of the choices that were made. Part II provides information on the digital release of the database in ASCII, Excel® 3.0 and dBase III® formats. Part III provides instructions for the use of Microsoft Access® implementation of the database, supplied as an example.

EXPLANATORY NOTES

I - CONTENT OF THE DATABASE

This section provides details concerning the type of information contained in the different fields as well as some of the principles that were applied and restrictions that were imposed. It also explains the relationships between certain types of data and the grade-tonnage calculations performed.

In dealing with mineral deposits databases, a distinction must be made between geological entities, represented by the **deposits**, and the mining entities, represented by the individual **mines**. Some of the data of interest pertain to the deposits (e.g. host rock age) whereas other types of data pertain only to the mines (e.g. production-reserve figures). It is also common for large gold deposits, for example Hemlo, to be exploited by more than one mine, in which case the database contains more than one mine for certain deposits. These facts have been taken into account in the design of the database which consists of two tables named "DEPOSITS" and "MINES", which are linked by the deposit number.

Following a review of the procedures used in calculating the size of gold deposits, the different fields comprising the "DEPOSITS" and "MINES" files will be described in greater detail.

CALCULATION OF THE TOTAL SIZE OF A DEPOSIT

Besides the fact that a number of gold deposits are exploited by several mines, two other important factors must be considered in reporting the **total size** of a gold deposit, i.e. the total gold content of the deposit expressed in metric tonnes. The first is that there are two types of available production-reserve data: what is referred to here as **measured gold resources**, in the form of

grade-tonnage figures for production and reserves, and **estimated additional gold resources**, in the form of tonnes of contained gold, without grade-tonnage information. Examples of estimated additional gold resources include known historical production (in tonnes of Au) from an old deposit for which new reserves are now being defined, or a total reserve figure (in tonnes of Au) for deposits with known production grade-tonnage data. The different types of resource data to be considered for any particular deposit are shown in Table 1.

The second factor is that for deposits exploited by more than one mine, three situations have been encountered: production-reserve data (grade-tonnage) are available for each of the individual mines; they are available only for the entire deposit, or they are available for the entire deposit and only for some of the individual mines. These different possibilities must be taken into account in calculation procedures, as explained below.

Table 1: Relationship among the different types of gold resource data to be considered at the mines and deposits levels; the corresponding field names are in parentheses.

FOR EACH MINE	MEASURED	ESTIMATED ADDITIONAL
PRODUCTION	tonnage (MPOrTnMi) grade (MPAuGtMi) total Au (MPAuTnMi)	total Au (EPAuTnMi)
RESERVES	tonnage (MROrTnMi) grade (MRAuGtMi) total Au (MRAuTnMi)	total Au (ERAuTnMi)
MINE TOTAL	tonnage (MTOrTnMi) grade (MTAuGtMi) Total measured Au (MTAuTnMi)	Est. additional Au (ETAuTnMi)
FOR THE DEPOSIT	MEASURED	ESTIMATED ADDITIONAL
PRODUCTION	tonnage (MPOrTnDe) grade (MPAuGtDe) total Au (MPAuTnDe)	total Au (EPAuTnDe)
RESERVES	tonnage (MROrTnDe) grade (MRAuGtDe) total Au (MRAuTnDe)	total Au (ERAuTnDe)
DEPOSIT TOTAL	tonnage (MTOrTnDe) grade (MTAuGtDe) total measured Au (MTAuTnDe)	Est. additional Au (ETAuTnDe)
TOTAL SIZE	total measured Au + estimated additional Au =	TOTAL SIZE OF DEPOSIT (TotSizDe)

Procedure adopted

First, it should be noted that, in order to avoid any possible confusion, all entries are in **metric system** units. For each mine, the available grade-tonnage data for production and reserve are reported in the corresponding **measured** production and reserve fields (Table 1); any **estimated additional** resource information is reported in the appropriate field (either production, reserve, or total Au for the mine) in the situation where corresponding grade-tonnage data are not available.

The procedure for calculating resource figures **for each mine** with available data is as follows:

- 1- the grade-tonnage data for production and reserves are used to calculate the **measured** tonnage, grade and total Au of the mine;
- 2- any estimated additional reserve or production data is listed in the **estimated additional** total Au for that mine.

Caution: resource figures in the estimated category are **in addition to**, and do not include, resources in the measured category.

