DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 2011/91

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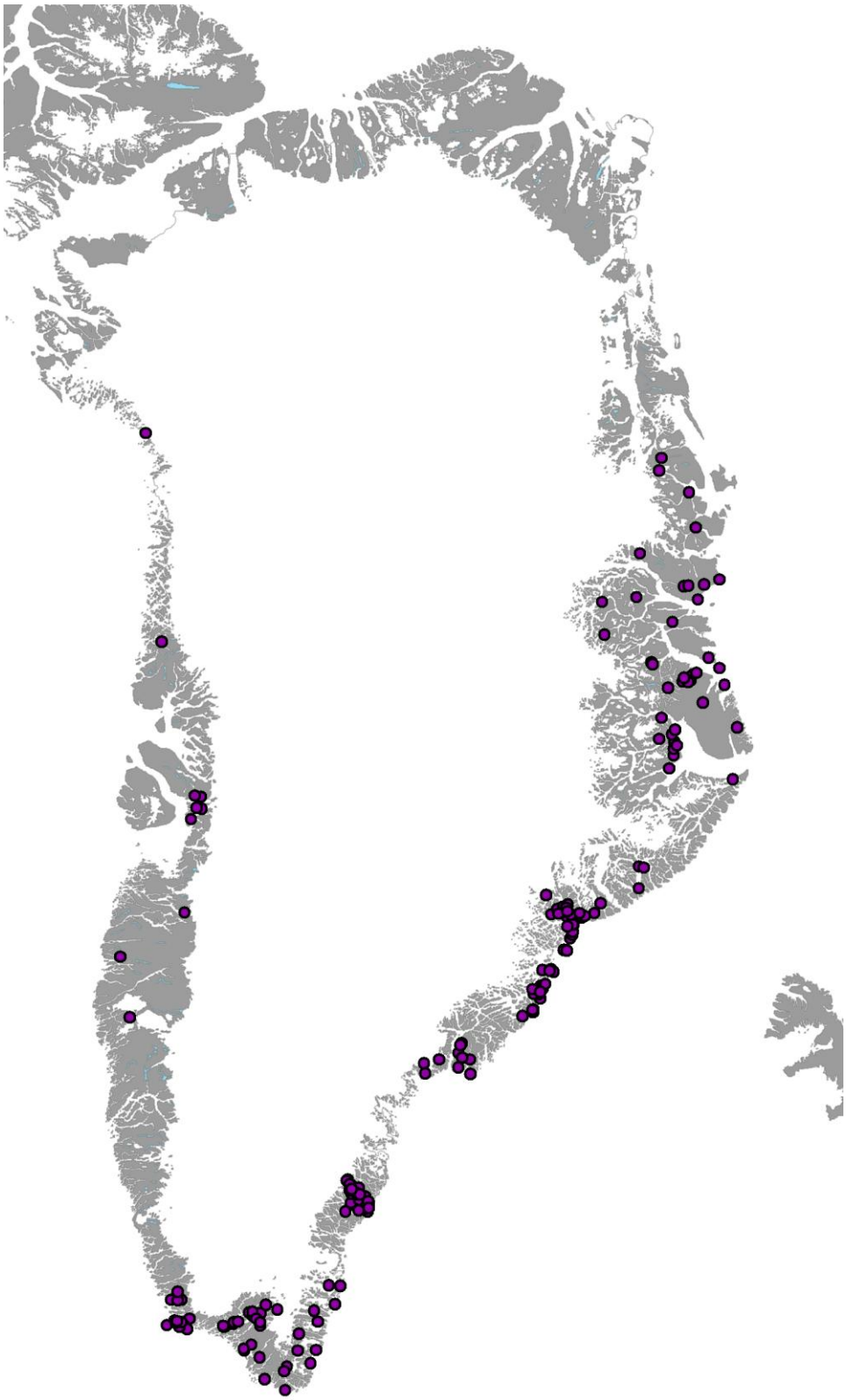
GEUS



Frontispiece

Location of intrusions and magmatic complexes presently in GMOM2DB (June 2011)

Content

Abstract

The Greenland Mineral Occurrence Map (GMOM) on the web launched in 2004 by GEUS has been successful as a source to fast and reliable information concerning known mineralised sites in Greenland for the international exploration industry. Over the last three years (2008-2010), the database behind the map (GMOMDB) has undergone a development culminating with a recent move from an Access platform to a true multiuser Oracle database facility. Simultaneously with the change of database platform, the data model for the database has been modified and is now in agreement with other Greenland related databases in the care of GEUS, opening the possibility of further integration of databases containing data and information of importance for exploration for mineral resources in Greenland.

The new upgraded database (GMOMDB2) now contains information from 919 mineralised sites in Greenland; many new sites have been added. The database has also been expanded to include entries of a different type containing compiled information on some 194 intrusions and magmatic complexes in Greenland. Many of these geological features are relatively un-explored and often information is very scarce, limited to brief descriptions and list of references. This report includes a brief description of the type of information now easily available in GMOMDB2 in the same manner as for known mineralised sites. The information has been compiled by GEUS geologist and will be augmented as more public information becomes available through GEUS and company activities. Only information released to the public will be made available to external users over the internet.

As part of the upgrade of GMOMDB2, security and user administration have been tightened significantly and a new web-based interface for compilers has been constructed. The maps displayed on the GEUS GMOM2 web-site via an ArcIMS server are still based on subsets of data from the database extracted at irregular interval. However, the first steps have been taken towards a truly dynamic generation of maps and information about sites, as and when the user requires it. This improved update facility is expected to be implemented during 2011, simultaneously with a change from ArcIMS to ArcMap- server technology.

Introduction

There have been three driving forces behind the recent developments of the Greenland Mineral Occurrence Map /GMOM) on the web:

1. The wish to compile information on the intrusions and magmatic complexes of Greenland including their economic potential and present this on-line on the GMOM web for international professional users.
2. The need for an upgrade of the database behind the map (GMOMDB) to a more secure relational data base system in compliance with GEUS policies for central databases (GMOMDB2).
3. The addition of further geological information concerning sites in Greenland. A new layer of information.

Intrusions and magmatic complexes are central, when it comes to an assessment of the geological economic potential of a region. There are many of these in Greenland, and only a few of them have been examined in detail for their economic potential. In Nielsen (2002), tertiary intrusions and complexes in East Greenland were described, and the added facilities in GMOMDB2 holding information about such geological features from all Greenland are modelled on a subset of the information given in Nielsen (2002).

Increasing use of the database had made it desirable to replace the original Access platform with an Oracle platform, which is a better multiuser system with superior handling of security and user administration.

The development reported here thus had different aspects, focused on both content and technological improvements. This has necessitated the close co-operation of many types of expertise and skill-levels, as can be seen from the number of authors to this report. In the following sections, a brief summary is given of the technical improvements and the updated and increased information content of the database. In Appendix 1, an updated list of attributes related to GMOMDB2 can be seen, and in Appendix 2 some principles and details behind the overview of intrusions and magmatic complexes are further explained.

From Access to Oracle platform: GMOMDB2

This section briefly describes the main modifications to the GMOM database, changing it into GMOMDB2. The decision to migrate from a local Access database to the central Oracle database provides several advantages compared to past use of the GMOMDB database. Programmers and experts from GEUS‟ Geological Data Centre and geologists from the Department of Petrology and Economic Geology have been involved in the work.

Security and Safety

Security is provided in three layers: 1) Inside the Oracle database, 2) in the web application that is placed on a JBOSS web-server and 3) by https data transfer between a user‟s browser and the web-server.

Using an Oracle database provides fine grained differentiation between different users and their roles. In the Access database, only simple security and issuing of individual user rights were employed, whereas in the new database and in the web-interface five roles have been implemented: administrator, quality controller, compiler, trusted viewer and normal viewer. Users of the GMOMDB2-Oracle database and the web interface will have their own password and one of these roles. A user with an administrator role will have access to all data of the GMOMDB2-database and can view and modify most of the data. A user with a viewer role can only see non-confidential data actively released for display.

The web interface and the database provide two additive layers of security against loss of data. First and foremost, the roles mentioned above secure against un-secured access to particular data. In the web application these same constraints are provided. For example, an administrator user can see all pages in the web-application, whereas a viewer cannot.

Platform, place independence and dynamic changes

The Oracle database and the new web interface allow manipulating data in the database by simply using a web-browser. The web-application has been extensively tested on Firefox 3.6, to a lesser extent in Internet Explorer 8 and somewhat in Internet Explorer 6. In all cases the functionality works correctly, although the layout may differ somewhat between different browsers. This functionality allows potential users from all over the world to have access to the GMOMDB2 database at the same time, provided that they have a user account for the database with a particular role. Any changes that a user makes are directly made available to other users of the data.

Integration with other (geological) data

The data model as it is currently implemented in ORACLE™ is based on the GeoSciML data model (Sen & Duffy, 2005), which is a standard for transferring geological type data

over the internet. Meta-data related to intrusions in Greenland have now been integrated in the same model as the mineral occurrences from the GMOM database. Data on intrusions can be viewed and changed in the same manner as data on mineral occurrences. In the future other geologic features could be included in the same manner.

GEUS principles applied

The procedures for handling security and safety of the database are in accordance with standard GEUS principles to ensure that data collected over many years can be edited and visualized in different places, while an administrator can keep control over what a user can access and do with the data. The quality and safety of the data can be safeguarded by applying the constraining mechanisms inherent in relational databases. Different users can work together to improve the quality and quantity of the database. This also prevents data loss from storing data on single in-house computers and allows the distribution of knowledge that previously may have been difficult to access. Integration with other types of geological data is improved and more advanced types of queries can be created to show relations that were previously difficult to visualize.

Migration of data from GMOMDB to GMOMDB2

Data from the GMOMDB Access database was transferred to Oracle by using TOAD-for-Oracle™'s import feature. Data was either directly transferred to appropriate „Tables" in the new database model or by creating temporary tables, which had the same attributes as in the Access database. Data from these tables were then transferred to appropriate tables in the new data model using appropriate SQL-statements.

Modification of data model

Extensive documentation of the data model is present in Appendix 1. Its main improvement is that easy addition of other geological features to the data model is now possible, because common attributes such as geographic location and description have been placed in a common Geologic feature table. Attributes that relate to mineral occurrences specifically have been placed in an „Occurrence" table. Some geologic features may be mineral occurrences, but a geologic feature can also be an intrusion. An occurrence or an intrusion is always a geologic feature.

