

# **Diamond exploration data from West Greenland: 2004 update and revision**

Sven Monrad Jensen, Karsten Secher, Thorkild M. Rasmussen  
& Frands Schjøth

(1 DVD included)



GEOLOGICAL SURVEY OF DENMARK AND GREENLAND  
MINISTRY OF THE ENVIRONMENT

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## Abstract

The present digital compilation of diamond exploration data from West Greenland is a revised and completely updated version of the compilation published by the Geological Survey of Denmark and Greenland (GEUS) in 2003. The data sources are 164 assessment reports submitted by exploration companies to the Bureau of Minerals and Petroleum, and data from field and laboratory investigations conducted by GEUS since 2000. A major improvement, compared to the first edition, is that the mineral chemistry data are now evaluated, corrected and used to assign kimberlite indicator mineral classes to the analysed mineral grains. This new compilation contains more than 96 000 analyses of kimberlite indicator mineral grains from till and stream sediment samples covering the whole Archaean craton of southern West Greenland, nearly 3000 analyses of mineral grains from 31 kimberlitic rock samples, 560 mineral classification diagrams, and all relevant company reports as Adobe PDF documents. All available geophysical maps from surveys conducted for exploration companies are now scanned in full size and available in PDF documents.

# Introduction

Exploration for diamonds in West and South-West Greenland has been conducted at irregular intervals since the early 1970s, but has been continuous now for the past decade. Exploration companies have produced a large volume of data relevant to diamond exploration since 1995, including mineral analyses of heavy minerals recovered from till samples, dyke outcrop and boulder distribution maps, geophysical surveys, results of diamond testing of mini-bulk sampled dykes, drill logs, etc.

The Geological Survey of Denmark and Greenland (GEUS) published a digital compilation on DVD in 2003 in order to provide an overview of available company and Survey data to the exploration community (Jensen *et al.* 2003a). This compilation provided raw kimberlite indicator mineral data only, and suffered from a substantial amount of data being confidential at the time.

The new digital data compilation is an updated and completely revised edition. The main improvements are the following:

- Twenty assessment reports from exploration companies submitted to the Bureau of Minerals and Petroleum (BMP) have been added, and there are now 164 scanned reports in Adobe PDF documents
- The amount of data has been nearly doubled as a result of expiry of confidentiality. There are now approximately 96 150 mineral analyses from 15 295 samples of till or stream sediment from 4563 localities, and 2780 mineral analyses from 31 kimberlitic rock samples
- All mineral chemistry data have been examined, and analysed kimberlite indicator mineral grains have been classified and plotted in 560 classification diagrams
- All available geophysical maps have been scanned in large format, and are presented in Adobe PDF documents. Approximately 300 maps have been added
- The number of observations of kimberlitic rocks has been nearly doubled to approximately 2700
- Topographic data at 1:100 000 scale are included for the regions of current diamond exploration

The present report is intended to provide an overview and hints to using the data provided on the DVD, with strong emphasis on the GIS presentation provided, and should be viewed as a user's guide. The report also contains a bibliography of all assessment reports and the most relevant papers.

For reviews of regional geology, geochemistry and kimberlites, the user is referred to Helmstaedt *et al.* (1999), Jensen *et al.* (2002), Jensen *et al.* (2003a; 2003b), Jensen & Secher (2004), Jensen *et al.* (2004), Larsen (1980; 1991a), Larsen & Rex (1992), Scott (1981), Secher & Larsen (1980), Secher & Jensen (2004), Steenfelt (2001; 2002) and van Gool *et al.* (2002).

## Diamond exploration in Greenland

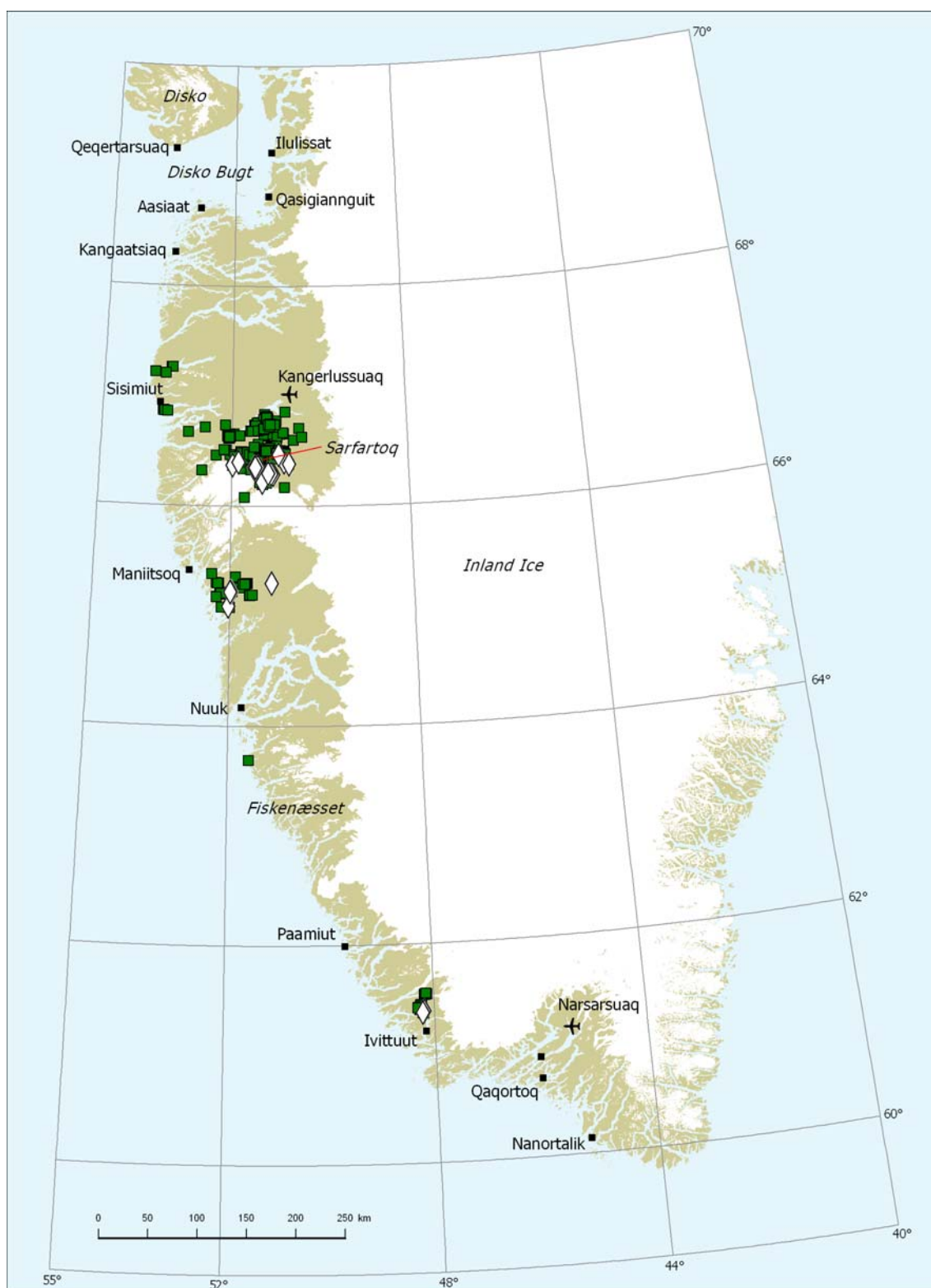
Greenland has seen diamond exploration activity since around 1970. For a review of investigations and occurrences up to 1991, see Larsen (1991a). Inspired by reports of kimberlite dykes at several locations in southern West Greenland, Renzy Mines Ltd. in the early 1970s first investigated occurrences in the Pyramidefjeld area north of Ivittuut in South-West Greenland and recovered two microdiamonds and one macrodiamond from kimberlitic samples (Figure 1). Further north, in the Fiskensæset area between Paamiut and Nuuk, Platinomino A/S reported ten microdiamonds from a large stream sediment sample. Charter Consolidated Mines Ltd. conducted regional kimberlite prospecting in large parts of West Greenland and recorded many new occurrences in the Sisimiut–Kangerlussuaq area. Two microdiamonds were reported from bulk stream sediment samples in the large Ar-nangernup Kuua ('Sarfartoq') valley SW of Kangerlussuaq. There have been several attempts at reproducing or explaining the early reported alluvial Fiskensæset diamonds, but without success; their authenticity is now regarded as dubious (Larsen 1991a; LeCouteur 1998p).

During the 1970s and 1980s, GEUS and various academic workers conducted investigations in West Greenland, especially in the Sarfartoq and Sisimiut areas, producing the first detailed studies of kimberlitic rocks (Goff 1973; Larsen 1980, 1991a, b; Scott 1977; Thy *et al.* 1987).

The next commercial exploration campaigns began around 1994, following the discoveries of diamondiferous kimberlites in Canada's Northwest Territories and the Voisey's Bay nickel-copper-cobalt deposit in Labrador. Many companies turned their eyes to Greenland, and large areas in the Archaean and adjacent Proterozoic mobile belts of western and south-western Greenland were covered by exploration licences in rapid succession. By 1997, all of western Greenland between Disko Bugt and Qaqortoq in South Greenland was claimed, covering a total of approximately 60 000 km<sup>2</sup>.

The first field seasons were dedicated to regional till and stream sediment sampling programmes with a view to detecting kimberlite indicator minerals. More than 10 000 sites were sampled and approximately 30 000 suspected indicator minerals were analysed. Next followed airborne geophysical magnetic and electromagnetic surveys and drilling for possible diatremes on frozen lakes. The first diamonds from in situ kimberlite were reported from the area east of Maniitsoq in 1997 by Platinova A/S. A 792 kg sample of a large dyke yielded 25 microdiamonds (<0.5 mm) and 16 macrodiamonds.

Many new kimberlitic occurrences, a high density of favourable indicator minerals in till samples and microdiamonds from several dykes and sills gradually shifted the focus back to the Sarfartoq region, and since 1999 most of the exploration activities have been concentrated here. The highest number of microdiamonds recovered was from a field of large boulders of subcropping sill that returned 474 microdiamonds and 5 macrodiamonds. Another striking discovery was of a very large dyke that is traceable by geophysical means over a length of 5 km. Two diamond drill holes placed 2.6 km apart confirmed a width of up to 20 m (Ferguson 2001, 2002b).



**Figure 1.** Map of western and southern Greenland showing occurrences of kimberlitic rocks (green square symbols) and diamonds (white diamond symbols).



GEUS has conducted field and laboratory investigations from 2000 to 2004. In 2002, GEUS and BMP conducted an airborne hyperspectral survey over parts of the Sarfartoq region, and the ability to detect kimberlitic rocks and kimberlitic weathering material was demonstrated (Tukiainen & Krebs 2004; Tukiainen *et al.* 2003). In 2003, GEUS sampled three large kimberlitic dyke occurrences that were subsequently tested for diamond content (Jensen *et al.* 2004).

From 1998 to 2002 there was a steady decline in exploration activity; at the end of 2002 only around 6500 km<sup>2</sup> were covered by exploration licences. In 2003 and 2004, however, new activity reached areas SW of Kangerlussuaq and E–SE of Maniitsoq, and at the end of 2004 all of the most obviously prospective areas SW of Kangerlussuaq, as suggested by kimberlite indicator minerals from till and stream sediment, are again covered.