The procedures for calculating resource figures **for the deposits** depends on the type of resource data available and are as follows (see Table 1):

A- for a deposit exploited by a single mine (the most common situation):

- 1- the measured total tonnage and grade data for the mine are reported in the measured tonnage and grade fields (production, reserve) for the deposit, from which the total measured Au for the deposit is calculated;
- 2- any estimated additional total Au resources for the mine (production, reserve) is added to the total measured Au of the deposit to determine its total size, in tonnes of Au.

B- for deposits exploited by more than one mine and where grade-tonnage data are available for each mine:

- 1- the measured tonnage and grade data (production and reserve) for each mine are used to calculate the measured tonnage and grade of the deposit and its total measured Au;
- 2- any estimated additional total Au resource for the mines are added together and then added to the measured total Au of the deposit to determine its total size, in tonnes of Au.

C- for deposits exploited by more than one mine and where grade-tonnage data are available only for the entire deposit and not for individual mines:

- 1- grade-tonnage data for the entire deposit appear in the appropriate fields for the deposit (production, reserve or total), and the grade-tonnage fields in the corresponding MINES records are left empty;
- 2- any estimated additional total Au resources for the mines or for the deposit (production, reserve, or total) are added together and then added to the measured total Au of the deposit to determine its total size, in tonnes of Au.

D- for deposits exploited by more than one mine and where grade-tonnage data are available for the entire deposit but only for some of the individual mines:

- 1- grade-tonnage data for the entire deposit appear in the appropriate fields for the **deposit** (production, reserve or total);
- 2- grade-tonnage data are included in the MINES record(s) corresponding to the individual mine(s) for which they are available. However, these data are not taken into account in the calculation of the total size of the deposit as they are already included in resource figures for the entire deposit;
- 3- any available estimated additional total Au resources for the mines or for the deposit

(production, reserve, or total) are added to the measured total Au of the deposit to determine its total size, in tonnes of Au.

Caution: in cases where grade-tonnage data or estimated additional Au data are available for the entire deposit **and for some** mines of a multi-mine deposit, only the deposit-level data are used to calculate the total size of a deposit.

DEPOSITS TABLE

This section provides information on each of the fields in the DEPOSITS Table. The names of the variables used in the ACCESS® implementation of the database are also shown.

Deposit number [Deposit#]

This is a unique number for each deposit and serves as the link between the deposit- and mine-level information.

Deposit name [Depname], Alternate names [Altnmes]

The name of a deposit commonly changes through its mining history. The *Deposit name* is taken as the most recent or most commonly accepted name for the deposit. Other historical names for the deposit are included in the *Alternate name* field.

In the case of deposits exploited by several mines, each mine has a name (entered in the mines-level information - see below), and there may or may not be a generally accepted name for the entire deposit. In absence of a well accepted deposit name (e.g. Hemlo), we have either taken the name of the "district", in cases of large deposits (e.g. Kirkland Lake or Golden Mile), or combined the names of the mines exploiting the deposit (e.g. Sigma-Lamaque).

Number of mines [.Mines]

This field indicates the number of mines related to this deposit. This number indicates records in the mines table correspond to that particular deposit.

Continent [Continnt], Country [Country], Province [Province], Area [Area]

The *Continent*, *Country* and *Provinces* fields are self explanatory and refer to geographic entities. The *Area* field provides a more specific geographical reference where appropriate; it can be a city, or a distance from a city, etc.

Latitude [Latd] [Ladm] [Lats] [Latori], Longitude [Longd] [Longm] [Longs] [Longori]

The determination of a deposit's latitude and longitude is of critical importance but at the same time the most challenging part of data acquisition. *Latitude* and *Longitude* data were entered in degree-minute-second format using the following international convention: negative values for western longitudes and negative values for southern latitudes. The orientation of latitude [Latori] is taken as 1 for North and -1 for South, and the orientation of longitude [Longori] is taken as 1 for East and -1 for West.

Object located [QualLL]

The *Object located* field provides information on what was located (shaft, orebody, center of a large deposit) and on the general quality of the location data; it also generally includes the source of information. The quality of the location data is not uniform across the database, despite efforts to obtain the most accurate data. In many parts of the world, for example Canada, Australia, United States, good quality location data are easily obtainable, however, in other parts of the world such

as China or the Community of Independent States, determining the location of a deposit is a challenge. In many cases the only available source of information was a page-size figure showing the deposit in relation to a few geographic markers, or a distance in a given direction from a particular town. It was deemed more important to include a deposit in the database with only an approximate location than to exclude it. The information contained in the Object located and Compiler's comment fields provides an indication of the quality of location data.

Elevation [Elevation]

Because the *Elevation* of a deposit maybe an important factor to consider in assessing its economic viability, whenever available, the information was included.