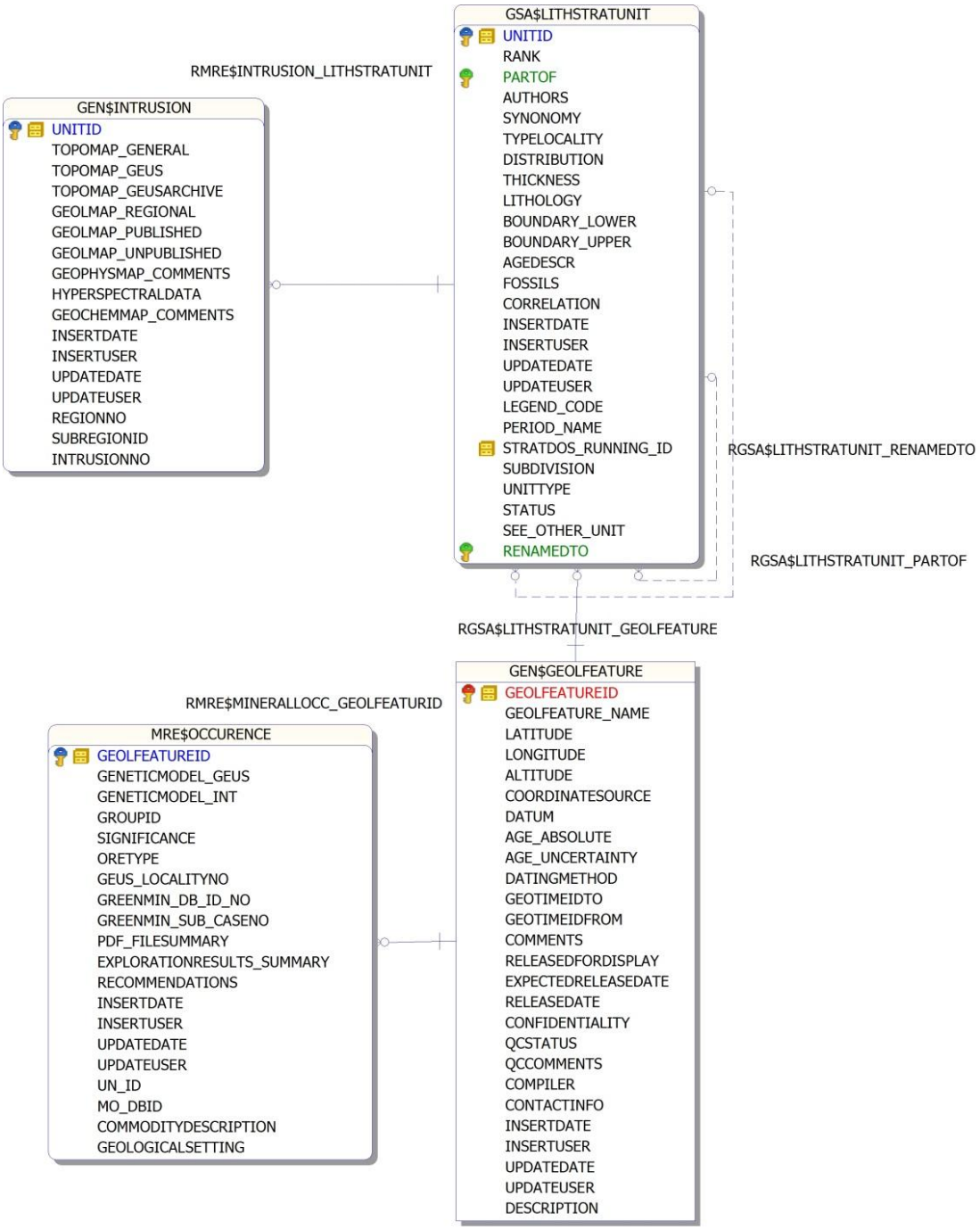


Figure 1. *Simplified Entity-Relationship diagram showing the most important relations in the new datamodel. Note that UnitID in the two above tables refers to GeolfeatureID in the Geolfeature table. Currently the attributes in the Lithostratigraphic unit table remain unused for intrusions.*

New Compiler web-interface

Whereas the interaction with the GMOMDB in its Access environment took place via Access screen forms, the user interface to GMOMDB2 has been constructed as a web-based interface. This section briefly gives examples of the use of the user interface.

Overview

A user with administrator status will have editing and viewing capability of most attributes of the database, a user with quality control or compiler status will have access to the features as shown in Figure 1 and a user with viewing status is only allowed to view data on occurrences and intrusions. The attributes that a user has access to are visible in a menu bar.

Typically, a Compiler will start a session by going to the homepage, which currently is

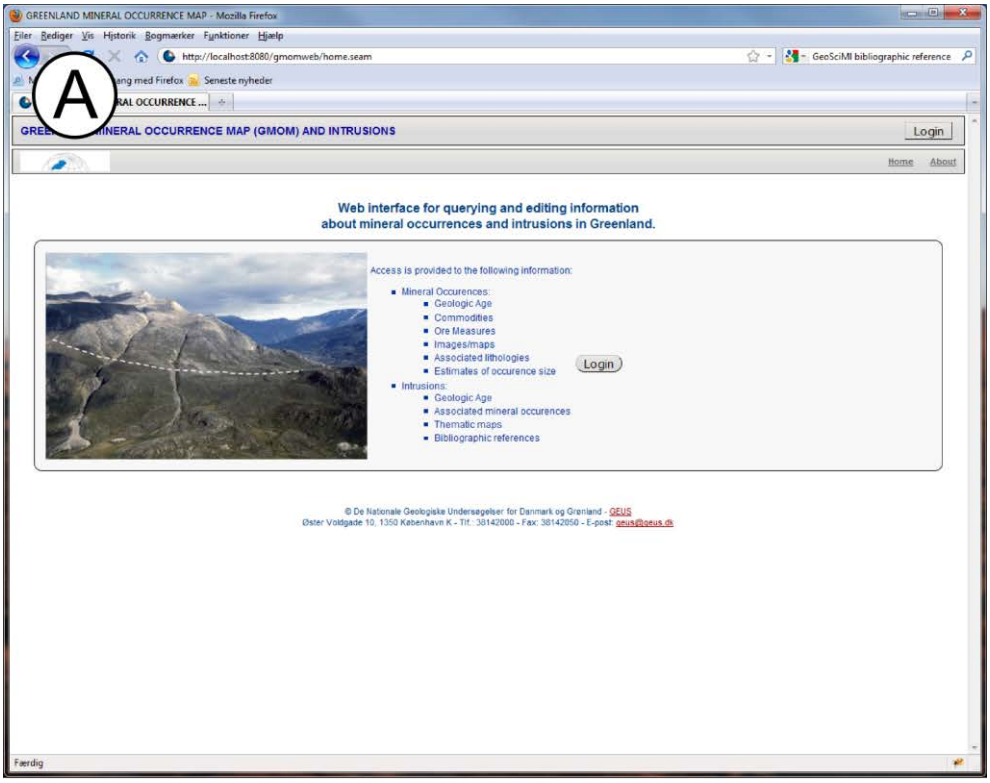
http://geusjuptest.geus.dk/gmomweb/ (A, figure 2),

and press the „Login" button. A „Login" window will be shown and the user has to identify himself (B). Then a similar page as in (A) will show up with a menu bar *„Data Menu'*. When hovering over this, a menu will pop up highlighted in orange (C) and a particular dataset can be chosen: here *„Mineral occurrences"*, *„Intrusions"*, *„Bibliographic references"* or *„Stored files"*.

In this case, the user chooses to look at „Mineral occurrences" and a page with a table of all occurrences are shown (D). On the left of this table three actions are visible: *„view'*, *„edit'* or *„report'* for each occurrence. Together with the *„insert occurrence"* button on the top left these give access to the basic actions that a user can perform. *„View"* means view more details about an occurrence than shown in the table (H), *„edit"* means editing an existing occurrence and *„report"* dynamically generates a detailed pdf-report of this occurrence, including images and maps, if these are available (G). The page also provides search functionality based on occurrences having a certain commodity, genetic model, longitude and latitude values and name.

When pressing *„edit"* a page, such as partly shown in (E and F), is created with editing fields, drop down menus, etc. A mineral occurrence can be edited for all its attributes on the same page, similar to the main entry in the Access database. When the user is done, he can press *„save"*, *„delete"* or *„cancel'*. A Google map (E) is provided to quickly show where the occurrence is approximately situated. Note, in Greenland the accuracy of the background layers provided by Google often is not very good, and correctly registered positions may sometimes appear to fall in a fjord; use better maps to check before correcting the position. When the user is done, he returns again to the occurrence list in (D).

When choosing *„Intrusion"* in the Menu bar (C) the same basic functionality is provided, apart from functionality related to specific attributes of intrusions. Images can be up- and downloaded when pressing „Stored files" in (C) and bibliographic references can be inserted, updated or deleted, when pressing *„Bibliographic references'*.



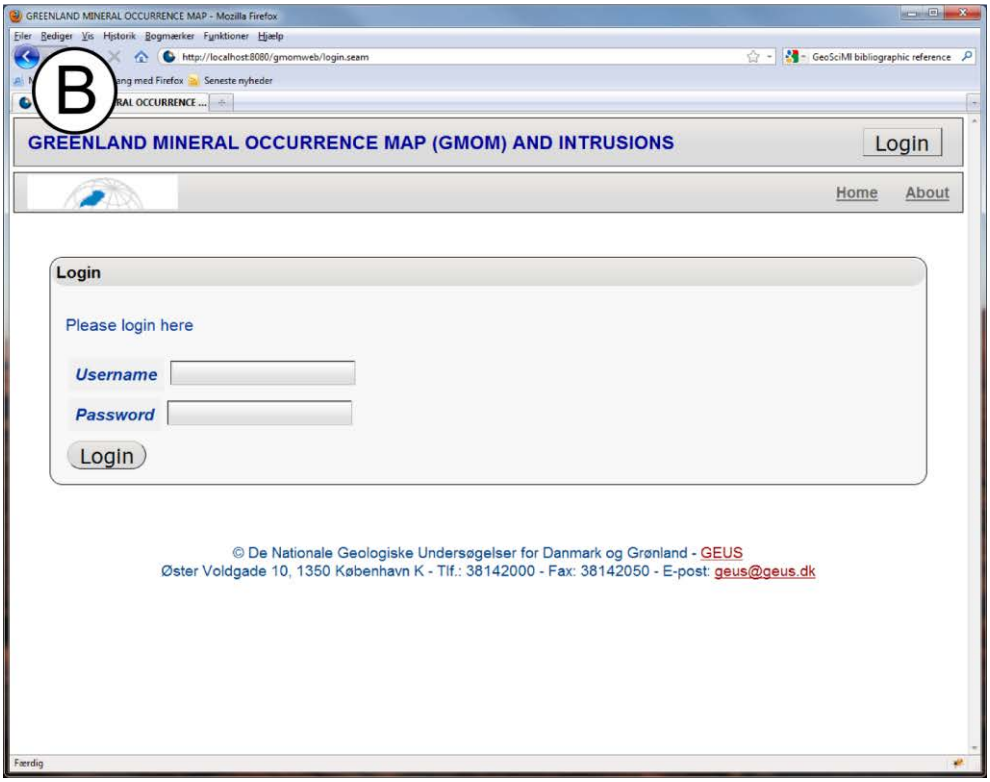
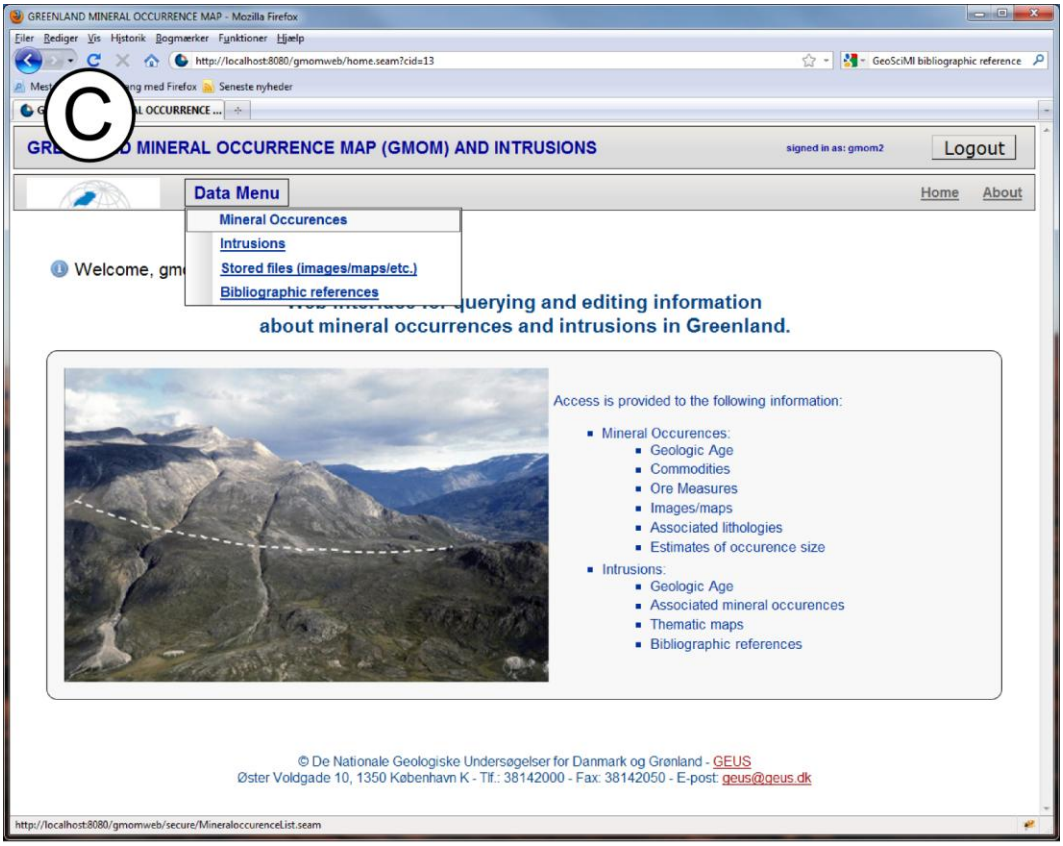