## Highlights of a decade of diamond exploration

- 1995     Investigations in South-West Greenland, partly in areas of previously reported kimberlites and diamond finds
- 1996     Regional till and stream sediment programmes for the whole of the Archaean block of southern West Greenland initiated  
Microdiamonds from boulders, E of Maniitsoq  
Helicopter-borne geophysics in the same area
- 1997     Helicopter-borne and ground geophysics in the Maniitsoq–Kangerlussuaq region  
Diamond drilling for possible kimberlite diatremes under frozen lakes  
Greenland's first diamonds from an in situ kimberlite dyke, reported from an area SE of Maniitsoq (16 macros and 25 micros from a 792 kg sample)
- 1998     Helicopter-borne geophysics in the Maniitsoq–Kangerlussuaq region  
Diamond drilling for possible kimberlite diatremes under frozen lakes in the same region, including an 18-hole programme of which 14 holes intersected kimberlite  
Reports of numerous new kimberlitic occurrences, several with 'unique' diamond indicator mineral chemistries  
Microdiamonds from several boulder and dyke occurrences SW of Kangerlussuaq  
474 microdiamonds and 5 macrodiamonds from mini-bulk samples of subcropping kimberlitic sill
- 1999     Ground geophysics in areas of the latest diamond finds  
Helicopter-borne geophysics in the Maniitsoq–Kangerlussuaq region
- 2000     Extensive indicator mineral analysis programme for samples from areas SW of Kangerlussuaq  
Field activities limited to follow-up on positive indicator mineral results
- 2001     Diamond drilling for kimberlites and base metal mineralisation in areas SW of Kangerlussuaq  
Citation Resources Ltd. reported a very large kimberlitic dyke (20 m wide and 5 km long)
- 2002     Field activities limited to brief reconnaissance by one company  
Government research and mapping in the Kangerlussuaq area  
Airborne hyperspectral survey in the Sisimiut-Kangerlussuaq region

- 2003     Field exploration and reconnaissance by a couple of companies  
           Government testing for diamond content of kimberlitic occurrences in the Sarfartoq-Maniitsoq area (128 diamonds, of which 116 micros and 9 macros came from a 1000 kg sample of a kimberlite dyke in the Maniitsoq region)  
           Hudson Resources Inc. reported 20 new microdiamonds from kimberlitic rocks collected in the Sarfartoq region
- 2004     Government research in the Kangerlussuaq and Maniitsoq regions  
           Hudson Resources Inc. reported new diamond testing results (111 micros and 9 macros) from the Sarfartoq region

# Data on DVD

## Data sources

Geological (or assessment) reports submitted to the Bureau of Minerals and Petroleum (BMP), or its predecessor, Mineral Resources Administration for Greenland, constitute the main source of mineral chemistry data in the present compilation. Data from kimberlitic occurrences are mainly from the Survey's first compilation (Larsen 1991a) and from Survey field campaigns from 2000 to 2004 (Jensen *et al.* 2002; Jensen *et al.* 2003a; Jensen & Secher 2004; Jensen *et al.* 2004; Jensen *et al.* 2003b, c).

A geological report must be submitted to BMP by 1 April for work conducted within any exploration or prospecting licence during the previous year. The confidentiality of assessment reports is handled in accordance with BMP's 'Standard Terms for Exploration Licences for Minerals (Excluding Hydrocarbons) in Greenland', available from [www.bmp.gl](http://www.bmp.gl): 'Reporting submitted in accordance with sections 1001–1002 shall be treated as confidential by BMP for a period of 5 years from the date when the reporting was submitted to BMP. However, the period of confidentiality will terminate at the expiry of the exploration licence (or a new licence granted according to sections 302–303) as regards those areas not covered by an exploitation licence'.

This means that data pertaining to areas that become open after an amendment to the delineation of a licence are free in so far as they can be isolated from the data that are still covered by the exploration licence. The present compilation only contains data from reports that are open in their entirety.

## Data files

There are three ways to browse and manipulate the compiled data: as ArcView GIS 3.3 views, as ArcMap or ArcReader dataframes, and as Excel spreadsheets. The content of the data tables is the same for all platforms. ArcReader is freeware and available for download from [www.esri.com](http://www.esri.com).

## Adobe PDF

A total of 164 company reports of relevance to diamond exploration have been scanned and stored in Adobe PDF format. Several reports are cross-referenced with hyperlinks, when the reporting on a specific set of data occurs in more than one source. The PDF documents are found in the folder \PDF and sub-folders on the DVD.

Each company report has a unique identifier, a five-digit GEUS Report File (GRF) number, for example 21478. This GRF number is the key tying all data tables and reports together. The GRF number is used as sole identifier for the scanned company reports, which have file names such as '21568.pdf'.

Most reports are given complete with all large maps and appendices. Very large sections on financial reporting on the exploration licences have generally been excluded, however. In such cases a page has been inserted, stating what has been left out.

Digital data from geophysical surveys conducted by licensees are not included, but are in most cases available from GEUS at the cost of reproduction. In the present compilation, all available geophysical paper maps from company reports are provided as full-size scans and stored in the relevant PDF documents. Metadata on geophysical surveys are provided in two Excel spreadsheets, and in several GIS views (dataframes).

Nine selected open file GEUS reports (Appel 1994; Jensen *et al.* 2003a; Jensen *et al.* 2004; Larsen 1991a; Smirnov *et al.* 1997; Stemp 1996; Stemp & Thorning 1995; Tukiainen & Krebs 2004; Tukiainen *et al.* 2003), three published papers (Rasmussen *et al.* 2003; Rasmussen & van Gool 2000; Steenfelt 2002) and one consulting report to GEUS (Griffin *et al.* 1995) are included as PDF documents.

## **Excel data**

Except for geophysical data, reporting to BMP has in most cases not been in digital form. Tabular data in the scanned printed reports have been extracted, digitised and organised in Excel spreadsheets. The data files listed below form the core of the compilation, and all GIS views have been generated from excerpts from them.

The following data files are found in the folder \Excel data on the DVD:

- Airports.xls
- Diamond\_drill\_holes.xls
- Diamond\_test\_rock.xls
- Diamond\_test\_stream\_sed.xls
- Geophysics\_air.xls (metadata)
- Geophysics\_ground.xls (metadata)
- KIM\_Chem\_Till-Ss\_CHR.xls
- KIM\_Chem\_Till-Ss\_CPX.xls
- KIM\_Chem\_Till-Ss\_GAR.xls
- KIM\_Chem\_Till-Ss\_ILM.xls
- KIM\_Chem\_Till-Ss\_OL.xls
- KIM\_Chem\_Till-Ss\_OPX.xls
- KIM\_Chem\_Till-Ss\_Other.xls
- KIM\_Pick\_Analysed\_Till-Ss.xls
- KIM\_Pick\_Visual\_Till-Ss.xls
- MIN\_Chem\_Rock\_CHR.xls
- MIN\_Chem\_Rock\_CPX.xls

MIN\_Chem\_Rock\_GAR.xls  
MIN\_Chem\_Rock\_ILM.xls  
MIN\_Chem\_Rock\_OL.xls  
MIN\_Chem\_Rock\_OPX.xls  
MIN\_Chem\_Rock\_Other.xls  
MIN\_Pick\_Analysed\_Rock.xls  
Occurrences.xls  
Photographs.xls  
Settlements.xls

The following accessory files (containing no data) are found in the folder \Excel data:

KIM\_Diagram\_Link\_Till-Ss.xls  
MIN\_Diagram\_Link\_Rock.xls  
Mineral-classes\_Abbreviations.xls  
Tables\_Explanation.xls

The names of all the Excel files should be self-explanatory, but the content of some of the data files requires additional explanation:

**KIM\_Pick\_Visual\_Till-Ss.xls:**

Statistics for visual picking of kimberlite indicator minerals are not available for any of the large number of till samples for which positions and mineral analyses are reported in GEUS Report Files 21700 (Dia Met Minerals Ltd. 1999a), 21701 (Dia Met Minerals Ltd. 1999b), 21724 (Ulansky 2000a), 21748 (Dia Met Minerals Ltd. 2000c) and 21761 (Dia Met Minerals Ltd. 2001). For all these samples the number of mineral grains picked has been set equal to the number of grains analysed, and as such is a minimum figure.

**KIM\_Chem\_Till-Ss\_CHR.xls, KIM\_Chem\_Till-Ss\_CPX.xls,  
KIM\_Chem\_Till-Ss\_GAR.xls, KIM\_Chem\_Till-Ss\_ILM.xls,  
KIM\_Chem\_Till-Ss\_OL.xls, KIM\_Chem\_Till-Ss\_OPX.xls,  
KIM\_Chem\_Till-Ss\_Other.xls, KIM\_Pick\_Analysed\_Till-Ss.xls:**

No mineral names for analysed grains were given for any of the large number of till samples for which positions and mineral analyses are reported in GEUS Report Files 21700 (Dia Met Minerals Ltd. 1999a), 21701 (Dia Met Minerals Ltd. 1999b), 21724 (Ulansky 2000a), 21748 (Dia Met Minerals Ltd. 2000c) and 21761 (Dia Met Minerals Ltd. 2001). In the present compilation, GEUS has assigned mineral names based on the chemistry data.

All other assessment reports have included both the number of visually identified grains, the number of analysed grains and mineral names for all grains picked and analysed. In the present compilation, GEUS has evaluated all mineral names reported and, based on the chemistry data, changed them as deemed appropriate. Column AA ('Min\_probed') in each of the seven mineral tables contains the corrected mineral names.

In all the till and stream sediment sampling campaigns reported, the kimberlite indicator minerals garnet (pyrope and eclogitic varieties), chromite, ilmenite and clinopyroxene

(chrome-diopside variety) have been picked and analysed. The minerals olivine and orthopyroxene are only listed as picked and analysed in some of the assessment reports, and their apparent skewed geographical distribution is therefore a false representation.

It should be noted that the mineral picking and chemistry data originate from a number of different exploration campaigns where sampling techniques, sample media, sample sizes, heavy mineral separation techniques, grains sizes considered, mineral picking (as discussed above) and to some degree microprobing have varied over time and with preferences of the samplers and laboratories involved. For example, in the mid-1990s a relatively high proportion of all samples collected for kimberlite indicator minerals were the sand and silt fractions from stream sediment, but almost all samples collected in later campaigns were from till deposits.

#### **Occurrences.xls:**

The table of occurrences combines information from very heterogeneous sources. Only kimberlitic, lamproitic, lamprophyre and beforite (Mg carbonatite) occurrences are included. GEUS has only been able to visit and confirm a limited number of the total population of kimberlitic and related rock occurrences reported, and the original descriptions are therefore given as is. The most important distinctions are in columns AA ('Occur\_cat'), AB ('Occur\_type'), and AC ('Rock'). The possible values of Occur\_cat are 'In situ', 'Subcrop' and 'Float'. Occur\_type has the possible values 'Blow?', 'Boulder', 'Diatreme', 'Dyke', 'Plug' and 'Sill'. Some localities are reported with a secondary position, and this implies a dyke or sill with an observed or inferred extent from the primary position to the secondary.