Geological province [Geolprov], subprovince [Gsubprov], district [GDistrict]

These three fields were included to provide some level of information on the general geologic location of the deposits, and to facilitate searches by geologic terranes or domains. This hierarchy is influenced by the subdivisions used in North America. *Geological province* corresponds to the highest-level geological entity; depending on the country, these may be referred to as Shields, Cratons, Provinces, Fold Belts, etc., and *Geologic subprovince* corresponds to first-order subdivisions of these geological entities. *Geologic district* includes more diverse type of information, ranging from the name of a well-know gold district to the name of a specific greenstone belt.

Examples of geological provinces include the American Cordillera, Guiana Shield, Yilgarn Craton, Lachlan Fold Belt, and corresponding examples of geological subprovinces include the Great Basin, Pastora-Amapa belt, Norseman-Wiluna belt, and Bendigo-Ballarat Structural Zone.

Host-rock age [Agehost]

Host-rock age is included for general geologic information and to facilitate searches. The age of host rock was divided according to Eons and Eras in a way which is relevant to the time distribution of lode gold deposits and which minimizes uncertainties and interpretations. The divisions that were applied are as follows:

<u><i>Precambrian Eon</i></u>	<u><i>Phanerozoic Eon</i></u>
<i>Archean era</i>	<i>Paleozoic era</i>
<i>Early Proterozoic era</i>	<i>Mesozoic era</i>
<i>Middle to Late Proterozoic era</i>	<i>Cenozoic era</i>

General style of mineralization [Genstyle]

Information about the type of deposit is highly desirable in any mineral deposit database. However, there are no generally accepted coherent classifications nor nomenclature for the different types of lode gold deposits. In addition, ascribing a particular gold deposit to a given type is highly interpretative and is largely a function of the user's particular objectives and interests. For these reasons, it was decided to only include information on the *Style of mineralization*, based on the nature of mineralization as observed in hand specimen, on an outcrop, or in a stope face. The style of mineralization has been ascribed to one of the following categories:

<i>Quartz veins and veinlets</i>	<i>Disseminated sulphide</i>
<i>Carbonate veins</i>	<i>Disseminated gold</i>
<i>Sulphide-rich veins and veinlets</i>	<i>Hydrothermal breccia</i>
<i>Semi-massive sulphide</i>	<i>Paleoplacer gold</i>
<i>Massive sulphide</i>	<i>Unknown</i>

With the exception of paleoplacer gold, none of these styles are diagnostic of a particular type of gold deposit. In addition, many deposits contain more than one style of mineralization, especially the large ones. Although two fields for the style of mineralization are included in the MINES table

to account for this important fact, only one field is included in the DEPOSITS table for identification of the volumetrically most important style of mineralization.

Ascribing a style of mineralization to one of the above choices is not entirely free from interpretation and subjectivity. It also hinges heavily on the quality of the descriptions available in the literature. However, a number of guiding principles were applied in order to ensure consistency. Quartz veins and veinlets and sulphide-rich veins and veinlets were considered to include veinlet zones and stockwork zones. Veins and veinlets were ascribed to the sulphide-rich category if they contain more than ~ 30 % sulphides. Ores containing > 60% sulphides were considered as massive sulphide, and ores containing between ~30-60% sulphides as semi-massive sulphide. Disseminated sulphide was applied to ores containing up to 20% sulphides approximately evenly distributed through the rock. Disseminated gold refers to a few cases where gold is disseminated in the rock without any sulphide minerals.

Total measured tonnage, overall grade of the deposit, total measured gold

Measured tonnage, *Measured grade* and *Measured total gold* of a deposit were calculated from the grade-tonnage data for production and reserves of all mines exploiting the deposit in the MINES table, **or** from grade-tonnage data for production and reserves for the entire deposit if data were not available for individual mines, following the procedures outlined above.

Total additional estimated gold

Total additional estimated gold was calculated from the corresponding values for all mines exploiting the deposit in the MINES table, following the procedure outlined above.

Total gold content [TotSizeDe]

The total gold content of a deposit was calculated by adding the measured total gold and any total additional estimated gold, as outlined above.

Source of numerical information [Snuminf]

As much as possible, the source(s) of grade-tonnage production-reserve data are indicated here if the deposits figures differ from the associated mines data (i.e. data have been entered directly at the deposit level - see below). Any additional comments regarding how different sources of information were combined are also included.

Compiler's comments [CompilerD]

Any *Compiler's comments* regarding any of the information included in the deposits table are entered here. They are meant to inform the user of any potential limitation, complexity or quality of the information contained in the table.