Figure 2. (This and the following three pages). *Screenshots of different parts of the GMOMweb+Intrusions interface giving an impression of the compiler's views. (A) Starting page, (B) Login-page, (C) Data Menu, (D) Mineral occurrence data table, (E, F) different parts of the editing page, (G) dynamic pdf report of an occurrence, (H) view page.*



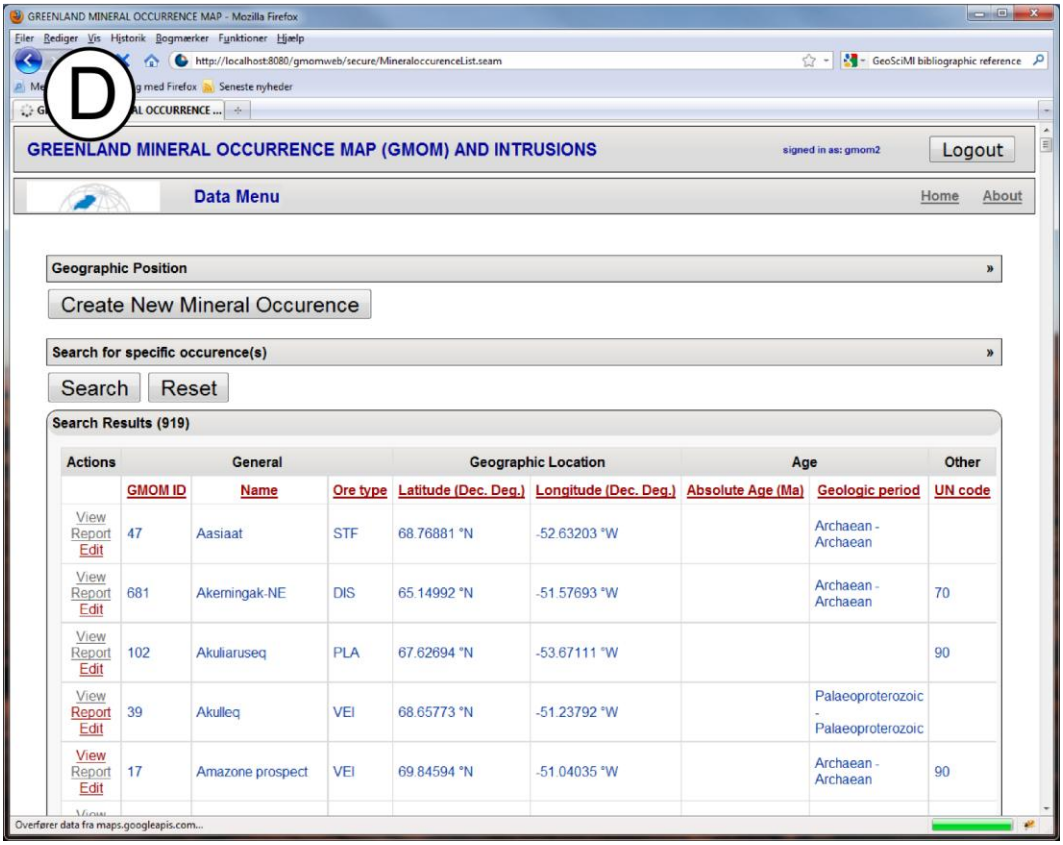


Figure 2 continued.

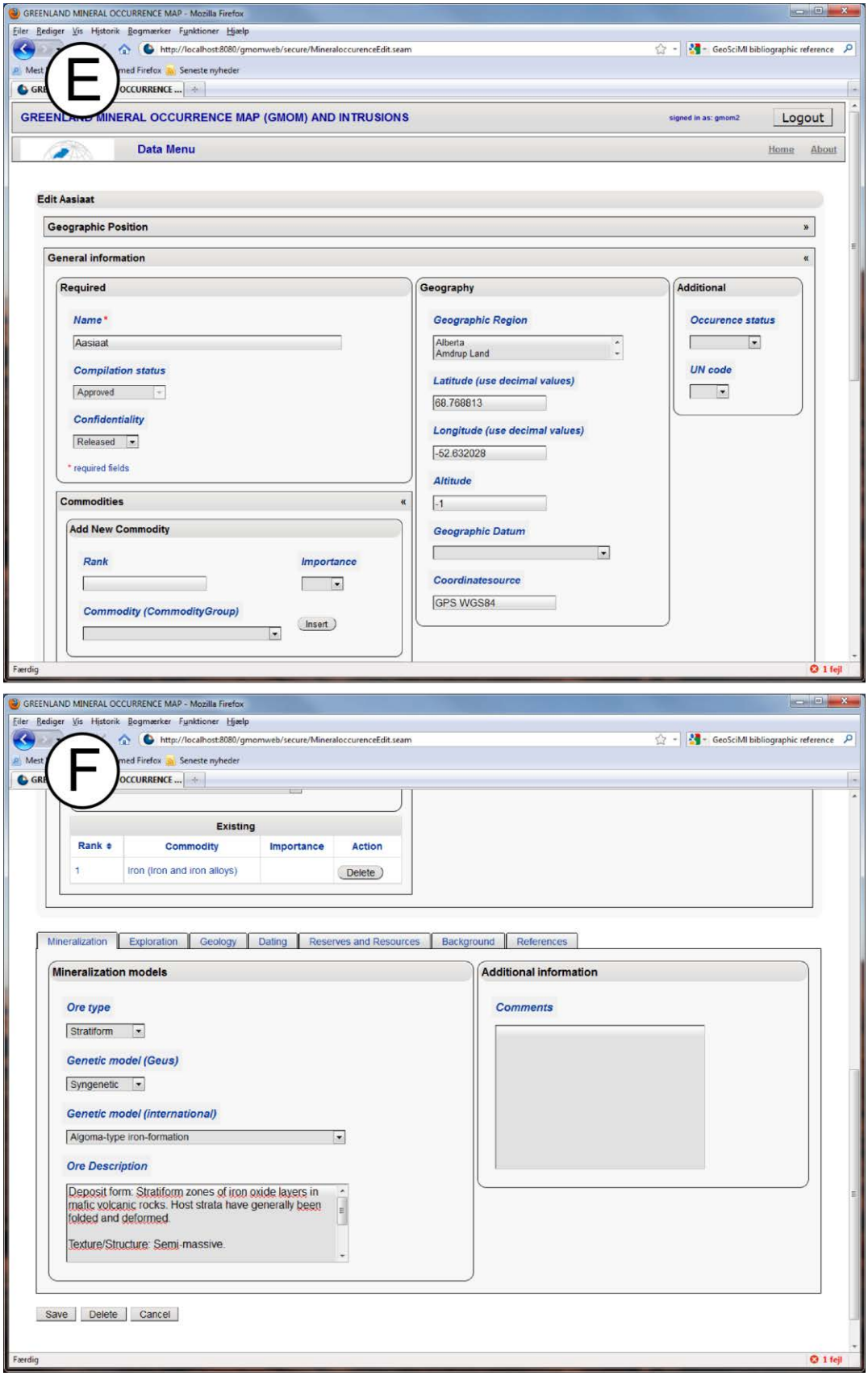
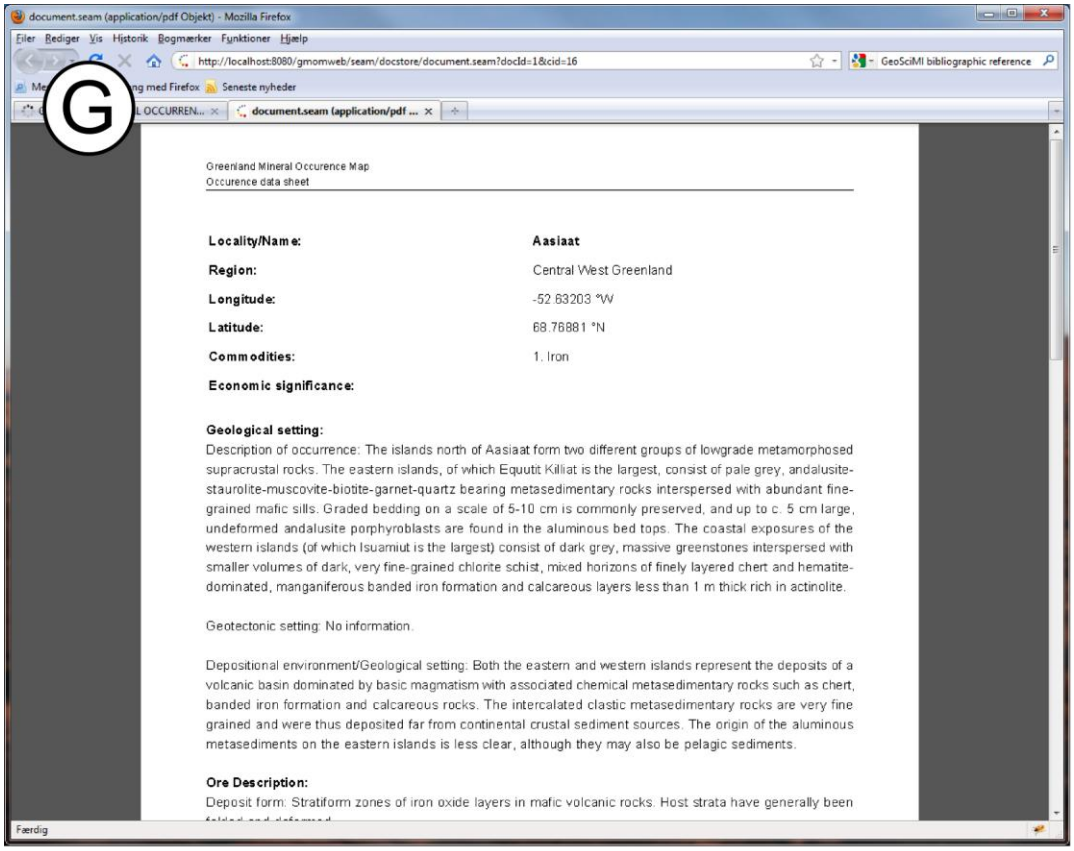


Figure 2 continued.