#### **Data file attributes**

Explanations to the abbreviations and names of data fields in the Excel spreadsheets and the ArcView shapefiles can be found in the PDF document \PDF\Etc\Abbreviations.pdf or the two spreadsheets \Excel data\Tables\_Explanation.xls and \Excel data\Mineral-classes\_Abbreviations.xls, and only the abbreviations for picked and analysed kimberlite indicator minerals are repeated here: GAR = garnet (unspecified), PYR = pyrope, ECL = eclogitic garnet, CHR = chromite, ILM = ilmenite, CPX = clinopyroxene, OPX = orthopyroxene, OL = olivine, ZR = zircon.

#### **Reliability of sample positions**

Almost all till and stream sediment sample positions reported have GPS-determined coordinates. They can generally be considered to be reliable, especially those recorded later than 2 May 2000, when the United States Government removed 'selective availability' precision degradation from the GPS signal. Observations of kimberlitic rocks from around 1990 onwards can also generally be considered to have reliable positions. Prior to this, sample positions were read from topographic maps of varying accuracy and detail, and they may deviate significantly from present-day GPS positions. Only those observations from the Survey's first compilation of kimberlitic rocks (Larsen 1991a) that have been re-visited by GEUS in recent years have been given new GPS coordinates.

## Mineral classification

All mineral analyses have been examined and used to assign indicator mineral class names, using long established as well as the most recent classification schemes:

### Garnet

Garnets have been classified according to the following schemes: Dawson & Stephens (1975; 1976), Gurney (1984), Gurney *et al.* (1993), Gurney & Zweistra (1995) and Grütter *et al.* (2004).

### Chromite

Chromites have been classified according to Grütter & Apter (1998), Fipke (1994) and Fipke *et al.* (1995).

### Ilmenite

Ilmenites have been classified according to Wyatt *et al.* (2004).

### Clinopyroxene

Clinopyroxenes have been classified according to Stephens & Dawson (1977), Ramsay & Tompkins (1994) and Morris *et al.* (2002). Those clinopyroxenes that qualify as 'clinopyroxenes from garnet peridotite' have further been classified as being from the diamond or graphite stability field, based on P–T estimates according to Nimis & Taylor (2000), and positions above or below the diamond–graphite stability curve of Kennedy & Kennedy (1976).

### Orthopyroxene

Orthopyroxenes have been classified according to Stephens & Dawson (1977) and Ramsay & Tompkins (1994).

### Olivine

No classification of the olivines analysed is provided, but magnesium numbers (Mg #) are listed in the relevant Excel data tables and ArcView shapefiles. In the mineral classification diagram documents, a diagram with nickel content of olivine against the magnesium number is shown as the last diagram for that sample, if available.

$$\text{Mg \#} = \frac{100 \cdot (\text{MgO}/40.30)}{(\text{MgO}/40.30) + (\text{FeO}/71.85)}, \text{ oxides in wt \%}.$$

## ArcView 3.3 project

In the previous version of 'Diamond exploration data from West Greenland' it was necessary to define a system variable, 'GMXCARAT', on the computer. For the present version of the DVD, defining a system variable is *no longer necessary*, and the ArcView project, **ArcView.apr**, can be opened straight away. The ArcView project has been tested on computers running under Windows 2000 Professional and Windows XP Professional. On Windows XP systems, the 'ArcView 3.x Windows XP Patch', which can be downloaded from [www.esri.com](http://www.esri.com), must be installed in order for the hyperlinking features to function.

## Views

The GIS presentation of the data compilation is arranged into 31 views, listed below. Sample screenshots and comments to these Views are shown in a later section of this report.

01. Welcome
02. Geographical overview and topographic data
03. Geological map 1:2,500,000
04. Field photographs
05. Occurrences of kimberlitic and related rocks
06. Tests for diamonds, and drilling for kimberlites
07. Mineral picking (rock): Microprobe identification
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09. Mineral chemistry (rock): Chromite
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11. Mineral chemistry (rock): Clinopyroxene
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13. Mineral chemistry (rock): Olivine
14. Mineral chemistry (rock): Other minerals
15. Mineral chemistry (rock): Most diamond-positive indicators combined
16. KIM picking (till/stream sed.): Visual identification
17. KIM picking (till/stream sed.): Microprobe identification
18. KIM chemistry (till/stream sed.): Garnet
19. KIM chemistry (till/stream sed.): Chromite
20. KIM chemistry (till/stream sed.): Ilmenite
21. KIM chemistry (till/stream sed.): Clinopyroxene
22. KIM chemistry (till/stream sed.): Orthopyroxene
23. KIM chemistry (till/stream sed.): Olivine
24. KIM chemistry (till/stream sed.): Other minerals
25. KIM chemistry (till/stream sed.): Most diamond-positive indicators combined
26. Aeromag surveys: GEUS/BMP
27. Aeromag surveys: Exploration companies
28. Combined AEM and aeromag surveys: GEUS/BMP and exploration companies
29. Ground geophysical surveys
30. Airborne hyperspectral survey coverage
31. Exploration licences, 1997–2004



## Toolbar buttons

The easiest way to navigate the 31 views in the ArcView project is to make use of the three blue view toolbar buttons marked '1024', '1280' and '1600'. When clicked, these buttons open a scroll-down list of the 31 views. To open a view, for example '05. Occurrences of kimberlitic and related rocks', double-click on the corresponding line, or choose the line and click OK. The chosen view is then activated and the project and view frames are adjusted to make the best use of the display area of the screen used. The default setting for the ArcView project on the DVD is for a screen resolution of 1280 x 1024 pixels.



For a screen with 1024 x 768 resolution, use the '1024' button for view navigation



For a screen with 1280 x 1024 resolution, use the '1280' button for view navigation



For a screen with 1600 x 1200 resolution, use the '1600' button for view navigation



The button marked 'ABB' opens a list of abbreviations for minerals and mineral classes used for kimberlite indicator minerals in diagrams and tables



The view button marked 'LEG' opens a legend to the 1:2 500 000 geological map



The button marked 'REP' opens the present report in PDF

## Hotlinks



Several point and polygon themes have an ArcView hotlink: selecting a feature in an active theme with the 'lightning' tool button opens an Acrobat Reader window displaying reports, diagrams or photographs. If the 'lightning' tool is dimmed, the active theme has no hotlink option.

Once Adobe Reader has been activated by a hotlink, it is recommended to keep the application open for faster display of subsequent hotlinked documents. Some of the PDF files are very large (several hundred megabytes), and opening them may take a few moments. Clicking several times on the same hotlinked feature will not speed up the displaying of the desired PDF document.

NOTE: It is strongly advised to apply the hotlink tool only after zooming in on the area of interest, so that the hotlinked features can be distinguished from each other on the screen. Otherwise, if an area with a high density of hyperlinked features is clicked, the GIS program may try to open dozens of PDF documents at the same time, and this may cause the GIS program or Adobe Reader to crash.

## **Projection and co-ordinate system**

The projection recommended and used in the ArcView project is UTM zone 22. The ArcView shapefiles are unprojected and in decimal degrees. Georeferenced TIF images showing total magnetic intensity maps of survey blocks are defined in UTM zone 22 projection, however. Point positions are in WGS84 datum and in decimal degrees and UTM co-ordinates. A field in the data tables ('Orig\_sys') states which co-ordinate system was originally reported. Co-ordinate transformations have been made using KMSTrans v. 25 Aug 2004 (freeware from [www.kms.dk](http://www.kms.dk)). This software implements the official transformations for Greenland from the National Survey and Cadastre (Kort & Matrikelstyrelsen, KMS).

## **Topographic and geological maps**

The area of interest is within longitudes 40°–55° W and latitudes 59°–70° N. The following map themes are provided:

1. Topographic map at scale 1:2 500 000 (G/2.5M Vector), clipped to the area of interest. Copyright Kort & Matrikelstyrelsen / GEUS, 1997
2. Geological map at scale 1:2 500 000, clipped to the area of interest. The geological map is a GIS version of Henriksen *et al.* (2000). Copyright GEUS
3. Topographic map at scale 1:250 000 (G/250 Vector), clipped to the area of interest. Copyright Kort & Matrikelstyrelsen, 1997, 1998
4. Topographic map at scale 1:100 000 (West Greenland, in two parts: 65°–66° and 66°–70°15' N). Copyright GEUS, 2003, 2004

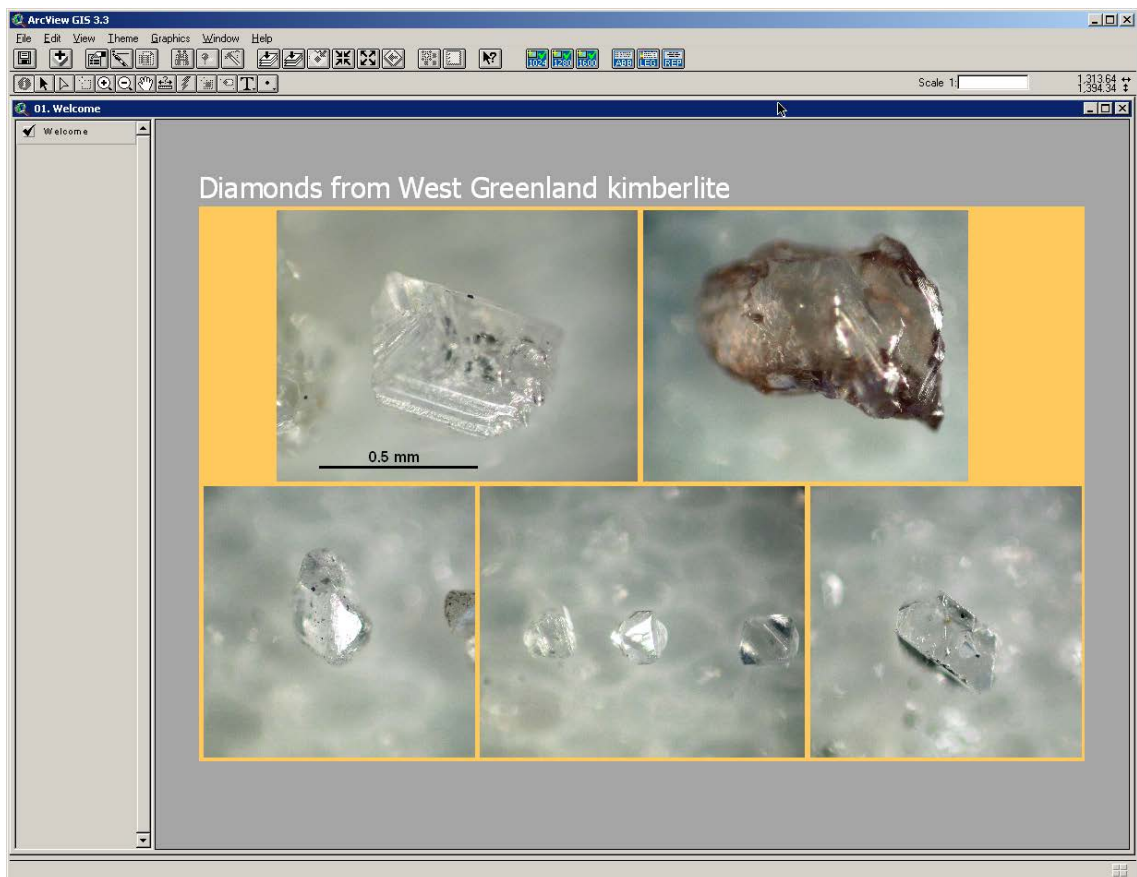
It should be noted that features in the 1:2 500 000 and 1:250 000 maps may have deviations from present-day GPS positions of up to 2 km and 200 m, respectively.

