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WORLD PORPHYRY AND PORPHYRY-RELATED DEPOSIT DATABASE

R.V. Kirkham and K.P.E. Dunne

Foreword: About this database by L.B. Churlton

This publication contains a database in Microsoft® Access® format that houses index level information for porphyry and porphyry-related deposits worldwide, plus derivative reports, transfer formats and geospatial data. Porphyry deposits are large, low- to medium-grade deposits in which primary (hypogene) ore minerals are dominantly structurally controlled and which are spatially and genetically related to felsic to intermediate porphyritic intrusions (Kirkham, 1972). The large size and structural control (e.g. veins, vein sets, stockworks, fractures, 'crackled zones', and breccias) distinguish porphyry deposits from a variety of deposits that may be peripherally associated, including skarns, high-temperature mantos, peripheral mesothermal veins, and epithermal precious-metal deposits. Secondary minerals may be developed in supergene-enriched zones in porphyry Cu deposits by weathering of primary sulphides. Such zones typically have significantly higher Cu grades (Kirkham and Sinclair, 1996; Sinclair, 2007). The porphyry mineralization review articles Kirkham and Sinclair (1996), Seedorff et al. (2005), and Sinclair (2007) complement this publication, and should be consulted for geoscientific context.

The early history of this database is summarized by Kirkham and Dunne (2000a). R.V. Kirkham, Geological Survey of Canada (GSC), initiated the database in 1983 with the technical assistance of R.M. Laramée and D.F. Garson. About one fifth of the current database was compiled intermittently by R.V. Kirkham, A.G. Douma, J.J. Carrière, A. Galley, and K.V. Ross before 1994. The database was restructured and updated between March, 1995 and August, 1998 by K.P.E. Dunne and R.V. Kirkham, supported initially by Inmet Mining Corporation (1995) and subsequently by ten exploration companies under the World Map Project (WMP: 1995-1998)¹. These companies received the database in 1998.

The porphyry, porphyry-related skarn, and bulk-tonnage epithermal deposit and occurrence database, as the porphyry and porphyry-related deposit database then called, was published in 2000 as a Microsoft® Access® database and Microsoft® Word document (Kirkham and Dunne, 2000a) accompanied by a paper world deposit–geology map (Kirkham and Dunne (2000b). Before and during WMP, the structure of each specialized GSC mineral deposit database was unique to individual geoscientific working groups, as exemplified by the contrasts among the databases of Kirkham et al. (1995), Jenkins et al. (1997), Kirkham and Dunne (2000a), and Jenkins and Lydon (2002). The WMP was followed by the World Minerals Geoscience Database Project (WMGDP: 1998–2004), another project sponsored jointly by the GSC and exploration companies². Under the WMGDP, a common format was developed for all deposit databases so that the same data management utilities could be used, and so that the databases could all be served over the Internet in the same way. Pre-existing deposit databases, including the world porphyry and porphyry-related database, were converted to the common format. The porphyry database was then updated by K.P.E. Dunne and R.V. Kirkham between May, 1999 and March 2002. It later underwent infrequent updates by W.D. Sinclair and L.B. Churlton as needed for the programs Consolidating Canada's Geoscience Knowledge (CCGK), Geomapping for Energy and Minerals (GEM), and a multinational Arctic Ore Deposits project.

In the conversion of the porphyry database to the new database structure, it was found that the majority of the deposit records belonged to porphyry systems for which a single generalized location was recorded, and for some of these systems individual zone locations were added. Thus, the porphyry systems were imported into the entity Deposit Groups. This means that Deposit Groups is the main entity in this database, rather than Deposits which is the main entity in all other deposit databases in this series. An entity means in this context a "thing" that is described with a common set of tables and attributes (see third paragraph, p. 2 and schema diagram on the last page of this document).

The generalized locations were commonly rounded to the nearest minute, which is not very accurate by today's standards, but data were compiled from paper maps and listings before GIS was in common use and generalization was adequate to show deposits on the world scale. This would preclude locating an individual mine or pit in Google Earth, although a few deposit groups which have been developed as large open pits have been repositioned based on recent information sources. The user should also be cautioned that resource estimates³ captured in this database are historical and do not conform to Securities Commission National Instrument 43-101 standards, regardless of how they are classified in the database.