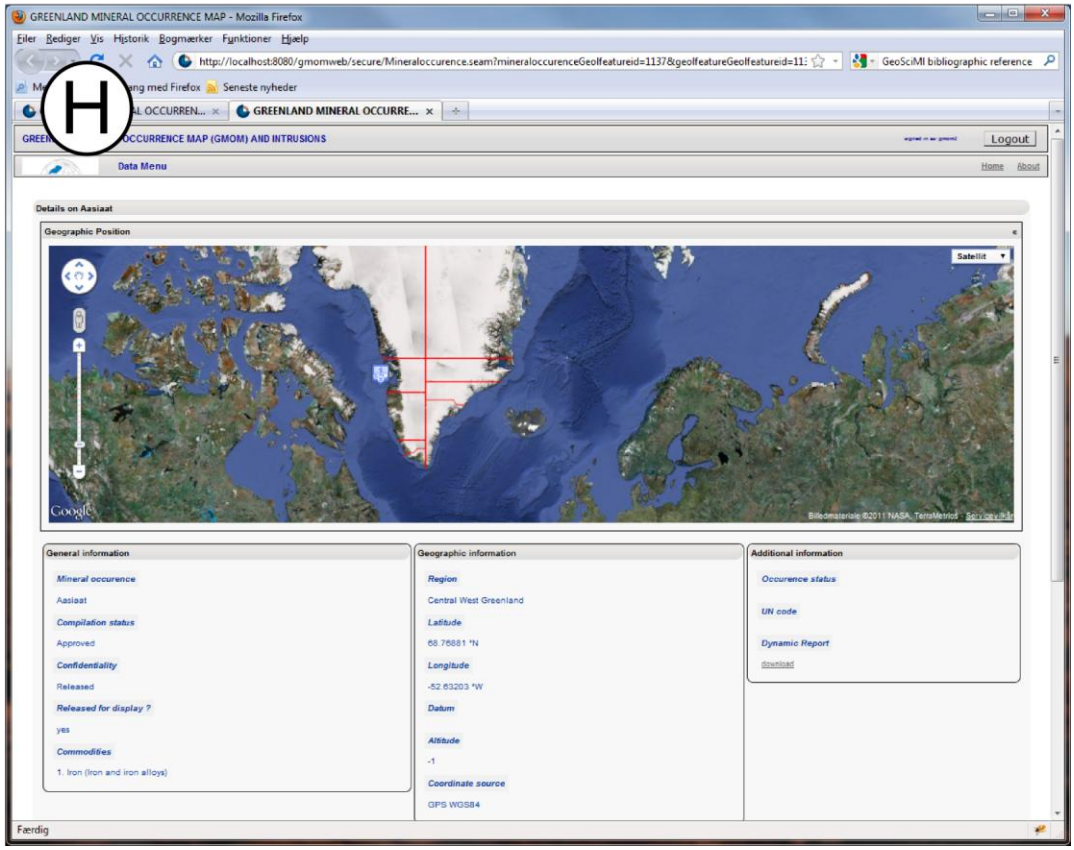


Figure 2 continued.

Editing

Some attributes such as commodities, bibliographic references and attached files are shared with several occurrences or intrusions. When editing such fields the following way of editing was chosen: When editing a mineral occurrence a particular commodity from a set of pre-defined commodities can be chosen and attached to this occurrence. When removing this commodity again from the occurrence, the commodity is not removed from the pre-defined list, but only from the occurrence. When a commodity is attached to several occurrences, it should first be deleted from these occurrences, before deleting the particular commodity. The same holds for attached files and bibliographic references.

Dynamic Pdf-generation

Pdf"s are dynamically generated in the compiler web-application. Using restful-http addresses hyperlinks are generated in a database-view that are linked to the ArcIMS environment. The occurrences found at

http://www.geus.dk/geuspage-dk.htm?http://www.geus.dk/gmom/gmom-dk.htm

will link to these pdf-files. A user that accesses this site can only view occurrences that are both released and not confidential.

New additions to user GMOM2 web-interface to come

At the moment the editing and viewing web interfaces have separate http address and hyperlinks have not yet been provided. Ideally, the new interface will provide seamless integration of the editing interface with the viewing interface, so that a user can view and/or edit data fluently.

From GMOMDB2 to GMOM2 web map

The GMOM data now stored in an Oracle database, GMOMDB2, is accessed via an ArcGIS-ArcMap database connection to a designed GMOMDB2 database-view selecting the data used for presentation of GMOM2 on the web. The database-view reflects dynamically the content of the released GMOMDB2-data for the web so that any change in content of the database immediately will be reflected on the map. The hyperlink in GMOMDB2 dynamically opens a pdf-file with further description of the GMOM2-occurrence by collecting the required content from the database (before it was a physical pdf-file) and presenting in a pdf-file produced at that moment for optional save on the user"s PC.

Intrusions and magmatic complexes – a new layer of information in GMOMDB2

After the success of the report on Paleogene intrusions and magmatic complexes in East Greenland (Nielsen, 2002), it was decided to create a layer in the GMOMDB2 containing information on intrusions and magmatic complexes in all of Greenland, modelled on the compilation in Nielsen (2002) for Palaeogene intrusions along the East Coast of Greenland.

The database for intrusions and magmatic complexes is dynamic and information will continue to be included, also as company reports become public. As a first step, focus has been on the inclusion of the basic information such as name, location, type of intrusion or magmatic complex, and key references. The rational is that evaluation of the economic potential of an intrusion or magmatic complex for which no exploration data is available rests on the type, mineralogy, and geochemistry of the intrusions and magmatic complexes. The reader is referred to the introduction of Nielsen (2002, see Appendix 2 of this report) for a detailed introduction to the attributes in Nielsen (2002), to attributes in the present database and the rational of the compilations.

As a starting point for the database 23 magmatic provinces were defined in Greenland (Appendix 2). The reason is that individual Survey compilers have detailed knowledge of specific provinces, and not necessarily of specific types of intrusions or magmatic complexes. Also, magmatic provinces in general include intrusions of common parentage and thus may have many features and possibly economic potentials in common. All intrusions and magmatic complexes are referred to a specific region, which both refer to a specific geographical region and a specific geological time period, suggesting a common geotectonic environment and thus common mineralisation processes and occurrence types. Dependent on the size of the provinces they may be further subdivided.

In the compilation of Nielsen (2002) all Palaeogene intrusions and magmatic complexes in East Greenland were included (Region 1) and all the defined provinces are numbered clockwise round Greenland starting in NE Greenland. The provinces may overlap, as do fx. the Palaeogene of East Greenland (Region 1), Caledonian granites (Region 2), and Devonian Granites(Region 3). Some regions have seen active research and exploration in the last decades and researchers active in these regions have compiled the information in the database. Other provinces have not seen investigations in the later decades, and information for these is limited and could prompt initiation of new investigations.

References to company reports are as a rule not included in the entries for intrusions and magmatic complexes. They may easily be found in DODEX.

Criteria for inclusion

In GMOMDB2 are included intrusions and magmatic complexes, sill complexes and macrodykes that are regarded as intrusions with a high length-width ratio. Excluded from the

database are dike swarms (with one exception). The swarms of kimberlite and ailikite dykes in West Greenland have been included due their obvious economic potential.

In undeformed terranes it is not difficult to decide which intrusive bodies to include, but it is a major problem in areas that have been subjected to deformation and metamorphic episodes. The Archaean of Greenland is in general composed of supracrustal belts, mafic intrusive sheets and tonalitic gneisses. As a rule of thumb, major bodies with areal homogeneity and preserved intrusive features are included, especially if mineralisation is related to these bodies. Tonalitic gneisses are not included and strongly deformed amphibolitic gneisses, although they may represent sill-like bodies are excluded, as are in general strongly deformed ultramafic bodies.

Likewise, in Proterozoic and Phanerozoic orogenic belts, only well-defined bodies of obvious intrusive origin are included in the database.

Present and future content

In the coming years, the information for regions, intrusions, and magmatic complexes will be systematically revised and expanded, region by region, and as new data becomes available. In addition and following Nielsen (2002), descriptions of the 23 regions of intrusions and magmatic complexes will be added to the database to give the exploration industry further possibilities for evaluation of the economic potential of magmatic regions in Greenland. As a further development, links between the intrusions and mineralised sites in GMOMDB2 may be established and can be shown on the same map. Coming links to DODEX will make searches for company reports related to intrusions easier in the future.

New tables and attributes in GMOMDB2

The new database has a more normalized structure than the previous Access database. This means that there are more tables than previously and also that there are fewer chances to duplicate data. This is essential when one wants to link different types of geological entities together. The GeoSciML model defines a generic „*Geological feature*" with some properties that different geological features have in common. All geologic features have for example some geographic locations, a description and need to be secured for release for example on the web. When something is described as a mineral occurrence, it will be a row in the *geologic feature* table and in the O*ccurrence* table, linked by the geologic feature id. However, when we describe an intrusion, it will also have a row in the *geologic feature* table and a row in the *intrusion* table. Intrusions are linked to geological features by the lithostratigraphic unit table because each intrusion also is a lithostratigraphic unit.

Presentation at GMOM2 web

Until now, ArcIMS technology has been used for the production of the map of mineral occurrences. Now the database is on another platform and it is feasible to make the production of the map and the descriptions of sites (pdf-files) dynamic and produce them as they are needed, eliminating the need to produce the site description pdf-files beforehand. This requires a change to ArcGIS technology.

In the near future, it is likely that a change to ArcGIS server technology will take place. At this moment, the ArcIMS-technology is still used to extract the GMOM2 data selected for display on the map using the designed GMOM2-view for this. It means that newly added occurrences has to be extracted manually for a new map to be created and placed in the ArcIMS system, before the updated map can be available on the web. Moving to ArcGIS-server technology, the process of creating a new map should be completely dynamical, immediately including modified or new data added to GMOMDB2.

Future options

The regular updating of GMOMDB2 will continue in the future, now including intrusions and magmatic complexes that may be discovered or identified. If fieldwork by GEUS or exploration companies reveal new information concerning new sites of mineralisation or new, hitherto unknown intrusions, data and information will be added to the database and automatically displayed on the map on the web.

Presently, plans are being considered by GEUS and BMP for a Greenland Mineral Resources Portal on the web encompassing the various facilities already developed (e.g. DODEX, GMOM2, Minex, etc.) together with facilities for the download of e.g. geophysical and geochemical data. The combination of all these tools into one geographical interface for searches would be a very strong development to the benefit of many.

Acknowledgements

This project has benefitted greatly from co-operation between many different types of experts in the two departments of GEUS: Department of Petrology and Economic Geology and Geological Data Centre. The Bureau of Minerals and Petroleum, Government of Greenland, supported the development economically from 2008 to 2010.