MINES TABLE

Deposit number [Deposit.]

The unique *Deposit number* provides the link with the DEPOSITS table. For a deposit exploited by a single mine, there will only be one record in the MINES table for that particular deposit. For those exploited by more than one mine, there will be as many records in the Mines Table as there are mines.

Mine number [Mine.]

The Mine number refers to one of the mines exploiting a particular deposit. This number is unique for each mine related to a given deposit.

Mine name [Minename], Alternate names [Altnames]

As is the case in the Deposits table, the *Mine name* is the most recent or most commonly accepted name for the particular mine, whereas *Alternate names* generally represent more historical names.

Owners [Ownersm]

If known, the *Owner(s)* (as of 1995) of the mine is indicated here.

Status [Statusm]

The *Status* of a particular mine (as of 1995) is indicated as being *Current Producer*, *Past Producer*, *Future Producer*, or *Developed Prospect*.

Measured production, Measured reserve, Measured total

Grade-tonnage data for production and reserves are used to calculate the total Au production and total Au reserve, as well as to calculate the total tonnage, grade and Au content of the mine. Corresponding field names are listed in Table 1. Efforts have been made to present up-to-date grade-tonnage production and reserve data. For well-established deposits, it also was considered less critical to present up-to-date data because production and reserve figures change on an annual basis, without significant changes in the total size of the deposit.

Caution: for mines with both production and reserve data, care must be taken to ensure that the dates at which production and reserve figures are quoted are the same. A gap between the dates of production and of reserves (e.g. production to Dec. 92 and reserves as of Dec. 94) could result in underestimating the amount of gold in the mine. Conversely, an overlap between the dates of production and reserves (e.g. production to Dec. 94 and reserves as of Dec. 92) leads to overestimating the amount of gold in the mine.

Estimated additional production, reserve and total

Estimated additional production or reserves and total for the mine correspond to additional production or reserve data, in tonnes of Au, for which grade-tonnage information is not available.

Caution: resource figures in the estimated category are **in addition to, and should not include**, resources in the measured category.

Production from [PStartm], Production to [PTom]

Dates of production are given in the form of *Production from* the first year of production to *Production to* either the last year of production in the case of past producers, or to the year for which cumulative production figures for the mine are recorded.

Date of reserves [RDatem]

Date of reserves indicates the year for which reserve figures for the mine are recorded.

Source of numerical Information [Snuminfm]

As much as possible, the source(s) of grade-tonnage production-reserve data are indicated here. Any additional comments regarding how different sources of information were combined are also included.

Discovery date [Discdatem]

If known, the *Discovery date* of the mine is given.

Annual gold production [AnAuprod]

If known, *Annual gold production* is given, in metric tonnes of gold.

Mining method #1 [Minmetm1], Mining Method #2 [Minmetm2]

The *Mining methods* employed at the mine are indicated as: *Underground*, *Open Pit*, *Open Pit-bedrock*, *Open Pit-laterite*, *Open Pit-laterite & bedrock*, or *Tailings*. As more than one mining method may be at a mine, two fields are available to report the two most prevalent methods.

Recovery method [Recmetm], Percent recovery [PerRecm]

The *Recovery method* is indicated as *bioleaching*, *heap leaching*, *carbon in leach*, *carbon in pulp*, *flotation*, or *gravity*. The *Percent recovery* is also given, if known.

Style of mineralization #1, #2 [Stlmin1m] [Stlmin2m]

One or two *Styles of mineralization* are included for the mine. The same choices and guiding principles as in the DEPOSITS table were used.

Compiler's comments

Compiler's comments regarding any of the information included in the deposits table are provided here. They are meant to inform the user of any potential limitations or complexities concerning the information or quality of data contained in the table.

II - ASCII, MICROSOFT EXCEL® AND DBASE III® FILES

The database is released in ASCII, Microsoft Excel® 3.0 and dBase III® formats. In both formats, the database consists of a pair of flat files, named "DEPOSITS" and "MINES", corresponding to the two Tables described above. The two tables are linked by a unique deposit number; there may be more than one mine for a particular deposit, but each mine has the same deposit number.

The fields included in each of the two files and the corresponding headings are listed below. Additional information on the content of each field is provided in the preceding section.