After the WMGDP, all deposit databases were made accessible through the World and Canadian Mineral Deposits web map portal under CCGK, as agreed to by project sponsors. However, this portal was decommissioned in 2014 under new Government of Canada internet guidelines. The only access NRCan now plans to provide to World and Canadian deposit

databases are Web Map Services (WMS). They are used by external web map portals which display them as points with no attribute data as components of geospatial mashups. The aim of this Open File is to make the full porphyry and porphyry-related deposit database and its supporting database management utilities available to any client who can use them, and to provide simple attributed derivative ESRI® Shape and Google Earth™ files, and folders of full deposit and deposit group reports, accompanied by Tables of Contents files index.html, that can be read by anyone using an Internet browser.

The database schema used for this database (Chorlton et al, 2007), and the supporting data management interfaces included with it in the folder **GlobalDBSystem321**, are described in web-style **Documentation** folder (modified from Laramée, 2004). This document can be read using an Internet browser by clicking on the file **default.htm**. During the WMGDP, compilers (deposit specialists) and company sponsors suggested topics to be included in the schema. They also provided helpful feedback for the functionality of the data management interfaces. This resulted in incremental updates between releases to company sponsors. World and Canadian lode gold databases (Gosselin and Dubé, 2005a, b) were released in schema 3.19, the version used for the final release 3.6 to company sponsors in 2004. The schema, now at version 3.21, release 3.7, is a major update of version 3.19, with the addition of extra tables required for Canada-only deposits for compilations under the Northern Resource Development and Northern Mineral Resource Development programs.

The GlobalDB System schema (diagram last page of this document) includes sets of tables that can be used to describe six entities (things): deposits/occurrences, deposit groups, mines, production figures, resource figures, and references. The deposits and deposit groups modules describe locations, deposit type and subtype, names, country and province, commodities, geological ages, host rocks, related igneous rocks, mineralization styles, coincident features, radiometric dates, tectonic settings, shape and dimensions, NTS areas, qualified comments, links to other databases, geophysical /geochemical signature, sample data, and compilation stage and progress. The service tables: entities, tabledoc, links, columndoc, tabpages, and lookup explicitly define the entities, tables, links between tables, fields, interface tab pages, and the lookup tables, to completely define the schema. Two additional service tables: dbversion and unitcvsn, provide the title, version and authors of the current database, and conversion factors (to metric) for the production and resource figures, respectively. The service tables, described above, should be consulted before transferring this data across database management programs and platforms, or rebuilding the data management applications when the application interfaces supplied with this Open File can no longer be used because of changes to the Windows® operating system.

Standalone custom Windows® application interfaces, developed by Robert M. Laramée⁴, enable a user with a 32 bit computer equipped with the Windows operating system to browse, filter, and obtain output from this database. They are included in this Open File in the folder **GlobalDBSystem321**. All applications require an ADO connection file, or Microsoft® data link, to each database for which they are to be used, created in the folder under the same folder that houses the application interfaces⁵. By convention, WMGDP compilers installed a folder GlobalDBSystem under Program Files on the local C: drive, but now the GlobalDBSystem321 folder and files can be saved anywhere and no installation is required. Instructions for creating the mandatory Microsoft data link file are included under “**Defining database aliases**” in the **Documentation\default.htm** and in the standalone file **HowtoADO.rtf**.

GShellBrowser allows a user to browse the database record by record, and offers the same tab page view of the data offered by the original data entry interface, GShellADO, known in short form as **GShell**. The latter only works under the Windows® XP and earlier Windows operating systems, and has been included in this package for users that still have a Windows XP computer (disconnected from the Internet because Microsoft no longer supports it by supplying Security updates), or have an XP emulator installed. GQueryADO, known as **GQuery** for short, provides a user the means to filter the occurrences based on attribute values, to build a template for a custom spreadsheet and export this spreadsheet or a default summary spreadsheet, and to create folders of occurrence reports for the full set or subsets of the deposits in the database. Both GShellBrowser and GQuery work under Windows 7 once the pre-requisite ADO connection file has been created.

There are three additional programs in GlobalDBSystem321: **GQ_ADO_XtraTables**, **Documenter**, and **GDBSTools**. The program GQ_ADO_XtraTables builds or rebuilds summary tables for the use of GQuery, which improved performance over an older method of creating these summary tables on the fly. The program Documenter allows users to examine each table and field of each category of table (Data, Junction, Lookup, and Service depending on their roles), which complements the more general web page style documentation. Finally, GDBSTools provides a database manager with utilities that can check the internal integrity of the database, rebuild the summary tables, time stamp a new release and export SQL data scripts of the contents of the connected database. These SQL scripts can be used to populate a new database created with GlobalDBSchema321.sql in one of many SQL-enabled relational database management systems available today⁶.