# Screenshots and comments to ArcView 3.3 Views and PDF documents

The sample screenshots in the following illustrate that the chosen combination of active, enabled and disabled themes in each data view is only one of an almost infinite number of possible representations. The user is encouraged to explore the data by trying other combinations. Themes can easily be copied from one view and pasted into another using ArcView's standard editing tools.

In the ArcMap and ArcReader versions of the GIS compilation, the themes are displayed in dataframes that are almost identical to the views in the ArcView version, and only ArcView samples are shown here.

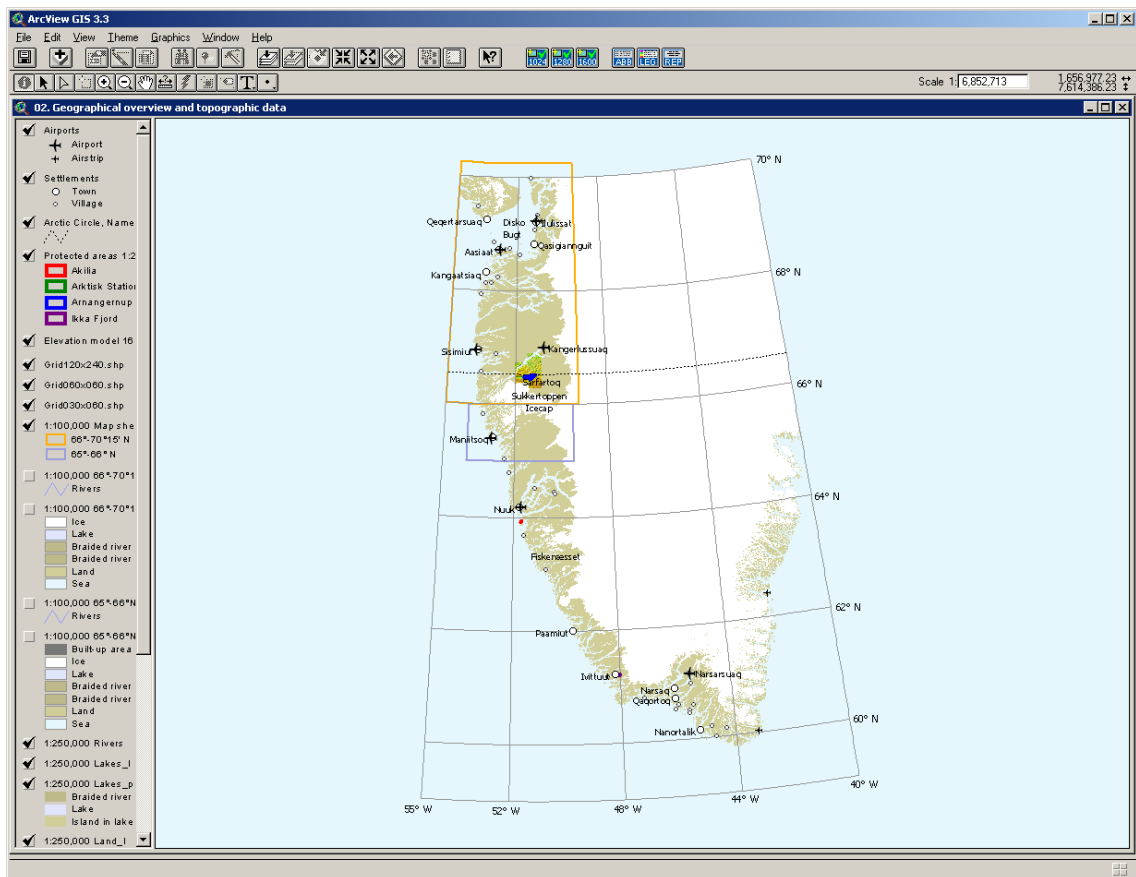
## 01. Welcome



**Figure 2.** Welcome screen with photographs of some of the diamonds recovered from three kimberlitic dykes samples by GEUS in 2003 (Jensen et al. 2004).

**Hotlinked themes:** none

## 02. Geographical overview and topographic data



**Figure 3.** *Geographical overview of the regions of interest in West and South Greenland, and presentation of all the topographic data provided on the DVD. Also shown is a theme with four protected areas, where certain restrictions to exploration activities apply.*

**Hotlinked themes:** none

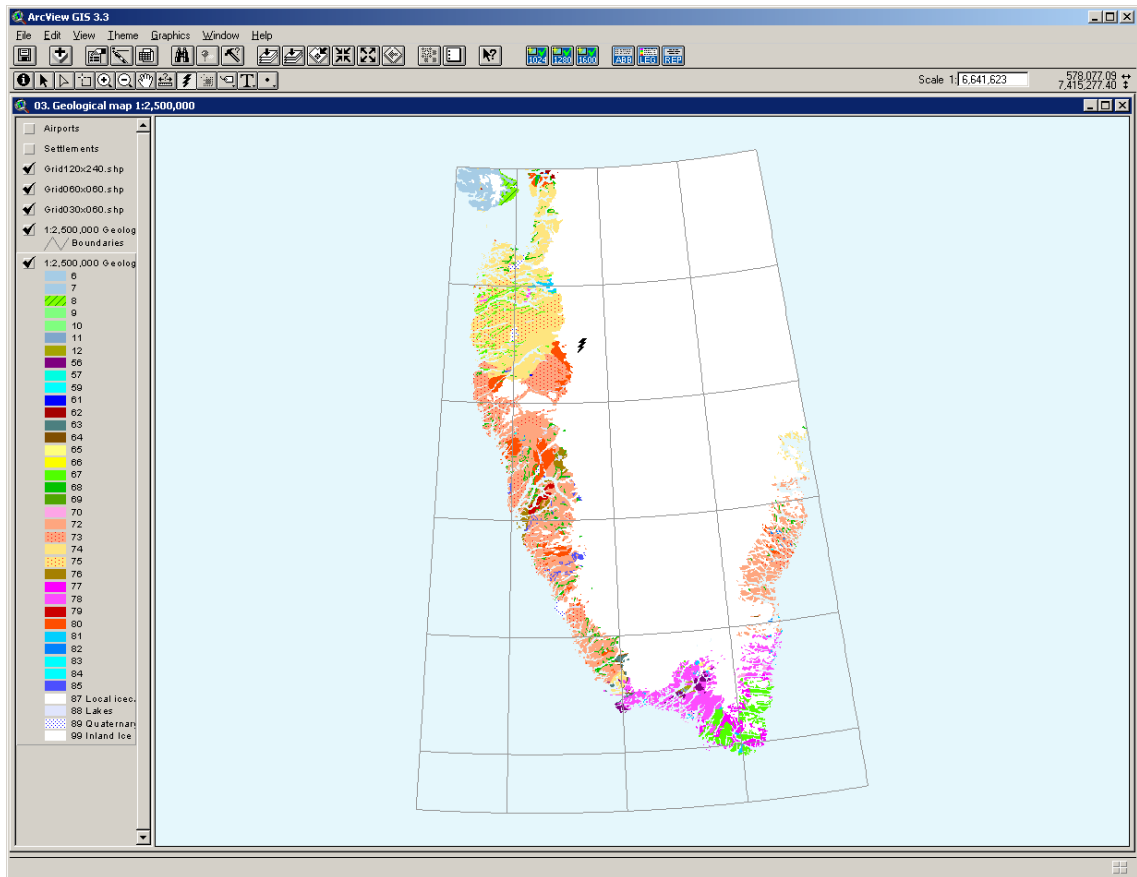
Shapefiles for the topographic data listed below are used in all views from '04. Photographs' onwards, as in Figure 3. The legends for these themes are hidden in the subsequent views, however.

- Latitude and longitude grids with increasing number of grid lines with increasing zoom factor
- Topographic map, scale 1:100 000 (two sheets: 65°–66° N and 66°–70°15' N)
- Topographic map, scale 1:250 000
- Topographic map, scale 1:2 500 000

The theme '1:100,000 Map sheets' shows the extent of the two 1:100 000 maps in orange and blue outline.

The theme 'Settlements' displays the shapefile 'settlements\_view', which is a subset of the shapefile 'settlements' (includes abandoned settlements, sheep farms, some mines, etc.). Text labels for towns, villages, airports, etc. do not scale well when the view is shown at greater scales. To make the labels look better at larger map scales, one can first 'remove labels' and then 'auto-label' the relevant themes using ArcView's standard theme tools.

### 03. Geological map 1:2,500,000

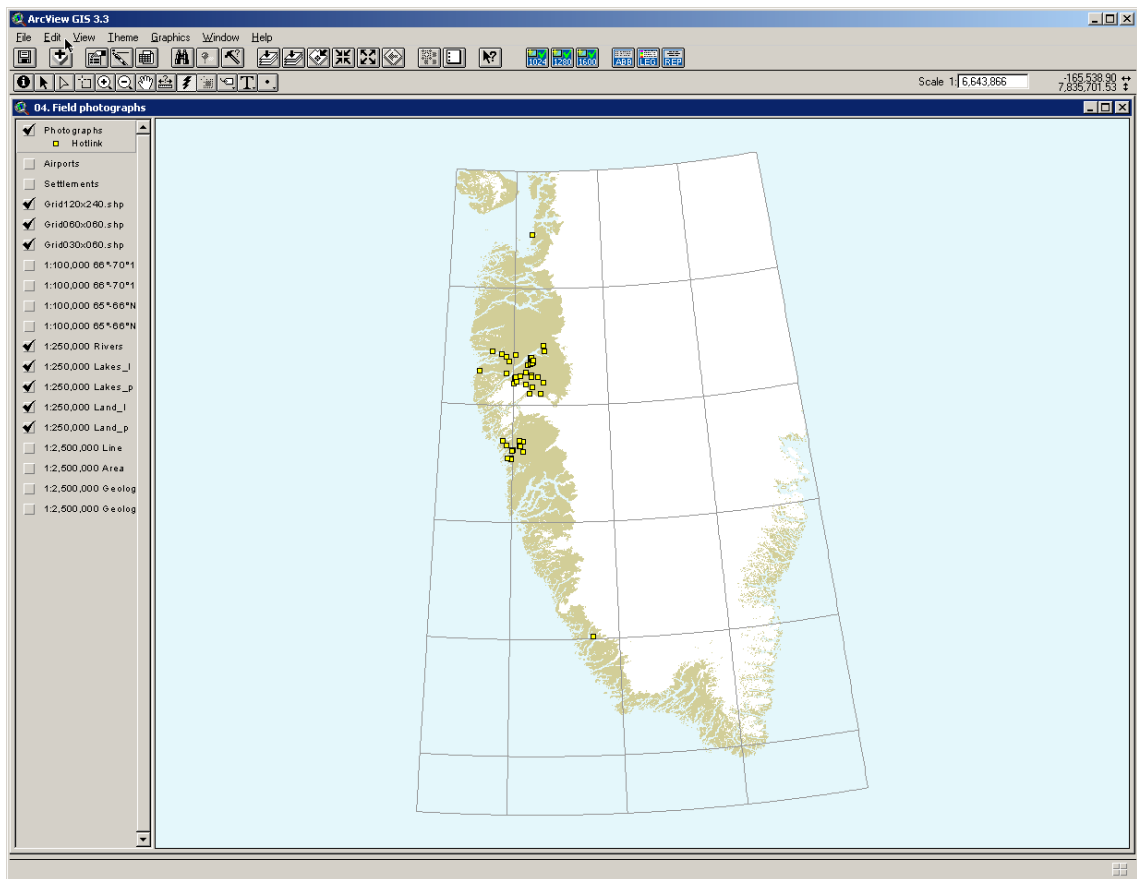


**Figure 4.** Simplified GIS version of the printed geological map of Greenland, 1:2 500 000 (Escher & Pulvertaft 1995; Henriksen *et al.* 2000).