DEPOSITS FILE

Field name / heading	Description
Deposit_	Deposit number
Depname	Deposit name
Altnmes	Alternate names
_Mines	Number of mines
Continnt	Continent
Country	Country
Province	Province
Area	Area
Latd	Latitude degrees
Latm	Latitude minutes
Lats	Latitude seconds
Latori	Latitude orientation
Longd	Longitude degrees
Longm	Longitude minutes
Longs	Longitude seconds

Longori	Longitude orientation
QualLL	Object located
Elevation	Elevation
Geolprov	Geological Province
Gsubprov	Geological Subprovince
GDistrict	Geological District
Agehost	Host-rock age
Genstyle	General style of mineralization
MPOrTnDe	Measured Production for the Deposit, tonnes of ore
MPAuGtDe	Measured Production for the Deposit, g/t Au
MPAuTnDe	Measured Production for the Deposit, tonnes of Au
MROrTnDe	Measured Reserve for the Deposit, tonnes of ore
MRAuGtDe	Measured Reserve for the Deposit, g/t Au
MRAuTnDe	Measured Reserve for the Deposit, tonnes of Au
MTOrTnDe	Measured Tonnage for the Deposit, tonnes of ore
MTAuGtDe	Measured Grade for the Deposit, g/t Au
MTAuTnDe	Measured Gold for the Deposit, tonnes of Au
EPAuTnDe	Estimated Additional Gold Production for the Deposit, tonnes of Au
ERAuTnDe	Estimated Additional Gold Reserves for the Deposit, tonnes of Au
ETAuTnDe	Estimated Additional Total Gold for the Deposit, tonnes of Au
TotSizDe	Total Size of the Deposit, tonnes of Au
SnuminfD	Source of numerical Information
CompilerD	Compiler's comments

MINES FILE

Field name / Heading	Description
Deposit_	Deposit number
Mine_	Mine number
MineName	Mine name
AltNames	Alternate names
Ownersm	Owners
Statusm	Status
MPOrTnMi	Measured Production for the Mine, tonnes of ore
MPAuGtMi	Measured Production for the Mine, g/t Au
MPAuTnMi	Measured Production for the Mine, tonnes of Au
MROrTnMi	Measured Reserve for the Mine, tonnes of ore
MRAuGtMi	Measured Reserve for the Mine, g/t Au
MRAuTnMi	Measured Reserve for the Mine, tonnes of Au
MTOrTnMi	Measured Tonnage for the Mine, tonnes of ore
MTAuGtMi	Measured Grade for the Mine, g/t Au
MTAuTnMi	Measured Gold for the Mine, tonnes of Au
EPAuTnMi	Estimated Additional Production for the Mine, tonnes of Au
ERAuTnMi	Estimated Additional Reserve for the Mine, tonnes of Au
ETAuTnMi	Estimated Additional Gold for the Mine, tonnes of Au
PStartm	Production from (year)
PTom	Production to (year)
RDatm	Date of reserves (year)
Snuminfm	Source of numerical Information
Discdatm	Discovery date
AnAuProd	Annual gold production
Minmetm1	Mining method #1
Minmetm2	Mining Method #2

Recmetm	Recovery method
PerRecm	Percent recovery
Stlmin1m	Style of mineralization #1
Stlmin2m	Style of mineralization #2
CompilerM	Compiler's comments

III - MICROSOFT ACCESS® IMPLEMENTATION

The relational database software MICROSOFT ACCESS® was used to construct the database and perform the required calculations; the corresponding ACCESS® files are released here as an example of implementation of the database. The current structure of the ACCESS® database was designed to satisfy the needs of the authors and is likely to satisfy the needs of most users. This section provides general information on the structure of the ACCESS® database and provides general instructions on how to use it.

STRUCTURE OF THE DATABASE

The information in the database is organized into a series of tables. The information pertaining to deposits and mines is contained in the DEPOSITS and MINES data tables, according to the principles described above. Several additional reference tables contain lists of pre-defined choices for the following fields in the DEPOSITS and MINES tables: style of mineralization, country, continent, host-rock age, status, mining method, and recovery method. The pre-defined choices for each of these fields are listed in the first part of this report.

In order to facilitate data entry and visualization in the DEPOSITS and MINES tables, corresponding entry **forms** were created. These forms also make use of pick-lists of pre-defined choices for the appropriate fields, saving time and eliminating possibilities of typographic error in these fields.

The DEPOSIT and MINES forms are shown in Figures 1 and 2, respectively. In both forms, the organization of the different fields and the nature of the information they contain are self evident. However, summary descriptions of the fields or any relevant instructions are displayed as an additional aid at the bottom of the form whenever the user clicks on a particular field.

In both the DEPOSITS and MINES form, fields in which data have to be entered directly by the user have a **white** background. Resource fields for which data are calculated have a **dark shaded** background, whereas those that can contain either a calculated value or a value entered directly by the user have a **light shaded** background, as shown in Table 2.