The upgrading and extension of the GMOMDB to the GMOMDB2 has demanded the patient co-operation between many colleagues in several different projects over an extended time period; the following list in alphabetic order give an indication of the nature of each individual"s part in the team"s creation of the GMOMDB2 and associated facilities for the use on the Internet:

Leif Thorning - (initiator, team leader)
Lisbeth A. Christensen - (transfer of database content from GMOMDB/Access to GMOMDB2/Oracle)
Peter R. Dawes - (contributor to content of GMOMDB2/Intrusions)
Adam A. Garde – (contributor to content of GMOMDB2/Intrusions)
Tjerk C. Heijboer - (construction of the new Oracle version of the database and the web-interfaces)
Per Kalvig - (every day manager of GMOMDB updating, etc.)
Lotte M. Larsen - (contributor to content of GMOM2DB/Intrusions)
Uffe Larsen - (SQL transfer of database content from GMOMDB/Access to GMOMDB2/Oracle))
Troels F. Nielsen (main contributor to content on the new layer of intrusions and magmatic complexes in GMOMDB2)
Emma F. Rehnström - (contributor to content of GMOMDB2/Intrusions)
Bjørn Thomassen - (contributor to content of GMOMDB2/Intrusions)
Kristine Thrane - (contributor to content of GMOMDB2/Intrusions)
Frands Schjøth - (GIS related work with the maps used and creation of the map to display on the Web)
Karsten Secher - (contributor to content of GMOMDB2/Intrusions)

References

Nielsen, T. F. D. 2002: Palaeogene intrusions and magmatic complexes in East Greenland. Danmark og Grønlands Geologiske Undersøgelse Rapport **2002/13**, 249 pp

Sen M. & Duffy T. 2005: GeoSciML: Development of a generic GeoScience Markup Language. Computers and Geosciences **31**, p 1095–1103

Thorning L., Christensen L. Aa., Schjøth F. & Stendal H. 2004: Greenland Mineral Occurrence Map. Status report for the development of a prototype for the internet, January 2004. Danmarks og Grønlands Geologiske Undersøgelse Rapport **2004/28**. 52 pp

Appendix 1: Main tables and attributes

Tables related to geological features

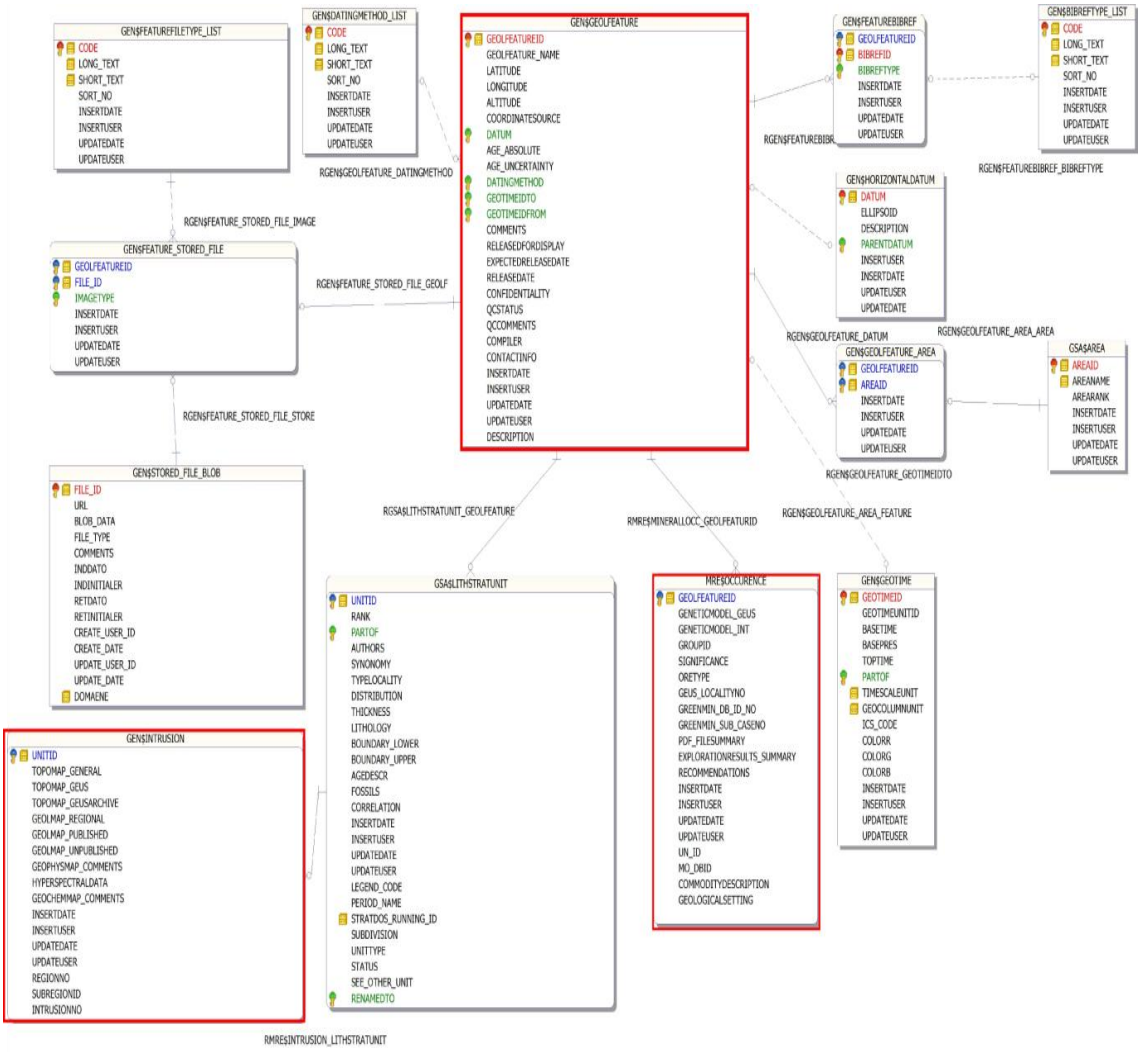


Figure 3. *Entity-Relationship-diagram of general geologic features. In highlighted in red: Geological feature table, intrusion and mineral occurence. Bibliographic References and stored files are related to gen$geolfeature.*

Tables related to mineral occurrences

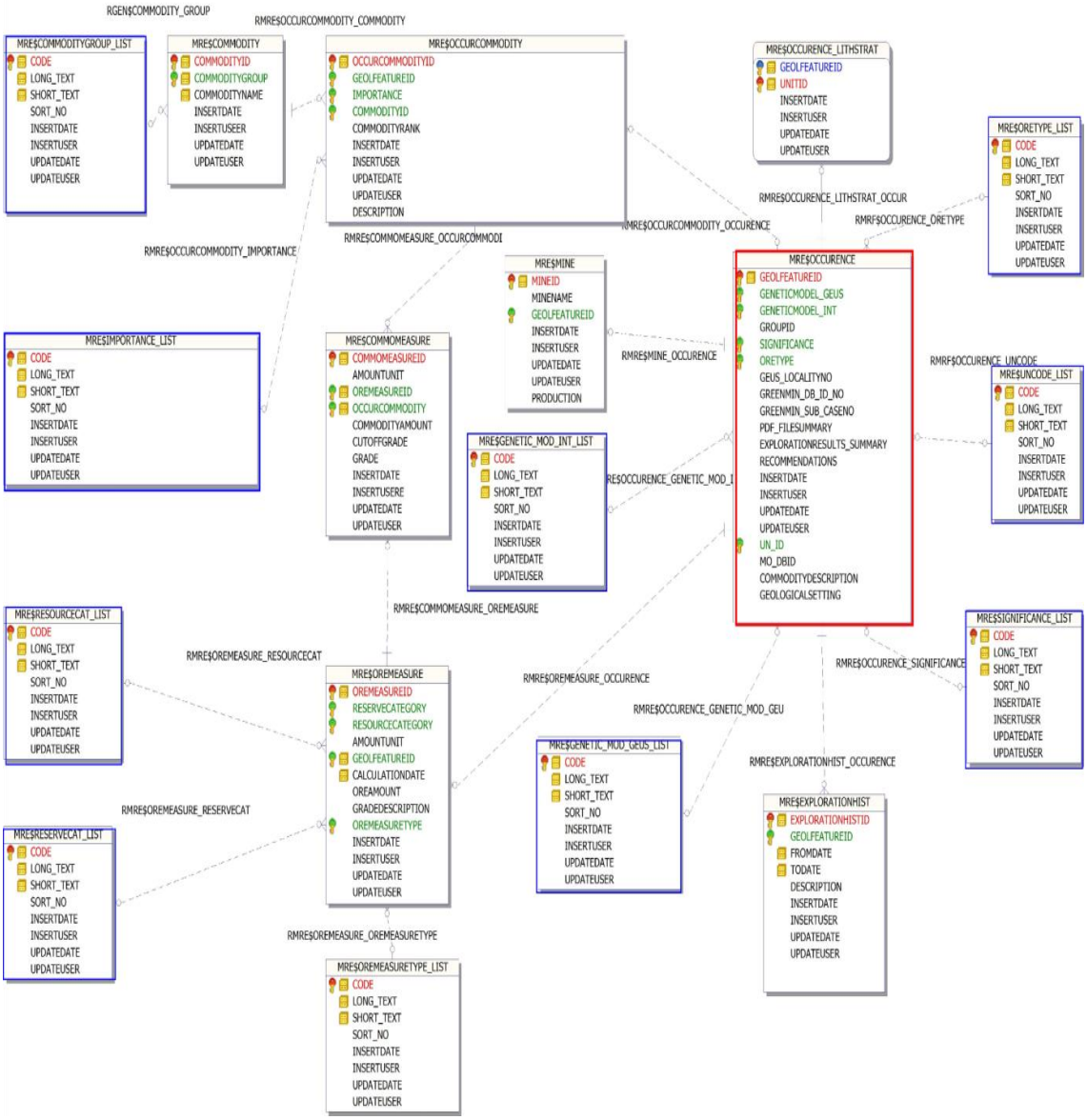


Figure 4. *Entity-Relationship-diagram of the attributes that are specifically related to mineral occurrences (highlighted in red). Highlighted in blue are List tables that have nearly the same attributes.*

GMOMDB2 attributes

GEN$GEOLFEATURE

GEOLFEATUREID	1	1	N	NUMBER (8)	
GEOLFEATURE_NAME	2		N	VARCHAR2 (100 Byte)	
LATITUDE	3		Y	NUMBER (11,6)	
LONGITUDE	4		Y	NUMBER (11,6)	
ALTITUDE	5		Y	NUMBER (7,2)	
COORDINATESOURCE	6		Y	VARCHAR2 (128 Byte)	
DATUM	7		Y	VARCHAR2 (7 Byte)	
AGE_ABSOLUTE	8		Y	NUMBER	
AGE_UNCERTAINTY	9		Y	NUMBER	
DATINGMETHOD	10		Y	NUMBER (4)	
GEOTIMEIDTO	11		Y	NUMBER (4)	
GEOTIMEIDFROM	12		Y	NUMBER (4)	
COMMENTS	13		Y	VARCHAR2 (4000 Byte)	
RELEASEDFORDISPLAY	14		N	VARCHAR2 (3 Byte)	
EXPECTEDRELEASEDATE	15		Y	DATE	
RELEASEDATE	16		Y	DATE	
CONFIDENTIALITY	17		Y	NUMBER (4)	
QCSTATUS	18		Y	NUMBER (4)	
QCCOMMENTS	19		Y	VARCHAR2 (4000 Byte)	
COMPILER	20		Y	NUMBER (5)	
CONTACTINFO	21		Y	VARCHAR2 (255 Byte)	
INSERTDATE	22		Y	DATE	SYSDATE
INSERTUSER	23		Y	VARCHAR2 (50 Byte)	USER
UPDATEDATE	24		Y	DATE	
UPDATEUSER	25		Y	VARCHAR2 (50 Byte)	
DESCRIPTION	26		Y	CLOB	

GEN$STORED_FILE_BLOB

FILE_ID	1	1	N	NUMBER (8)	
URL	2		Y	VARCHAR2 (255 Byte)	
BLOB_DATA	3		Y	BLOB	
FILE_TYPE	4		Y	VARCHAR2 (4 Byte)	
COMMENTS	5		Y	VARCHAR2 (255 Byte)	
INDDATO	6		Y	DATE	SYSDATE
INDINITIALER	7		Y	VARCHAR2 (50 Byte)	USER
RETDATO	8		Y	DATE	
RETINITIALER	9		Y	VARCHAR2 (50 Byte)	
CREATE_USER_ID	10		Y	INTEGER	
CREATE_DATE	11		Y	DATE	
UPDATE_USER_ID	12		Y	INTEGER	
UPDATE_DATE	13		Y	DATE	