**Hotlinked themes:** 1:2,500,000 Geology Area

A legend to the geological map (Henriksen *et al.* 2000) in PDF opens when the button marked 'LEG' is clicked, or when the hotlink tool is used on any feature of the theme '1:2,500,000 Geology Area', if active.

## 04. Field photographs

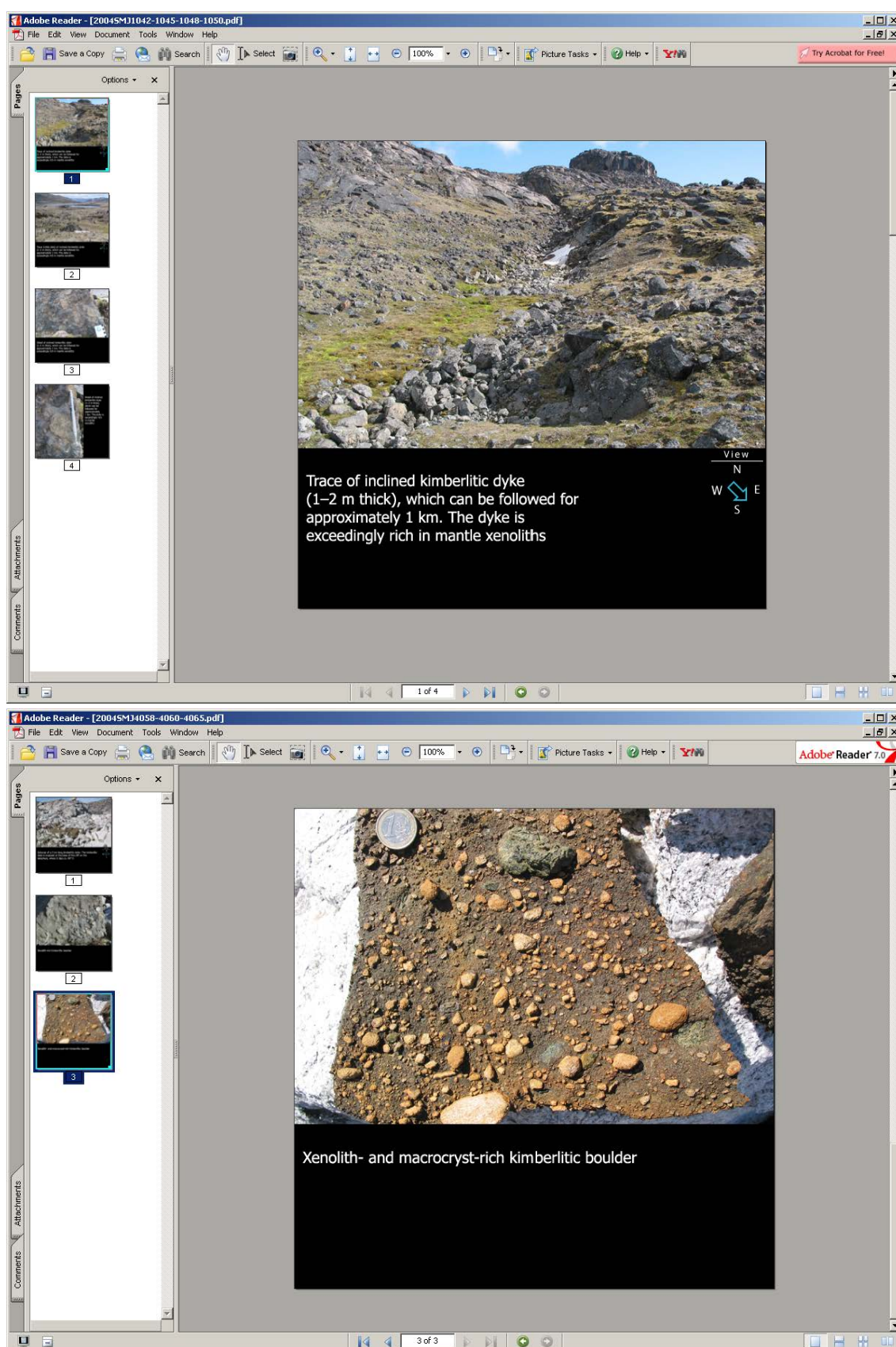


**Figure 5.** View with hotlink theme to a series of field photographs from the Sarfartoq and Maniitsoq regions, and from two outlying areas to the north and south.

**Hotlinked themes:**      Photographs  
                                 1:2,500,000 Geology Area

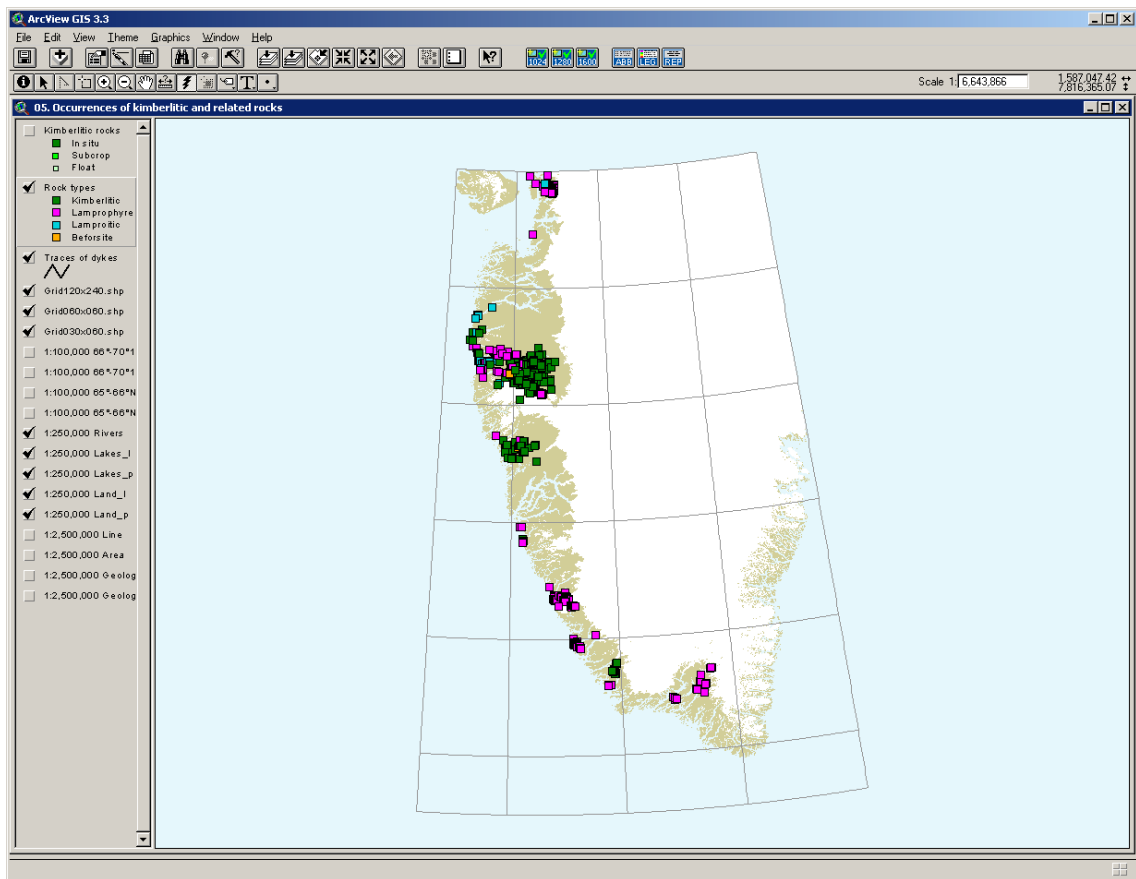
The hotlink tool will open a PDF file with one or several photographs for each of the features of the theme 'Photographs'. Two examples of PDF documents with field photographs are shown in Figure 6.





**Figure 6.** *Examples of PDF documents with field photographs.*

## 05. Occurrences of kimberlitic and related rocks



**Figure 7.** View showing observations of kimberlitic, lamproitic and related rocks, and traces of some of the larger kimberlitic dykes.

**Hotlinked themes:** Kimberlitic rocks  
Rock types  
1:2,500,000 Geology Area

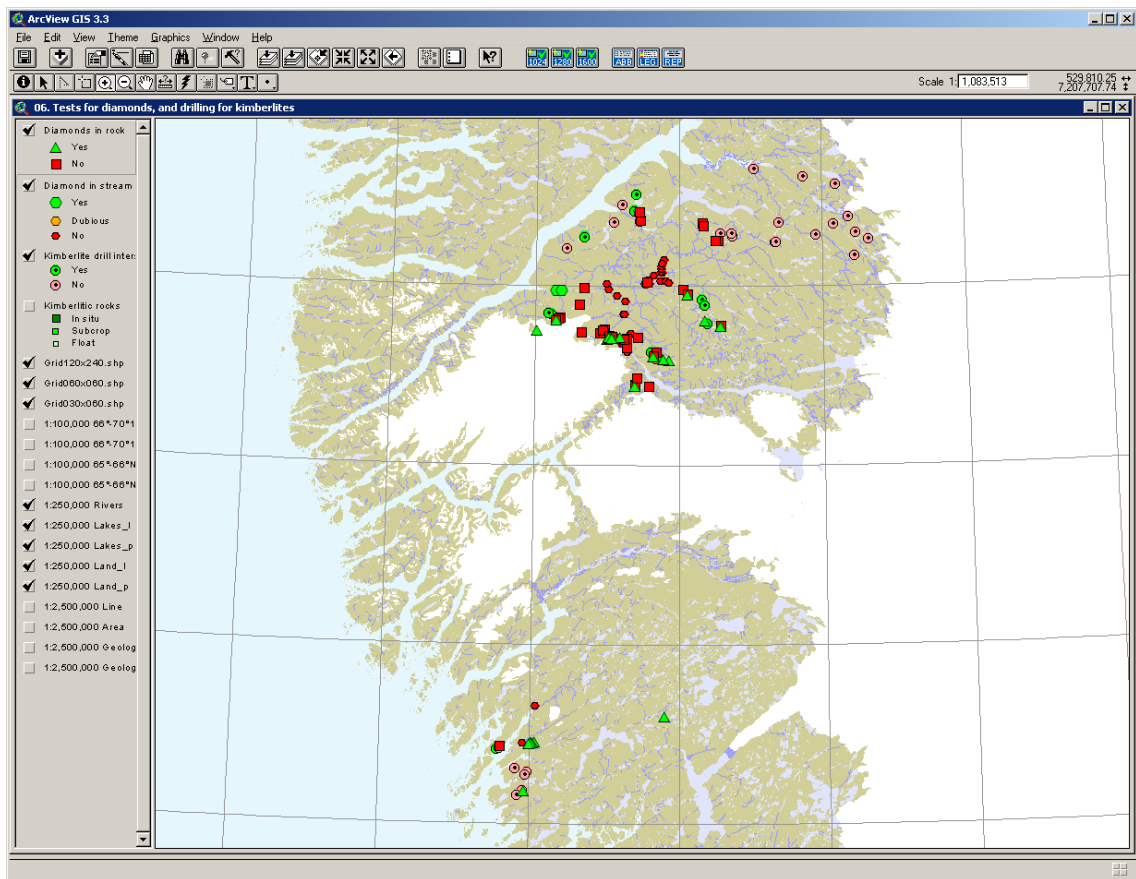
Rock types are generally used as given in the original reports, but in the case of Larsen (1991a) several have been grouped together and renamed to the generic term lamprophyre.