DEPOSIT Mines ... Use keyboard [PgDn]/[PgUp] to view entire form

Deposit #: Number of Mines: Deposit name:

General style of mineralization: Alternate names:

Country: Geologic prov:

Continent: Geologic subprov:

Province: Geologic District:

Area: Host-rock age:

Latitude: N S Elevation:

Longitude: E W Object located:

Computer's Comments:

Record: of 1010

DEPOSIT Mines ... Use keyboard [PgDn]/[PgUp] to view entire form

MINES TOTALS: *(Total gold resources from all mines for deposit)*

	Ore tonnes	Grade gm/tonne	Contained Au tonnes	Estimated additional contained Au tonnes
PRODUCTION:	<input type="text" value="416855"/>	<input type="text" value="19710"/>	<input type="text" value="822"/>	<input type="text" value="200"/>
RESERVES:	<input type="text" value="0"/>	<input type="text" value="0000"/>	<input type="text" value="000"/>	<input type="text" value="300"/>
TOTALS:	<input type="text" value="416855"/>	<input type="text" value="19710"/>	<input type="text" value="822"/>	<input type="text" value="500"/>

Total contained Au for all mines: tonnes

DEPOSIT TOTALS On initial data entry, these figures are derived from totals from all mines for deposit. To recalculate these data from mines totals, click on this command button

	Ore tonnes	Au Grade g/tonne	Contained Au tonnes	Estimated additional contained Au tonnes
PRODUCTION	<input type="text" value="416855"/>	<input type="text" value="19710"/>	<input type="text" value="822"/>	<input type="text" value="200"/>
RESERVES:	<input type="text" value="0"/>	<input type="text" value="0000"/>	<input type="text" value="000"/>	<input type="text" value="300"/>
DEPOSIT TOTALS:	<input type="text" value="416855"/>	<input type="text" value="19710"/>	<input type="text" value="822"/>	<input type="text" value="500"/>

Total contained Au for deposit: tonnes

Source of numerical data for deposit:

Record: of 1010

Figure 1. Deposits data entry form.

Mines

MINES Deposit# 1 Depname [REDACTED]

Deposit#: 1 Mine#: 1 Status: Current Producer Mine name: White Devil

Owners: [REDACTED] Alternate names: [REDACTED]

DATES AND ANNUAL PRODUCTION

from: 1935 Annual Au production: 2.61 (tonnes) Style #1 of mineralization: Disseminated sulphide

to: 1995 Discovery date: 1934 Style #2 of mineralization: [REDACTED]

	MEASURED		ESTIMATED/ADDITIONAL	
	Ore (metric tonnes)	Au grade (g/metric tonne)	Contained Au (metric tonnes)	Contained Au (metric tonnes)
PRODUCTION:	416,855	19.71	[REDACTED]	2.00
RESERVES:	0	0.00	[REDACTED]	3.00
MINE TOTALS:	[REDACTED]	[REDACTED]	[REDACTED]	5.00

Source of numerical information: Geology of the Mineral Deposits of Australia and PNG (1990) F.E. Hughes, ed., Mono. 14 of the Australasian IMM, P.849; past production figures combined with

Date of reserves: [REDACTED]

Mining method #1: Underground Recovery method: Carbon in pulp

Mining method #2: Open Pit-laterite & bedrock Percent recovery: [REDACTED]

Compiler's Comments: [REDACTED]

Record: 1 of 1 (Filtered)

Figure 2. Mines data entry form.

Table 2: Details on the source of data in the various resource fields of the MINES table in the ACCESS® database.

FOR EACH MINE	MEASURED	ESTIMATED ADDITIONAL
PRODUCTION	tonnage (MPOrTnMi) <i>entered by user</i>	total Au (EPAuTnMi) <i>entered by user</i>
	grade (MPAuGtMi) <i>entered by user</i>	
RESERVES	tonnage (MROrTnMi) <i>entered by user</i>	total Au (ERAuTnMi) <i>entered by user</i>
	grade (MRAuGtMi) <i>entered by user</i>	
MINE TOTAL	total Au (MPAuTnMi) <i>calculated from grade-tonnage</i>	Total est. additional Au (ETAuTnMi) <i>calculated from production-reserve or entered by user</i>
	tonnage (MTOrTnMi) <i>calculated from production-reserve</i>	
	grade (MTAuGtMi) <i>calculated from production-reserve</i>	
	Total measured Au (MTAuTnMi) <i>calculated from production-reserve</i>	

HANDLING OF RESOURCE DATA

As much as possible, calculations involved in determining the total size of a gold deposit have been automated, while taking into account the various complications outlined in the first section of this report.