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FOOTNOTES

¹ACKNOWLEDGEMENTS: WORLD MAP PROJECT

The World Map Project (WMP: 1995-1998) was carried out by the former Mineral Resources Division, Geological Survey of Canada with the support of the following industry sponsors: Anglo American Corporation, Barrick Gold Corporation, BHP Minerals Canada Ltd., Cyprus Amax Minerals Company, Falconbridge Limited, INCO Ltd., Noranda Exploration Company Limited, Placer Dome Exploration Inc., Rio Tinto Mining and Exploration Limited, and WMC International Limited.

²ACKNOWLEDGEMENTS: WORLD MINERALS GEOSCIENCE DATABASE PROJECT

The World Minerals Geoscience Database Project (WMGDP) was carried out by the former Mineral Resources Division, Geological Survey of Canada (now Ore Systems, Central Canada Division, Geological Survey of Canada), with the support of the following industry sponsors: Anglo American plc, Barrick Gold Corporation, BHP Billiton Group, Cyprus Amax Minerals Company, Inco Ltd., Metal Mining Agency of Japan, North Ltd., Phelps Dodge Exploration Corporation, Placer Dome Exploration Inc., Randgold Resources Ltd., Rio Tinto Mining and Exploration Limited, Teck Cominco Limited and Western Mining Corporation. W. D. Sinclair managed this project on behalf of the Geological Survey of Canada, L. B. Chorlton coordinated schema, tool development, and compilation, and R. M. Laramée implemented the schema, developed the applications for GlobalDBSystem, and provided technical support to compilers.

³DISCLAIMER – RESOURCE/RESERVES DATA

Her Majesty the Queen in Right of Canada, represented by the Minister of Natural Resources (NRCan), does not warrant or guarantee the accuracy, completeness or fitness for any purpose of Reserve and Resource information (Data) contained in this database, including whether the Data is compliant with any securities regulations or standards, and NRCan does not assume any liability with respect to any damage or loss incurred as a result of the use made of the Data.

Resource and reserve figures are historical in nature. The Data source provided with each set of figures should be cited if the Data are re-reported.

⁴DISCLAIMER – APPLICATIONS AND DATABASE

The Geological Survey of Canada (GSC) has endeavored to develop and produce this product with a minimum of errors. GSC does not, however, warrant that the product is error free nor will GSC or its Minister and officials accept liability for any loss of profits or revenue, or any other form of loss or damage relating to the use of this product.

⁵CAUTION: UTILITIES MAY NOT WORK ON SOME WINDOWS COMPUTERS

While the WMGDP and successive projects have been successfully using Global DBSystem since the year 2000, there are now imitations due to the evolution of the Windows operating system and the introduction of 64 bit computers. In order to use GShellBrowser.exe, GQueryADO.exe, GQ_ADO_XtraTables.exe, Documenter.exe, and GDBSTools.exe, you must first create a data link file to allow connection between the program and the database (see “Defining database aliases” under Documentation). It is known that these instructions will not work on Windows 64 bit computers, and the interfaces will not work on computers with operating systems other than Windows®. At present, the data entry and browsing program GShellADO (GShell) will not work under Windows Operating Systems greater than XP, but is included here for anyone who might have an older operating system on a computer disconnected from the Internet or who has an XP emulator.

⁶ LOADING A WMGDP DATABASE USING SQL SCRIPTS

SQL scripts are provided here for anyone with an SQL-enabled database management system (DBMS) and the technical skill to modify the scripts according to the requirements of their software. We have loaded the data onto InterBase and PostgreSQL for the use of applications that emulate GQuery for the Internet and the contents of folders for loading the schema reflect our own processes. There are subtle differences in the scripts for loading the database schema among DBMSs, and some tweaks applied to the schemas supplied in this publication were specific to the Query applications. The scripts for inserting the data into the empty database schema are standard, and only one insert script is supplied per database.

A note of caution: it would be tempting to try to import the SQL contents of all of the mineral deposit databases in this Open File series (e.g. 7686, 7688, 7708, 7764, 7773, 7775 and so on) into one big database. This will not work because the entities of each separate database are indexed independently from each other, and were compiled on disconnected computers by compilers in many different places. In addition, the metadata file dbversion records different compilers and titles for each database. Thus, without substantial and careful re-indexing primary keys will clash between the different databases.