The theme 'Kimberlitic rocks', displaying the shapefile 'occurrences\_kimberlitic', is a subset of the shapefile 'occurrences\_all'.

The theme 'Traces of dykes' shows observed and inferred traces of dykes, usually based on many observations and GPS positions from each trend.



## 06. Tests for diamonds, and drilling for kimberlites



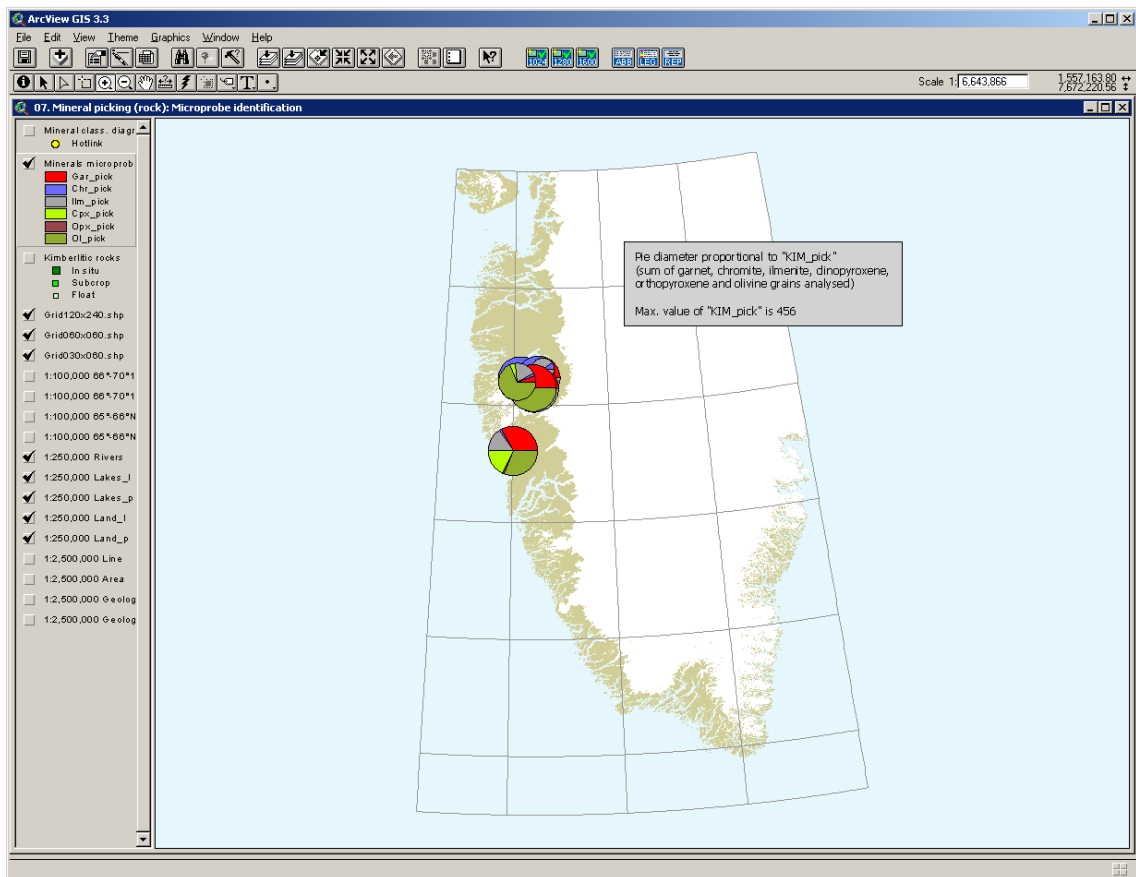
**Figure 8.** Zoomed view showing the most important localities tested for diamond content, and localities drilled for kimberlite.

**Hotlinked themes:**

- Diamonds in rock
- Diamonds in stream sed.
- Kimberlite drill intersection
- Kimberlitic rocks
- 1:2,500,000 Geology Area

Hotlinks in the theme 'Kimberlite drill intersection' open PDF documents with drill logs for the holes in question, and these logs have further links to the full reports from which the logs have been extracted.

## 07. Mineral picking (rock): Microprobe identification



**Figure 9.** View of mineral picking and microprobing statistics for 31 kimberlitic rock samples.

**Hotlinked themes:**

- Mineral class. diagrams
- Minerals microprobed
- Kimberlitic rocks
- 1:2,500,000 Geology Area

The pie diagrams have diameters proportional to the number of 'kimberlitic' mineral grains for each sample (the sum of garnets, chromites, clinopyroxenes, orthopyroxenes and olivines illustrate the relative numbers of minerals picked and analysed from kimberlitic rock samples). The pie diagrams become distinguishable from each other when viewed at larger map scale.

The theme 'Mineral class. diagrams' has hotlinks to PDF documents with up to nine mineral classification diagrams for each sample. Examples of two diagrams are shown in Figure 10.

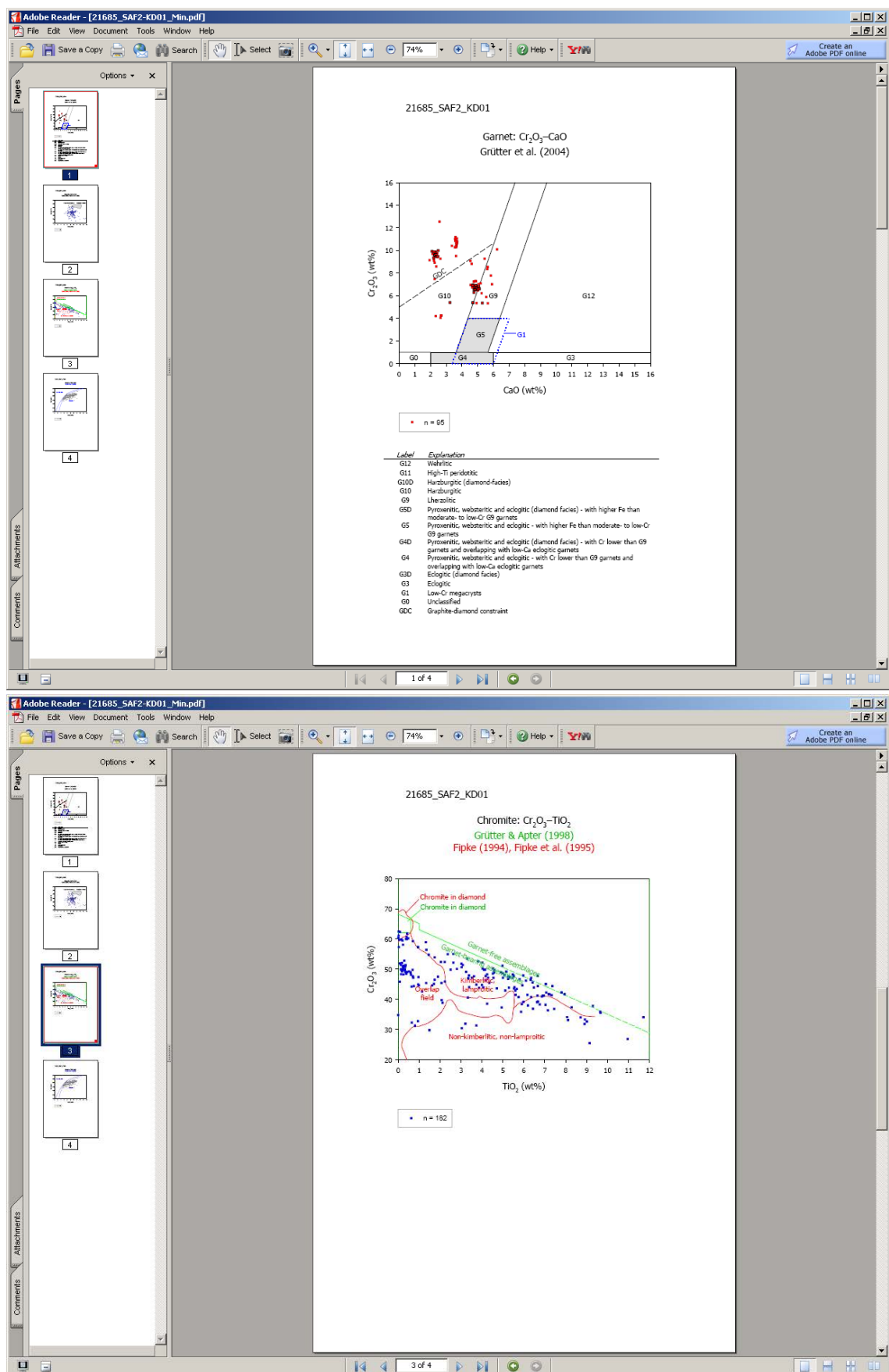
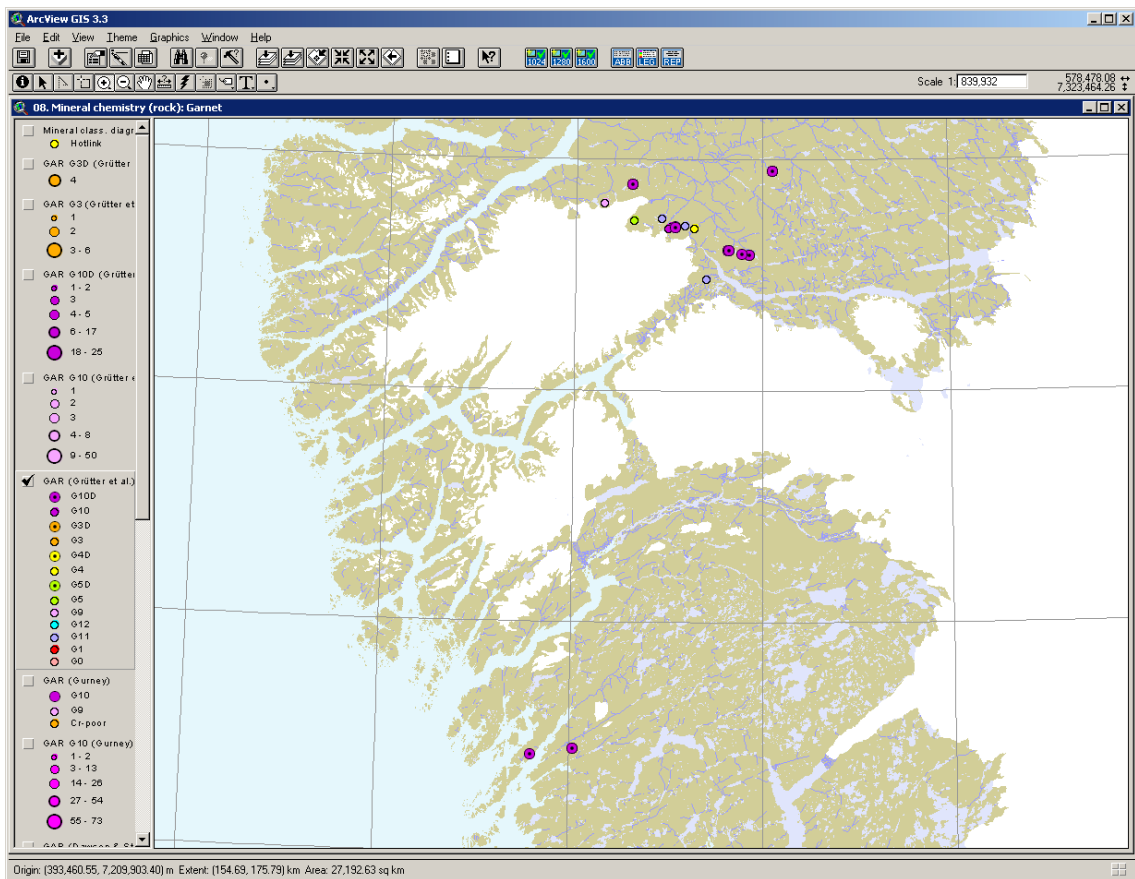


Figure 10. Example of mineral classification diagrams for one kimberlite sample.