At the mine level, the only data to be entered are the measured tonnage and grade for production and for reserves, and the estimated additional Au for production and for reserves. The values in the remaining fields are automatically calculated from these values, as shown in Table 2. It is also possible for the user to override the default calculation by directly entering a value in the "Total estimated additional Au" field, if only a total figure for the mine is available.

At the deposit level, depending on which of the four previously-described cases (i.e. A-D, p. 5) is applicable, procedures for calculating resource figures for the deposits are variable. For single-mine deposits (case A), or for multiple-mine deposits, where measured grade-tonnage data are available for each of the individual mines (case B), all measured resources figures in the DEPOSITS table are calculated from corresponding figures in the MINES table. Estimated additional Au production, reserve or total for the deposit can either be calculated from the mines data, if available, or entered directly in the appropriate field in the DEPOSITS table (Table 3), in which case the default calculation from the MINES data is overridden.

For multiple-mine deposits where measured grade-tonnage data are only available for the entire deposit (case C), the measured resources fields in the MINES table are left empty and measured

resources data are entered in the appropriate fields in the DEPOSITS table (Table 3). Estimated additional Au production, reserve, or total for the deposit can be either calculated from mines data, if available, or entered directly in the appropriate field in the DEPOSITS table, overriding the default calculation from the MINES table.

Table 3: Details on the source of data in the various resource fields of the DEPOSITS table in the ACCESS® database.

FOR THE DEPOSIT	MEASURED	ESTIMATED ADDITIONAL
PRODUCTION	tonnage (MPOrTnDe) <i>calculated from mines or entered by user</i> grade (MPAuGtDe) <i>calculated from mines or entered by user</i> total Au (MPAuTnDe) <i>calculated from mines or from deposit's tonnage-grade data</i>	total Au (EPAuTnDe) <i>calculated from mines or entered by user</i>
RESERVES	tonnage (MROrTnDe) <i>calculated from mines or entered by user</i> grade (MRAuGtDe) <i>calculated from mines or entered by user</i> total Au (MRAuTnDe) <i>calculated from mines or from deposit's tonnage-grade data</i>	total Au (ERAuTnDe) <i>calculated from mines or entered by user</i>
DEPOSIT TOTAL	tonnage (MTOrTnDe) <i>calculated from production-reserve</i> grade (MTAuGtDe) <i>calculated from production-reserve</i> total measured Au (MTAuTnDe) <i>calculated from production-reserve</i>	Total est. additional Au (ETAuTnDe) <i>calculated from production-reserve or entered by user</i>
TOTAL SIZE		TOTAL SIZE OF DEPOSIT <i>calculated from deposit total</i>

For multiple-mine deposits where measured grade-tonnage data are available for the entire deposit and for some of the mines (case D), measured grade-tonnage data are entered in the appropriate record of the MINES table and measured grade-tonnage figures for the deposit are entered directly in the corresponding fields of the DEPOSITS table, overriding the default calculations from the MINES table. In such cases, there is a built-in provision to avoid the possibility that measured resource figures in the MINES table be added to measured resource figures in the DEPOSITS table and that some of the gold be counted twice. As in the other cases, estimated additional Au

production, reserves, or a total for the deposit can be either calculated from the mines data, if available, or entered directly in the appropriate field in the DEPOSITS table, overriding the default calculation in the DEPOSITS table.

In all four cases, the total size of the deposit is calculated by adding the total measured gold and the total estimated additional gold figures.

USING THE DATABASE

The implementation of this database is designed to allow the user to view, edit and enter data by using standard ACCESS® forms and queries. Also, there are many automatic macros associated with these forms which are required to make various calculations; **these macros should not be used directly or modified by the user.** The system is configured to display the DEPOSIT form once the application is opened. Data in both the DEPOSITS and the MINES tables can be examined and new records can be created according to procedures outlined below. It is assumed here that the user is familiar with the ACCESS® software, and in particular, is familiar with using forms for data entry and modification. To further aid the user, help and "pop-up tips" appear on the ACCESS® status bar at the bottom of the screen and when the cursor overlies certain command buttons on the forms.

Examination of data

All data in the DEPOSITS table pertaining to a particular deposit are displayed on the multi-page DEPOSIT form (Fig. 1). It is possible to scroll through the list of deposits (records) by clicking on the appropriate arrow button besides the record number, displayed in the lower left corner of the form. Navigation between the first and second screens of data is performed by using the keyboard [PgUp] and [PgDn] keys. To examine data pertaining to a specific deposit, the user can search with the ACCESS® Find toolbar item.