DOMAENE	14		Y	VARCHAR2 (16 Byte)	
GEN$GEOLFEATURE_AREA					
GEOLFEATUREID	1	1	N	NUMBER (8)	
AREAID	2	2	N	NUMBER (4)	
INSERTDATE	3		Y	DATE	SYSDATE
INSERTUSER	4		Y	VARCHAR2 (50 Byte)	USER
UPDATEDATE	5		Y	DATE	
UPDATEUSER	6		Y	VARCHAR2 (50 Byte)	
GEN$FEATURE_STORED_FILE					
GEOLFEATUREID	1	1	N	NUMBER (8)	
FILE_ID	2	2	N	NUMBER (8)	
IMAGETYPE	3		N	NUMBER (1)	
INSERTDATE	4		Y	DATE	SYSDATE
INSERTUSER	5		Y	VARCHAR2 (50 Byte)	USER
UPDATEDATE	6		Y	DATE	
UPDATEUSER	7		Y	VARCHAR2 (50 Byte)	
GEN$HORIZONTALDATUM					
DATUM	1	1	N	VARCHAR2 (7 Byte)	
ELLIPSOID	2		Y	VARCHAR2 (20 Byte)	
DESCRIPTION	3		N	VARCHAR2 (255 Byte)	
PARENTDATUM	4		Y	VARCHAR2 (7 Byte)	
INSERTUSER	5		Y	VARCHAR2 (50 Byte)	USER
INSERTDATE	6		Y	DATE	SYSDATE
UPDATEUSER	7		Y	VARCHAR2 (50 Byte)	
UPDATEDATE	8		Y	DATE	
GEN$GEOTIME					
GEOTIMEID	1	1	N	NUMBER (4)	
GEOTIMEUNITID	2		Y	NUMBER (2)	
BASETIME	3		Y	NUMBER	
BASEPRES	4		Y	VARCHAR2 (10 Byte)	
TOPTIME	5		Y	NUMBER	
PARTOF	6		Y	NUMBER (3)	
TIMESCALEUNIT	7		Y	VARCHAR2 (30 Byte)	
GEOCOLUMNUNIT	8		Y	VARCHAR2 (30 Byte)	
ICS_CODE	9		Y	VARCHAR2 (20 Byte)	
COLORR	10		Y	NUMBER (3)	
COLORG	11		Y	NUMBER (3)	
COLORB	12		Y	NUMBER (3)	
INSERTDATE	13		Y	DATE	SYSDATE

INSERTUSER	14		Y	VARCHAR2 (50 Byte)	USER
UPDATEDATE	15		Y	DATE	
UPDATEUSER	16		Y	VARCHAR2 (50 Byte)	

GEN$FEATUREBIBREF

GEOLFEATUREID	1	1	N	NUMBER (8)	
BIBREFID	2	2	N	NUMBER (8)	
BIBREFTYPE	3		Y	NUMBER (4)	
INSERTDATE	4		Y	DATE	SYSDATE
INSERTUSER	5		Y	VARCHAR2 (50 Byte)	USER
UPDATEDATE	6		Y	DATE	
UPDATEUSER	7		Y	VARCHAR2 (50 Byte)	

GEN$INTRUSION

UNITID	1	1	N	NUMBER (8)	
TOPOMAP_GENERAL	2		Y	VARCHAR2 (500 Byte)	
TOPOMAP_GEUS	3		Y	VARCHAR2 (500 Byte)	
TOPOMAP_GEUSARCHIVE	4		Y	VARCHAR2 (500 Byte)	
GEOLMAP_REGIONAL	5		Y	VARCHAR2 (500 Byte)	
GEOLMAP_PUBLISHED	6		Y	VARCHAR2 (500 Byte)	
GEOLMAP_UNPUBLISHED	7		Y	VARCHAR2 (500 Byte)	
GEOPHYSMAP_COMMENTS	8		Y	VARCHAR2 (2000 Byte)	
HYPERSPECTRALDATA	9		Y	VARCHAR2 (2000 Byte)	
GEOCHEMMAP_COMMENTS	10		Y	VARCHAR2 (2000 Byte)	
INSERTDATE	11		Y	DATE	SYSDATE
INSERTUSER	12		Y	VARCHAR2 (50 Byte)	USER
UPDATEDATE	13		Y	DATE	
UPDATEUSER	14		Y	VARCHAR2 (50 Byte)	
REGIONNO	15		Y	NUMBER (4)	
SUBREGIONID	16		Y	NUMBER (4)	
INTRUSIONNO	17		Y	NUMBER (4)	

GSA$AREA

AREAID	1	1	N	NUMBER (4)	
AREANAME	2		Y	VARCHAR2 (50 Byte)	
AREARANK	3		Y	VARCHAR2 (15 Byte)	
INSERTDATE	4		Y	DATE	SYSDATE
INSERTUSER	5		Y	VARCHAR2 (50 Byte)	USER
UPDATEDATE	6		Y	DATE	
UPDATEUSER	7		Y	VARCHAR2 (50 Byte)	

GSA$LITHSTRATUNIT

UNITID	1	1	N	NUMBER (5)	
RANK	2		Y	VARCHAR2 (4 Byte)	
PARTOF	3		Y	NUMBER (5)	
AUTHORS	4		Y	VARCHAR2 (255 Byte)	
SYNONOMY	5		Y	VARCHAR2 (500 Byte)	
TYPELOCALITY	6		Y	VARCHAR2 (255 Byte)	
DISTRIBUTION	7		Y	VARCHAR2 (500 Byte)	
THICKNESS	8		Y	VARCHAR2 (255 Byte)	
LITHOLOGY	9		Y	VARCHAR2 (2000 Byte)	
BOUNDARY_LOWER	10		Y	VARCHAR2 (500 Byte)	
BOUNDARY_UPPER	11		Y	VARCHAR2 (500 Byte)	
AGEDESCR	12		Y	VARCHAR2 (255 Byte)	
FOSSILS	13		Y	VARCHAR2 (255 Byte)	
CORRELATION	14		Y	VARCHAR2 (1000 Byte)	
INSERTDATE	15		Y	DATE	SYSDATE
INSERTUSER	16		Y	VARCHAR2 (50 yte)	USER
UPDATEDATE	17		Y	DATE	
UPDATEUSER	18		Y	VARCHAR2 (50 Byte)	
LEGEND_CODE	19		Y	VARCHAR2 (10 Byte)	
PERIOD_NAME	20		Y	VARCHAR2 (30 Byte)	
STRATDOS_RUNNING_ID	21		Y	NUMBER (5)	
SUBDIVISION	22		Y	VARCHAR2 (1000 Byte)	
UNITTYPE	23		Y	VARCHAR2 (5 Byte)	
STATUS	24		Y	NUMBER (4)	
SEE_OTHER_UNIT	25		Y	VARCHAR2 (70 Byte)	
RENAMEDTO	26		Y	NUMBER (8)	

RAP$RAPPORT

RAPPORTID	1	1	N	NUMBER (8)
REPORT_FILE_NO	2		Y	NUMBER (8)
TITEL	3		N	VARCHAR2 (512 Byte)
KORTTITEL	4		Y	VARCHAR2 (256 Byte)
UNDERTITEL1	5		Y	VARCHAR2 (256 Byte)
UNDERTITEL2	6		Y	VARCHAR2 (256 Byte)
RAPPORTTYPE_KODE	7		N	NUMBER (4)
FORFATTERE	8		Y	VARCHAR2 (256 Byte)
UDGIVELSESDATO	9		Y	DATE
UDGIVELSESSTED	10		Y	VARCHAR2 (70 Byte)
UDGIVER	11		Y	VARCHAR2 (70 Byte)
RAPPORTSERIE_KODE	12		Y	NUMBER (4)
RAPPORTSERIENUMMER	13		Y	VARCHAR2 (32 Byte)
BIND	14		Y	VARCHAR2 (16 Byte)
NUMMER	15		Y	VARCHAR2 (16 Byte)
EDITOR	16		Y	VARCHAR2 (256 Byte)
SPROG_KODE	17		Y	NUMBER (4)
KLASSIFIKATION_KODE	18		N	NUMBER (4)

SIDEFRA	19		Y	NUMBER (6)	
SIDETIL	20		Y	NUMBER (6)	
ANTALSIDER	21		Y	NUMBER (8)	
FILSTOERRELSETOTAL	22		Y	NUMBER (8)	
FORVENTETFRIGIVELSESDATO	23		Y	DATE	
FRIGIVELSESDATO	24		Y	DATE	
FRIGIVETTILVISNING	25		Y	VARCHAR2 (3 Byte)	
MODTAGETDATO	26		Y	DATE	
ISBN	27		Y	VARCHAR2 (20 Byte)	
KOMMENTARER	28		Y	VARCHAR2 (4000 Byte)	
DOMAENE	29		N	VARCHAR2 (32 Byte)	
SPROG	30		Y	VARCHAR2 (64 Byte)	'DANISH'
INDDATO	31		N	DATE	SYSDATE
INDINITIALER	32		Y	VARCHAR2 (50 Byte)	USER
RETDATO	33		Y	DATE	
RETINITIALER	34		Y	VARCHAR2 (50 Byte)	
MRE$OCCURENCE	1	1	N	NUMBER (8)	
GEOLFEATUREID	2		Y	NUMBER (4)	
GENETICMODEL_GEUS	3		Y	NUMBER (4)	
GENETICMODEL_INT	4		Y	NUMBER (4)	
GROUPID	5		Y	NUMBER (4)	
SIGNIFICANCE	6		Y	NUMBER (4)	
ORETYPE	7		Y	VARCHAR2 (64 Byte)	
GEUS_LOCALITYNO	8		Y	NUMBER (4)	
GREENMIN_DB_ID_NO	9		Y	VARCHAR2 (32 Byte)	
GREENMIN_SUB_CASENO	10		Y	VARCHAR2 (254 Byte)	
PDF_FILESUMMARY	11		Y	VARCHAR2 (4000 Byte)	
EXPLORATIONRESULTS_SUMMARY	12		Y	VARCHAR2 (2000 Byte)	
RECOMMENDATIONS	13		Y	DATE	SYSDATE
INSERTDATE	14		Y	VARCHAR2 (50 Byte)	USER
INSERTUSER	15		Y	DATE	
UPDATEDATE	16		Y	VARCHAR2 (50 Byte)	
UPDATEUSER	17		Y	NUMBER (3)	
UN_ID	18		Y	NUMBER (3)	
MO_DBID	19		Y	VARCHAR2 (254 Byte)	
COMMODITYDESCRIPTION	20		Y	CLOB	
GEOLOGICALSETTING					
MRE$OCCURENCE_LITHSTRAT	1	1	N	NUMBER (8)	
GEOLFEATUREID	2	2	N	NUMBER (8)	
UNITID	3		Y	DATE	SYSDATE
INSERTDATE	4		Y	VARCHAR2 (50	USER