## 08. Mineral chemistry (rock): Garnet



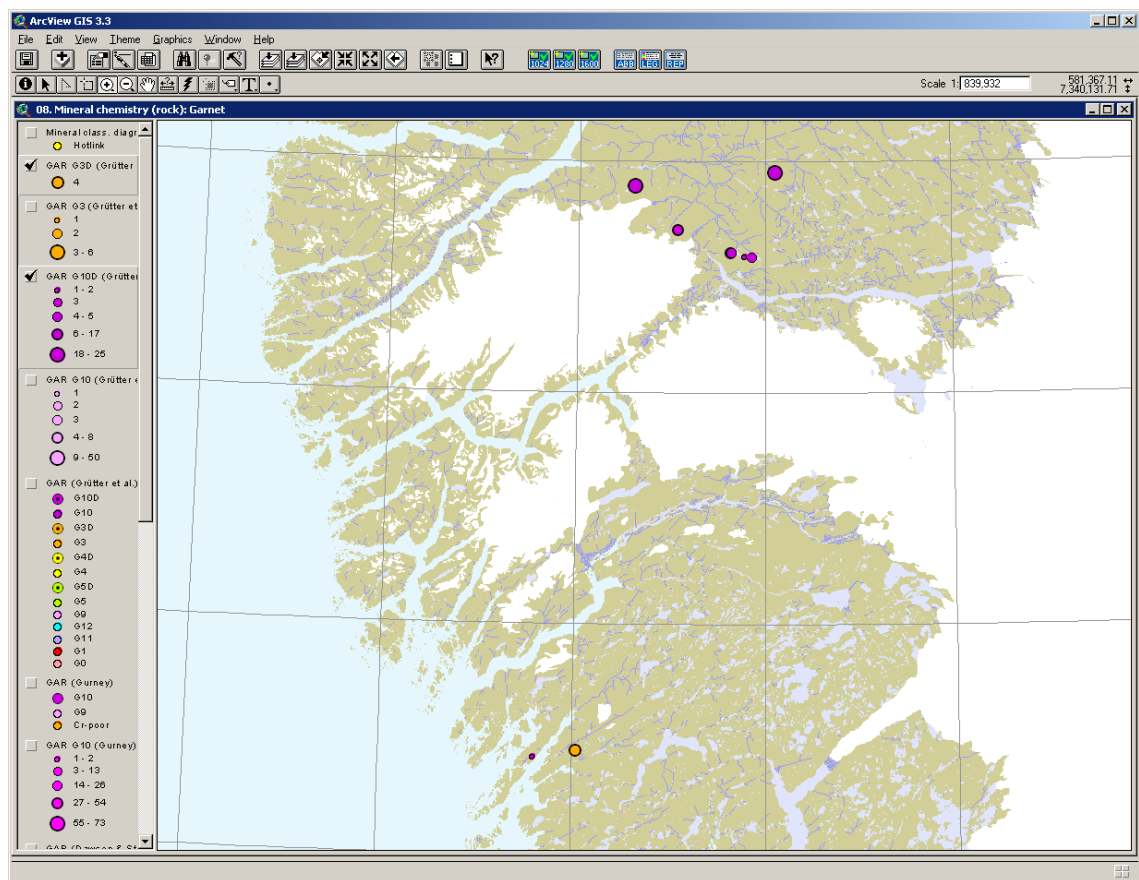
**Figure 11.** Zoomed view of the distribution of garnet types (Grütter et al. 2004) from kimberlitic rock samples.

**Hotlinked themes:**

- Mineral class. diagrams
- GAR G3D (Grütter et al.)
- GAR G3 (Grütter et al.)
- GAR G10D (Grütter et al.)
- GAR G10 (Grütter et al.)
- GAR (Grütter et al.)
- GAR (Gurney)
- GAR G10 (Gurney)
- GAR (Dawson & Stephens)
- GAR (no sorting)
- Kimberlitic rocks
- 1:2,500,000 Geology Area

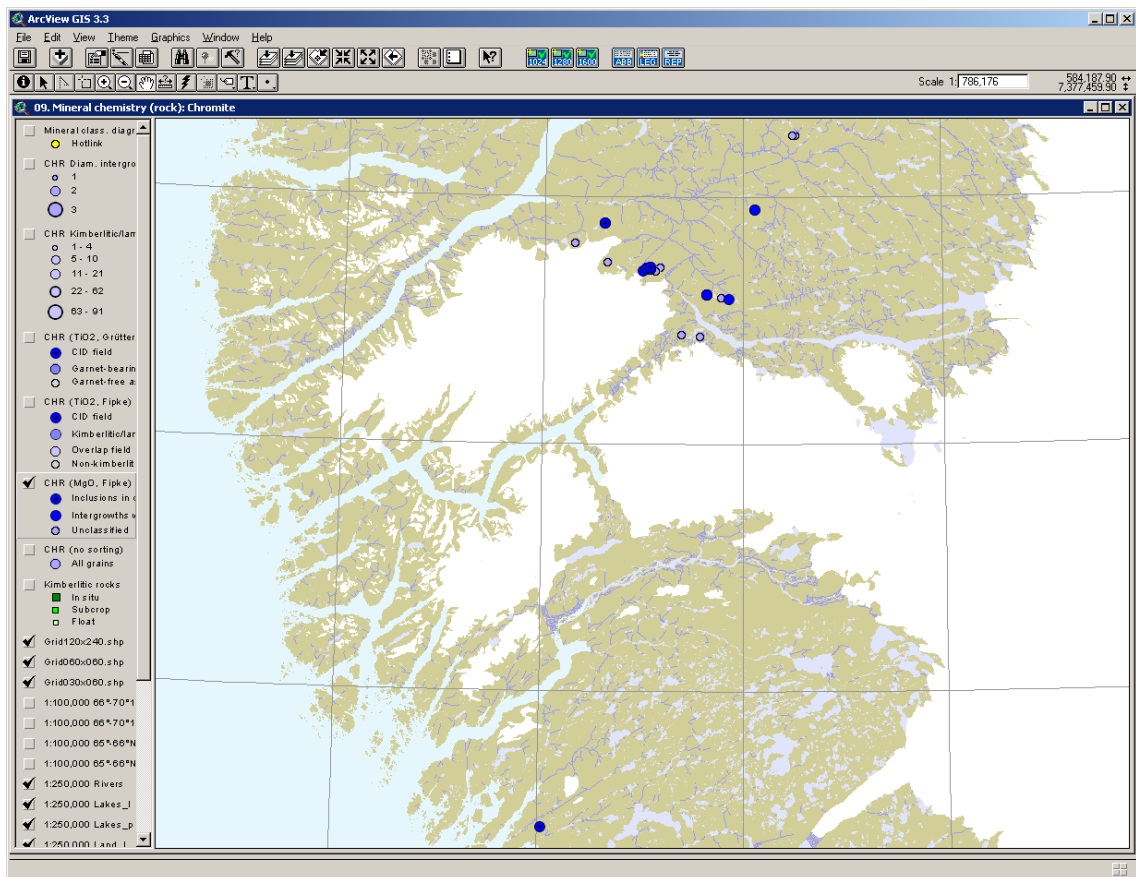
The themes with numerals and symbols of increasing size in their legend show the number of garnets of a specific class analysed in each kimberlitic rock sample.

Themes with text labels in their legend show the distribution of all garnet classes in a specific classification scheme. The records have been sorted so that grains from the classes of highest interest always plot on top.



**Figure 12.** Same view as in Figure 11, except here, only garnet classes G10D and G3D are shown, with symbol sizes proportional to the number grains for each kimberlitic rock sample.

## 09. Mineral chemistry (rock): Chromite



**Figure 13.** Zoomed view of the distribution of chromite classes determined from  $\text{Cr}_2\text{O}_3$ – $\text{MgO}$  diagram (Fipke 1994; Fipke et al. 1995). The chromites are from kimberlitic rock samples.