Data in the MINES table are displayed through the MINES form (Fig. 2) which is opened by clicking on the "Mines ..." button at the top of the DEPOSIT form. The number of mines related to the deposit selected is indicated by the number of records in the lower left corner of the screen, and it is possible to scroll through the mines (if there are more than one mine) by clicking on the appropriate arrow button.

In addition the "MinesData" query can be used to view lists of data from the DEPOSITS and MINES tables.

<p>Caution: the queries CalcMine, CalcMines1, CalcMines2 and CalcDep are used to control data between forms and tables. Do not use or modify these queries.</p>

Creation of new records

In order to enter a new deposit in the database, a new deposit record must first be created from the DEPOSIT form, and one (or several) new mine(s) record(s) must also be created from the MINES form. The following steps should be followed to ensure that the data are properly entered and stored in the database:

From the DEPOSIT form:

- 1- create a new deposit record by clicking on the "plus" (+) command button on the top of the form;
- 2- enter relevant data, however, resource figures should be entered only after appropriate mines records have been created (see below);

- 3- save the entered information by clicking on the "write to disk" button at the top of the form (this actually creates the new deposit record);
- 4- click on the "Mines" button at the top of the DEPOSIT form; this opens the MINES form;

From the MINES form:

- 5- create a new mine record by clicking on the "plus" (+) button on the top of the form;
- 6- enter the relevant data for that particular mine, including resource figures if they are available. Once again, the user is reminded that the tonnage/grade/contained-gold fields on the form have different background colours. Uncoloured (or white) means that the user enters data in this field. Light grey signifies that the field can contain data entered directly by the user, or can contain data calculated from other fields. For example, on the Mines form, the field for estimated total contained gold is calculated as the sum of the estimated contained gold from reserves and from production. However, the user can override this in the case of only having an unsubdivided total. Fields with a dark grey background indicate calculated variables in which the user cannot enter data;
- 7- save the entered information by clicking on the "write to disk" button at the top of the form (this actually creates the new mine record);
- 8- repeat the procedure for each additional mine exploiting the deposit;
- 9- click on the "open door" button at the top of the form to return to the DEPOSIT form;

From the DEPOSIT Form:

- 10- click on the "✓" button at the top of the form to refresh data, i.e. to calculate resource figures at the deposit level from the newly entered resource figures at the mines level;
- 11- if resource figures are not available for one or all of the mines for this particular deposit, then resource figures for the entire deposit can be entered directly in the corresponding fields of the DEPOSIT form at this stage. Note that this procedure overrides all calculations involving mines-level data.

As previously mentioned, in both the DEPOSIT and MINES forms, several fields have attached "pick-lists" of pre-defined choices, making it simpler for the user to enter new data and avoiding typographic errors. For these fields, the pick-list is displayed automatically once a field is selected. In the case of the "Country" field, it is possible to simply type the first few letters of the country for the full name to appear in the field; hitting the computer's Enter key after choosing the desired country will make the name of the corresponding continent appear automatically in the "Continent" field.

The other fields of both forms are free-style, i.e., the user has to type in completely the appropriate information in each of these fields.

Modification of existing data

From time to time, it may be necessary to update resource figures of deposits entered in the database, or to fill currently empty fields as new information on deposits and mines becomes available. The procedures for such modifications are the same as for entering data in new records, with a few exceptions.

At the individual mine level, it was deemed desirable to allow the user to enter a value for estimated total additional contained gold for the mine (ETAuTnMi) where a breakdown between production and reserves estimates was unavailable. Once this field is set to non-null or non-zero, the automatic summation of the component production and reserve fields (EPAuTnMi, ERAuTnMi) is turned off. If estimates for contained gold from additional estimated production or reserves are subsequently entered, the total must be recalculated. To do this, delete the existing entry in the total field (ETAuTnMi) and tab through the field to calculate the new total.

A similar situation exists at the DEPOSITS level and the same procedure should be followed to

update the estimated total additional contained gold for the deposit (ETAuTnDe).

If resource figures in the MINES table are updated, it is essential to update the calculations in the DEPOSIT form in order that the new figures be considered at the deposit level. A command button showing the mathematical summation symbol (Σ) allows the user to recalculate the deposit totals from the mine totals at any time.

Caution: updating the calculations in the DEPOSIT form to take into account updated resource figures in the MINES table will overwrite all previously entered (or calculated) tonnage, grade and contained gold figures in the DEPOSITS table.