				Byte)	
INSERTUSER	5		Y	DATE	
UPDATEDATE	6		Y	VARCHAR2 (50 Byte)	
UPDATEUSER					
MRE$EXPLORATIONHIST	1	1	N	NUMBER (8)	
EXPLORATIONHISTID	2		N	NUMBER (8)	
GEOLFEATUREID	3		Y	DATE	
FROMDATE	4		Y	DATE	
TODATE	5		N	VARCHAR2 (2000 Byte)	
DESCRIPTION	6		Y	DATE	SYSDATE
				VARCHAR2 (50	
INSERTDATE	7		Y	Byte)	USER
INSERTUSER	8		Y	DATE	
UPDATEDATE	9		Y	VARCHAR2 (50 Byte)	
UPDATEUSER					
MRE$GROUP	1	1	N	NUMBER (4)	
GROUPID	2		N	VARCHAR2 (50 Byte)	
GROUPNAME	3		Y	DATE	SYSDATE
				VARCHAR2 (50	
INSERTDATE	4		Y	Byte)	USER
INSERTUSER	5		Y	DATE	
UPDATEDATE	6		Y	VARCHAR2 (50 Byte)	
UPDATEUSER					
MRE$OCCURCOMMODITY	1	1	N	NUMBER (8)	
OCCURCOMMODITYID	2		Y	NUMBER (8)	
GEOLFEATUREID	3		Y	NUMBER (1)	
IMPORTANCE	4		N	NUMBER (4)	
COMMODITYID	5		Y	NUMBER (3)	
COMMODITYRANK	6		Y	DATE	SYSDATE
				VARCHAR2 (50	
INSERTDATE	7		Y	Byte)	USER
INSERTUSER	8		Y	DATE	
UPDATEDATE	9		Y	VARCHAR2 (50 Byte)	
UPDATEUSER	10		Y	VARCHAR2 (255 Byte)	
DESCRIPTION					
MRE$COMMODITY	1	1	N	NUMBER (4)	
COMMODITYID	2		Y	NUMBER (4)	
COMMODITYGROUP	3		Y	VARCHAR2 (100 Byte)	
COMMODITYNAME	4		Y	DATE	SYSDATE
				VARCHAR2 (50	
INSERTDATE	5		Y	Byte)	USER
INSERTUSEER	6		Y	DATE	

UPDATEDATE	7		Y	VARCHAR2 (50 Byte)	
UPDATEUSER					
MRE$MINE	1	1	N	NUMBER (8)	
MINEID	2		N	VARCHAR2 (100 Byte)	
MINENAME	3		N	NUMBER (8)	
GEOLFEATUREID	4		Y	DATE	SYSDATE
				VARCHAR2 (50	
INSERTDATE	5		Y	Byte)	USER
INSERTUSER	6		Y	DATE	
UPDATEDATE	7		Y	VARCHAR2 (50 Byte)	
UPDATEUSER	8		Y	CLOB	
PRODUCTION					
MRE$OREMEASURE	1	1	N	NUMBER (8)	
OREMEASUREID	2		Y	NUMBER (4)	
RESERVECATEGORY	3		Y	NUMBER (4)	
RESOURCECATEGORY	4		Y	NUMBER (4)	
AMOUNTUNIT	5		N	NUMBER (8)	
GEOLFEATUREID	6		N	DATE	
CALCULATIONDATE	7		Y	NUMBER	
OREAMOUNT	8		Y	VARCHAR2 (4000 Byte)	
GRADEDESCRIPTION	9		Y	NUMBER (1)	
OREMEASURETYPE	10		Y	DATE	SYSDATE
				VARCHAR2 (50	
INSERTDATE	11		Y	Byte)	USER
INSERTUSER	12		Y	DATE	
UPDATEDATE	13		Y	VARCHAR2 (50 Byte)	
UPDATEUSER					
MRE$COMMOMEASURE	1	1	N	NUMBER (8)	
COMMOMEASUREID	2		Y	NUMBER (4)	
AMOUNTUNIT	3		N	NUMBER (8)	
OREMEASUREID	4		N	NUMBER (8)	
OCCURCOMMODITY	5		N	NUMBER	
COMMODITYAMOUNT	6		Y	NUMBER	
CUTOFFGRADE	7		Y	NUMBER	
GRADE	8		Y	DATE	SYSDATE
				VARCHAR2 (50	
INSERTDATE	9		Y	Byte)	USER
INSERTUSERE	10		Y	DATE	
UPDATEDATE	11		Y	VARCHAR2 (50 Byte)	
UPDATEUSER					
MRE$BIBREF					
BIBREFID	1	1	N	NUMBER (8)	

BIBREF	2		N	VARCHAR2 (4000 Byte)	
RAPPORTID	3		Y	NUMBER (8)	
INSERTDATE	4		Y	DATE	SYSDATE
INSERTUSER	5		Y	VARCHAR2 (50 Byte)	USER
UPDATEDATE	6		Y	DATE	
UPDATEUSER	7		Y	VARCHAR2 (50 Byte)	

MRE$REGIONBIBREF

REGIONNO	1	1	N	NUMBER (4)	
BIBREFID	2	2	N	NUMBER (8)	
INSERTDATE	3		Y	DATE	SYSDATE
INSERTUSER	4		Y	VARCHAR2 (50 Byte)	USER
UPDATEDATE	5		Y	DATE	
UPDATEUSER	6		Y	VARCHAR2 (50 Byte)	

MRE$SUBREGIONBIBREF

SUBREGIONID	1	1	N	NUMBER (4)	
BIBREFID	2	2	N	NUMBER (8)	
INSERTDATE	3		Y	DATE	SYSDATE
INSERTUSER	4		Y	VARCHAR2 (50 Byte)	USER
UPDATEDATE	5		Y	DATE	
UPDATEUSER	6		Y	VARCHAR2 (50 Byte)	

MRE$REGION

REGIONNO	1	1	N	NUMBER (4)	
REGIONNAME	2		N	VARCHAR2 (255 Byte)	
INSERTDATE	3		Y	DATE	SYSDATE
INSERTUSER	4		Y	VARCHAR2 (50 Byte)	USER
UPDATEDATE	5		Y	DATE	
UPDATEUSER	6		Y	VARCHAR2 (50 Byte)	

MRE$SUBREGION

SUBREGIONID	1	1	N	NUMBER (4)	
REGIONNO	2		Y	NUMBER (4)	
SUBREGIONNO	3		Y	NUMBER (4)	
SUBREGIONNAME	4		N	VARCHAR2 (255 Byte)	
INSERTDATE	5		Y	DATE	SYSDATE
INSERTUSER	6		Y	VARCHAR2 (50 Byte)	USER
UPDATEDATE	7		Y	DATE	
UPDATEUSER	8		Y	VARCHAR2 (50 Byte)	

STO$ACTOR

ACTORID	1	1	N	NUMBER (5)	
SUPERVISOR	2		Y	VARCHAR2 (40 Byte)	
INSTITUTION	3		Y	VARCHAR2 (40 Byte)	
ADDRESS_1	4		Y	VARCHAR2 (40 Byte)	
ADDRESS_2	5		Y	CHAR (40 Byte)	
FULLNAME	6		Y	VARCHAR2 (40 Byte)	
EMAIL	7		Y	CHAR (18 Byte)	
COLLECTOR_ID	8		Y	NUMBER (5)	
INITIALS	9		Y	VARCHAR2 (5 Byte)	
INSERTDATE	10		Y	DATE	SYSDATE
INSERTUSER	11		Y	VARCHAR2 (50 Byte)	USER
UPDATEDATE	12		Y	DATE	
UPDATEUSER	13		Y	VARCHAR2 (50 Byte)	

GEN$KLASSIFIKATION_LISTE

KODE	1	1	N	NUMBER (4)	
LANG_TEKST	2		N	VARCHAR2 (60 Byte)	
KORT_TEKST	3		Y	VARCHAR2 (20 Byte)	
SORT_NR	4		Y	NUMBER (4)	
DOMAENE	5		N	VARCHAR2 (32 Byte)	
SPROG	6		Y	VARCHAR2 (64 Byte)	'DANISH'
INDDATO	7		Y	DATE	SYSDATE
INDINITIALER	8		Y	VARCHAR2 (50 Byte)	USER
RETDATO	9		Y	DATE	
RETINITIALER	10		Y	VARCHAR2 (50 Byte)	

GEN$DATINGMETHOD_LIST

CODE	LONG_TEXT	SHORT_TEXT	SORT_NO
10	Ar-Ar		
20	Rb-Sr		
30	U-Pb		
40	Fission Track		
50	Pb-Pb		
60	Reading from 1:250000 map		
70	Zircon		
80	Pb-Pb of allanite		
90	K-Ar		
100	Pb-Pb isotope dating of discrete monazite grains		
110	Re-Os		
120	Zircon SHRIMP		
130	Zircon - ICP-MS		
140	U-Pb on Baddeleyite		

999	No Data	No Data	1

GEN$FEATUREFILETYPE_LIST

CODE	LONG_TEXT	SHORT_TEXT	SORT_NO
1	map	map	
0	no data	no data	
3	illustration	illustr	
2	photo	photo	
5	summary	summary	
4	table	table	

GEN$UNITSTATUS_LIST

1	Formal
2	Informal
3	Superseded
4	Probably obsolete
5	Obsolete
6	Reserved

GEN$BIBREFTYPE_LIST

1	main
2	petrography
3	geochemistry

GEN$WEIGHTUNIT_LIST

1	tonnes	t
2	kilotonnes	kt
3	megatonnes	mt

MRE$ORETYPE_LIST

17	No Data	NO
1	Concordant	CON
2	Disseminated	DIS
3	Igneous	IGN
4	Lenticular	LEN
5	Massive	MAS
6	Pegmatite	PEG
7	Pipe	PIP
8	Placer	PLA
9	Porphyry	POR
10	Precipitate	PRE
11	Skarn	SKA
12	Stockwork	STO
13	Stratabound	STR
14	Stratiform	STF
15	Unspecified	UNK

16	Vein	VEI

MRE$SIGNIFICANCE_LIST

1	No data	0
2	Indication	10
3	Showing	20
4	Prospect	30
5	Deposit	40
6	Mine	50
7	Mine, closed	60

MRE$GENETIC_MOD_INT_LIST

1	No Data	No Data
2	Placer uranium, gold	1.0
3	Palaeoplacer	1.1
4	Placer	1.2
5	Statiform phosphate	2.0
6	Stratiform iron	3.0
7	Lake Superior-type iron formation	3.1
8	Algoma-type iron-formation	3.2
9	Ironstones	3.3
10	Residually enriched deposits	4.0
11	Enriched iron-formation	4.1
12	Supergene base metals and precious metals	4.2
13	Evaporites	5.0
14	Exhalative base metal sulphides	6.0
15	Sedimentary exhalative sulphides (Sedex)	6.1
16	Sedimentary nicckel sulphides	6.2
17	Volcanic-associated massive sulphide base metals	6.3
18	Volcanic-associated massive sulphide gold	6.4
19	Unconformity-associated uranium	7.0
20	Stratabound clastic-hosted uranium, lead, copper	8.0
21	Sandstone uranium	8.1
22	Sandstone lead	8.2
23	Sediment-hosted stratiform copper	8.3
24	Kupferschiefer-type	'8.3a
25	Redbed-type	'8.3b
26	Volcanic redbed copper	9.0
27	Mississippi Valley-type lead-zinc	10.0
28	Ultramafic-hosted asbestos	11.0
29	Volcanic-associated uranium	12.0
30	Vein uranium	13.0
31	Arsenide vein silver,cobalt,uranium	14.0
32	Lode gold	15.0
33	Epithermal gold	15.1
34	Quartz carbonate vein gold	15.2

35	Iron-formation-hosted stratabound gold	15.3
36	Disseminated and replacement gold	15.4
37	Clastic metasediment-hosted vein silver-lead-zinc	16.0
38	Vein copper	17.0
39	Vein-stockwork tin, tungsten	18.0
40	Porphyry coper, gold, molybdenum, tungsten, tin, silver	19.0
41	Skarn deposit	20.0
42	Skarn zinc-lead-silver	20.1
43	Skarn copper	20.2
44	Skarn gold	20.3
45	Skarn iron	20.4
46	Skarn tungsten	20.5
47	Granitic pegmatites	21.0
48	Kiruna/Olympic Dam-type iron, copper, uranium, gold, silver	22.0
49	Peralkaline rock-associated rare metals	23.0
50	Carbonatite-associated deposits	24.0
51	Primary diamond deposits	25.0
52	Kimberlit-hosted diamond	25.1
53	Lamproite-hosted diamond	25.2
54	Mafic intrusion-hosted titanium-iron	26.0
55	Anorthosite-hosted titanium-iron	26.1
56	Gabbro-anorthosite-hosted iron-titanium	26.2
57	Magmatic nickel-copper-platinum group elements	27.0
58	Nickel-copper sulphides	27.1
59	Magmatic platinum group elements	27.2
60	Mafic/ultramafic-hosted chromite	28.0
61	Stratiform chromite	28.1
62	Podiform (ophiolithic) chromite	28.2
63	Vein Cu - hydrothermal activity in linear zone	
65	Skarn	
66	Not classified	
67	Mafic/ultramafic	
68	Carbonatite associated occurrence	
69	Alkaline rock-associated rare metals	

MRE$GENETIC_MOD_GEUS_LIST

1	No Data	No Data	1
2	Magmatic	MAG	10
3	Igneous	IGN	20
4	Volcanogenic	VOL	30
5	Sedimentary	SED	40
6	Diagenetic	DIA	50
7	Syngenetic	SYN	60
8	Epigenetic	EPI	70
9	Hydrothermal	HYD	80

10	Replacement	REP	90
11	Residual	RES	110
12	Metamorphic	MET	120
13	Unspecified	UNK	130

MRE$COMMODITYGROUP_LIST

20 Base metals
60 Fissionable minerals
80 Gemstones
70 Industrial minerals
40 Iron and iron alloys
30 Light metals
50 Minor metals and non-related non-metals
0 No data
10 Precious metals
3 Sulphide mineralisation

MRE$OREMEASURETYPE_LIST

1 reserves
2 resources
3 reserves + resources

MRE$IMPORTANCE_LIST

1 major
2 minor

RAP$QCSTATUS_LISTE

7 Ny
8 Unchecked
9 In progress
10 Ready for approval
11 Approved
1 Unchecked
2 In progress
3 Ready for approval
4 Approved

GEN$UNITSTATUS_LIST

1 Formal
2 Informal
3 Superseded
4 Probably obsolete
5 Obsolete
6 Reserved

MRE$RESERVECAT_LIST

1 proved ore reserves
2 proved and probable ore reserves [non-JORC]
3 probable ore reserves
4 proved and probable ore reserves [JORC]
5 inferred reserve
6 Indicated reserve
7 Measured reserve

MRE$RESOURCECAT_LIST

1 measured, indicated and inferred mineral resource [non-JORC]
2 measured, indicated and inferred mineral resource [JORC]
3 measured mineral resource
4 measured and indicated mineral resource
5 indicated mineral resource
6 inferred mineral resource

Appendix 2: Notes on principles and names

This appendix contains a modified version of the introduction to “Palaeogene intrusions and magmatic complexes in East Greenland, 66 to 75°N” (Nielsen, 2002) outlining the philosophy and principles for the compilation in the “Intrusion database” for all of Greenland. Similar principles have been applied to the other regions in Greenland.

The data sheet

The Paleaogene magmatic intrusions and complexes in East Greenland (Region 1) are described from north to south in ”data sheets”. The intrusions and complexes are not evenly distributed along the volcanic rifted margin. The clusters of intrusions and complexes are often referred to as ”centres” or ”districts”. In this report the intrusions and complexes are referred to subregions 1-12. The data sheets for the 69 intrusions and complexes of Palaeogene age are identified by a numerical code. The code consists of three numbers: a region code (Region 1), a subregion code (1 to 12,) and the number for the individual intrusion or complex magmatic body within regions, f. ex., the information on the Skaergaard intrusion in the Kangerlussuaq subregion (subregion # 9) is summarised in data sheet 1.9.1. This structuring of the information has been applied in the database.

Inventory of a data sheet

Data sheet number	See definition above.
Name	See section below.
Short characterisation	Type of complex and mineralisations.
Location:	The location is given in the form of the geographical co-ordinates for a single point within the intrusion/complex or within macrodykes. The co-ordinates have been read from the topographic maps published by National Survey and Cadastre Denmark; KMS, formerly GI) in the scale 1:250 000.
Main references:	References to the most useful general introduction (s) and description (s).
Topographic maps:	Topographic maps available from National Survey and Cadastre Denmark (KMS, formerly GI) and the Geological Survey of Denmark and Greenland (GEUS).
Landsat image:	Landsat images available from GEUS.
Geological maps:	Geological maps sheets available from GEUS, publication maps and in some cases maps open company reports and unpublished maps.

Geophysical maps:	Geophysical maps available from GEUS.
Geochemical maps:	Geochemical maps and data for such maps available from GEUS and in open company reports.
Short description:	Short geological description based on published and unpublished information.
Petrography:	Metadata for petrographic descriptions of the magmatic rocks.
Geochemistry:	Metadata for whole rock major and trace element analyses.
Exploration activity:	Summary of exploration activity.
Exploration results:	Short summary of exploration results.
Comments and company recommendations:	only if available.
References:	A selection of literature references. For the least known occurrences of magmatic rocks virtually all references are given. For well-described occurrences only a selection of references is given. A full list of company reported can be obtained from GEUS on request.
Date:	Date for the most recent up-date of the data sheet.

Listing of regions in Greenland.

Below are listed the regions defined for the purpose of registration of intrusions etc. in Greenland, base on part geographical and part geological criteria:

East Greenland from N to S

1 Palaeogene East Greenland (corresponds to Nielsen, 2002)
2 Caledonian granites (sensu lato)
3 Devonian granites (sensu lato).

South-East Greenland

4 Proterozoic intrusions and volcanics (Ammassalik region)
5 Archaean intrusions (Skjoldungen Alkaline Province)

South Greenland

6 Ketilidian intrusions (gabbro rapakivi, a.o.)
7 Gardar intrusions

South-West Greenland

8 Archaean anorthosite, norite and gabbro intrusions.
9 Archaean granitic and granodioritic intrusions
10 Archaean carbonatitic intrusion
12 Middle Proterozoic magmatism in SW Greenland (dyke swarms, **NOT** included in database)
13 Neoproterozoic magmatism i(kimberlite, ailikite, carbonatite)
14 Mesozoic intrusions (carbonatite)

Central West Greenland

15 Proterozoic in West Greenland (Nagssugtoqidian intrusions, Prøven charnokite)
16 Archaean to Mesozoic dykes, etc. In Disko Bugt region **(NOT** included in database))
17 Archaean intrusive bodies
18 Palaeogene intrusion in West Greenland

North-West and North Greenland (Melville Bugt and North Greenland)

19 Archaean in North-West Greenland (Thule, intrusions)
20 Palaeoproterozoic in North-West Greenland (Thule, Inglefield Land, sills, dykes, a.o..)
21 Meso- to Neoproterozoic in North-West Greenland (Thule, Inglefield Land, sills, dykes, a.o..)
22 Mesoproterozoic in North and North-East Greenland (Midsommersø dolerites)
23 Mesozoic in North Greenland (Kap Washington volcanics, dykes, plugs, **ONLY** plugs included)

Intrusion, intrusive complex and complex: definitions

In the literature, “intrusion” and “complex” have often been used arbitrarily. They are regarded as descriptive adjectives. In the present report “intrusion” refers to a succession of magmatic rocks formed by a single pulse or very homogeneous intrusive bodies, as opposed to “complex” that refers to magmatic rock occurrences formed by several, possibly, related intrusive bodies.

The distinction between “intrusion”, “complex” and in one case, ”diatreme” is in many cases not easily made. In this report, the use of these descriptive adjectives is based on the subjective understanding of the genesis of the complex and the relationship between the different parts of the intrusive body or bodies. The descriptive adjectives are as a rule spelled with small letters (e.g., Skaergaard intrusion). Exceptions to this (see data sheet 9.0) are:

Kangerdlugssuaq Complex

Kangerdlugssuaq Alkaline Intrusion

Kap Edvard Holm Complex.

Kap Edvard Holm Intrusion

Two intrusions are identified by the rock they are composed of. More specific names would probably have been appropriate and the names of these magmatic rock occurrences are modified as shown:

Biotite Granite = (Amdrup Fjord) Biotite Granite

Augite Syenite = (Kangerdlugssuaq) Augite Syenite

Spelling of names for intrusions and complexes

Intrusions and magmatic complexes in East Greenland are not always referred to by the same name and the spelling can - and does - quite often vary. In the data sheets is generally adopted the name used in the main reference(s). That is in general the name given in the first descriptions of the intrusion or complex. Exception to this is, f. ex., the Forchammer pluton (data sheet 1. 4.2) which is now currently referred to as the Kap Simpson complex.

The spelling of names of magmatic rock occurrences based on geographical place names follows in general the spelling in the 1:250 000 topographic maps published by National Survey and Cadastre Denmark (KMS). The currently official spelling is ***not*** used for most names of intrusions and complexes, as virtually all of these have been named and described before the introduction of the now official spelling. The rational for this is that the first recorded names are “formation names”. In table 1, some of the intrusions and complexes, where mistakes can occur are listed.

Some intrusions and complexes, where mistakes in names can occur

Name used in this report	Other used names
Region 4: Traill Ø	
Kap Simpson complex	Forchammer Pluton
Region 5: Antarctic Havn	

Theresabjerg complex	Theresabjerg composit intrusion
Region 6: Werner Bjerge	
Werner Bjerge complex	Werner Bjerge alkaline Massif
Region 8: Blosseville Kyst	
Borgtinderne complex	Bortinderne intrusion
Lilloise complex	Lilloise alkaline gabbro complex
Region 9: Kangerlussaq	Kangerdlugssuaq
Skaergaard intrusion	Skærgårdsintrusionen and Skærgårds Intrusionen
Kangerdlugssuaq complex	Kangerdlugssuaq Alkaline Intrusion and Satellite intrusions
Kangerdlugssuaq Alkaline Intrusion	Kangerdlugssuaq intrusion
(Kangerdlugssuaq) Augite Syenite intrusion	Augite Syenite
(Amdrup Fjord) Biotite Granite intrusion	Biotite Granite
Kap Edvard Holm Complex	Kap Edvard Holm layered intrusion
Kap Edvard Holm Intrusion	Kap Edvard Holm (gabbro)
Kontaktbjerg Breccia complex	Kontaktbjerg Breccia Zone, Kontaktbjerg hybrid rocks
New name:	
Cirque 1320 complex	
Region 10: Nualik	
Pátûlâjivit gabbro	Pâtûterajivit
Region 11: Kialineq (trad. name)	Kialeq (map sheet name)
Ikâsangmit complex	Ikerasangmuit, Ikerasangmiut, Ikasangmiit
Bjørn intrusion	Bjørn Syenite
Qajarsak granite	Matikalaq intrusion
Nûk diorite	Nûk breccia complex (Nûk at Piliarpe bay)
Aliuarssik intrusion	Auluiartik Granite
Place names	
Pilagpik (island)	Don Ø
Nûluk	Nûk (at Pueratse bay).

Errors, omissions and corrections

The data sheets are an introduction to the Palaeogene intrusions and complexes in East Greenland and the available published and unpublished information. The information summarised in the data sheets represents a condensate of the vast information in the literature and the subjective understanding of the compiler of the data sheets. It is the intension to update the data sheets as new information becomes available.

There may be omissions, errors and a need for correction. All comments are welcome and can be directed to: Geological Survey of Denmark and Greenland, att: T.F.D. Nielsen, Øster Voldgade 10, DK-1350 Copenhagen K, Denmark (tfn@GEUS.dk).

Abbreviations

A number of abbreviations are used in the data sheets:

GEUS:	Danmarks og Grønlands Geologiske Undersøgelse (Geological Survey of Denmark and Greenland).
KMS:	Kort og Matrikkelstyrrelsen (National Survey and Cadastre Denmark).
GRF:	Greenland Report File (in GEUS archive).
ppm:	Parts per million
ppb:	Parts per billion