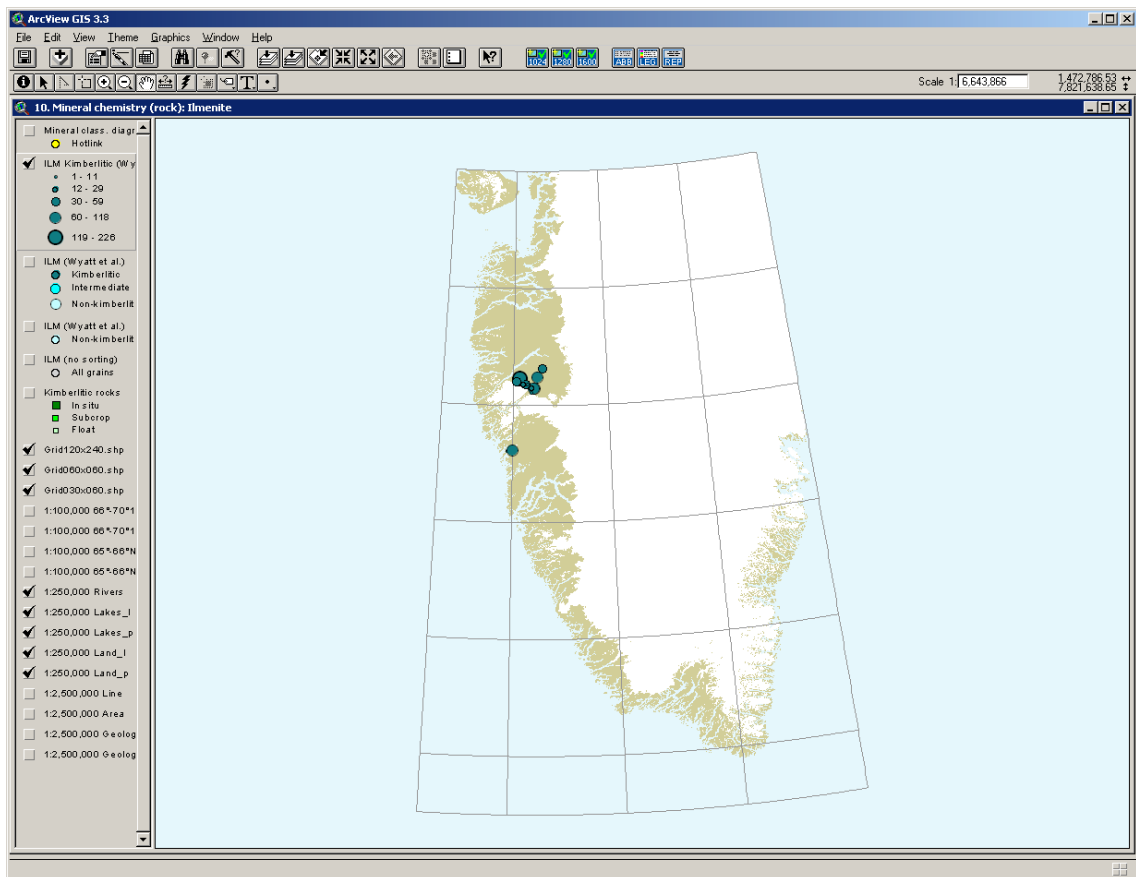
**Hotlinked themes:**

- Mineral class. diagrams
- CHR Diam. intergrowths (Fipke)
- CHR Kimberlitic/lamproitic (Fipke)
- CHR (TiO<sub>2</sub>, Grütter & Apter)
- CHR (TiO<sub>2</sub>, Fipke)
- CHR (MgO, Fipke)
- CHR (no sorting)
- Kimberlitic rocks
- 1:2,500,000 Geology Area

The themes with numerals and symbols of increasing size in their legend show the number of chromites of a specific class analysed in each kimberlitic rock sample.

Themes with text labels in their legend show the distribution of all chromite classes in a specific classification scheme. The records have been sorted so that grains from the classes of highest interest always plot on top.

## 10. Mineral chemistry (rock): Ilmenite



**Figure 14.** Distribution of the number of kimberlitic ilmenites (Wyatt et al. 2004) analysed from each kimberlitic rock sample.

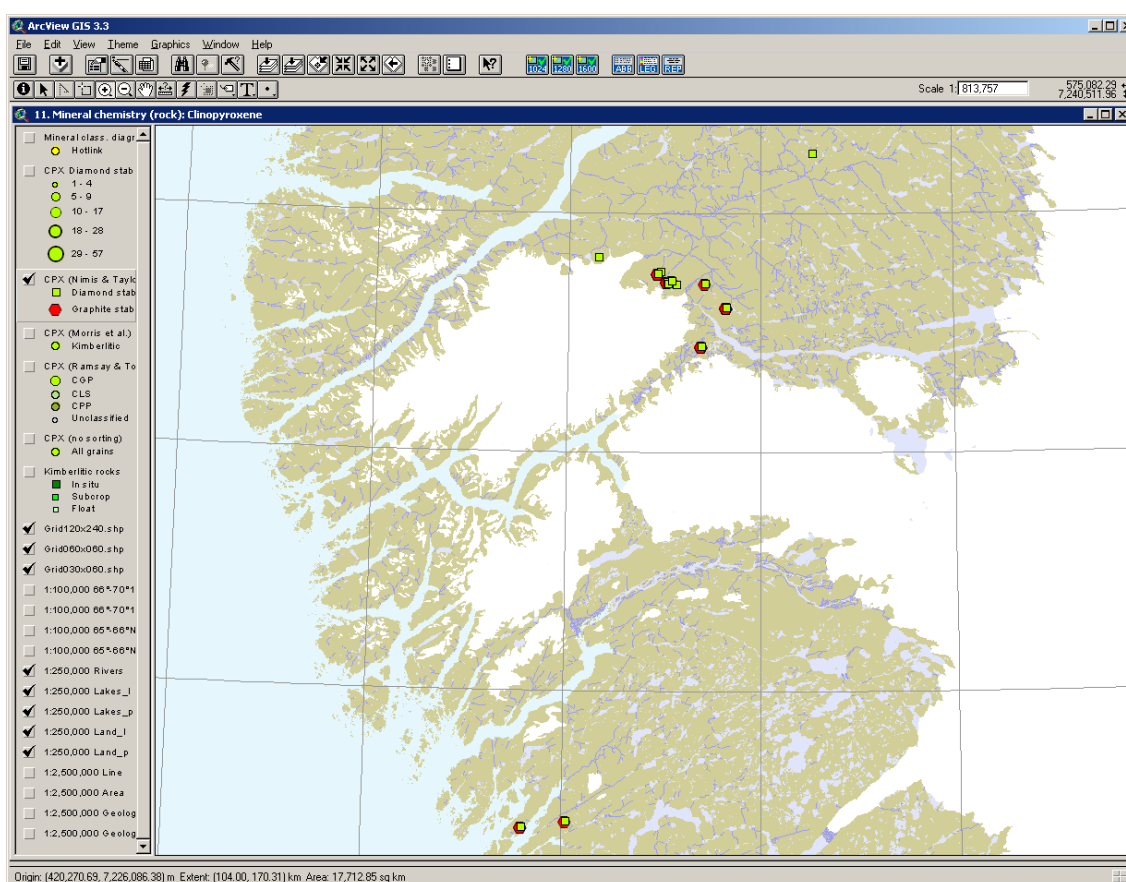
**Hotlinked themes:**

- Mineral class. diagrams
- ILM Kimberlitic (Wyatt et al.)
- ILM (Wyatt et al.)
- ILM (Wyatt et al.) [non-kimberlitic ilmenites only]
- ILM (no sorting)
- Kimberlitic rocks
- 1:2,500,000 Geology Area

Of a total of 833 analyses of ilmenite from kimberlitic rock samples, 693 are 'kimberlitic' in the classification of Wyatt *et al.* (2004), 55 are 'non-kimberlitic' and 85 are intermediate.



## 11. Mineral chemistry (rock): Clinopyroxene



**Figure 15.** Distribution of diamond-stable and graphite-stable chrome-diopsides based on  $P$ - $T$  estimation procedure of Nimis & Taylor (2000) and diamond-graphite stability curve of Kennedy & Kennedy (1976).

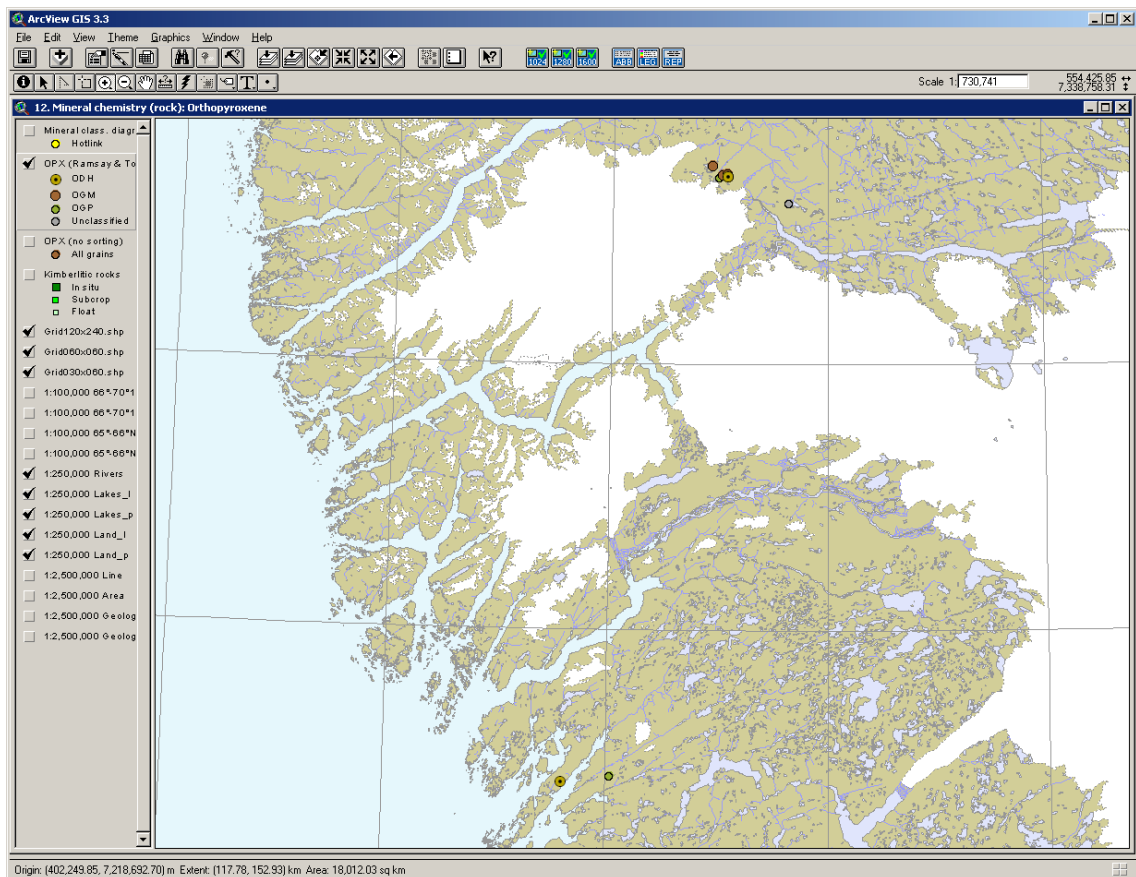
**Hotlinked themes:**

- Mineral class. diagrams
- CPX Diamond stability (Nimis & Taylor, Kennedy & Kennedy)
- CPX (Nimis & Taylor, Kennedy & Kennedy)
- CPX (Morris et al.)
- CPX (Ramsay & Tompkins)
- CPX (no sorting)
- 1:2,500,000 Geology Area

This view shows the distribution of chrome-diopside grains from stability field of diamond and graphite, respectively, using the  $P$ - $T$  estimation procedure of Nimis & Taylor (2000) and the diamond-graphite stability curve of Kennedy & Kennedy (1976). The records have been sorted so that the symbols for diamond-stable chrome-diopsides always plot on top.



## 12. Mineral chemistry (rock): Orthopyroxene



**Figure 16.** Zoomed view of the distribution of orthopyroxene classes (Ramsay & Tompkins 1994) from kimberlitic rock samples.

**Hotlinked themes:**

- Mineral class. diagrams
- OPX (Ramsay & Tompkins)
- OPX (no sorting)
- Kimberlitic rocks
- 1:2,500,000 Geology Area

The view shows the distribution of just 20 orthopyroxene grains analysed. Six of these are categorised as 'ODH' ('orthopyroxene from diamondiferous harzburgite') in the classification of Ramsay & Tompkins (1994).

For a list of abbreviations used for kimberlite indicator mineral classes and in mineral data spreadsheets, see the document \PDF\Etc\ [Abbreviations.pdf](#).

### 13. Mineral chemistry (rock): Olivine

No screenshot sample

**Hotlinked themes:** Mineral class. diagrams  
OL (Mg #)  
OL (no sorting)  
Kimberlitic rocks  
1:2,500,000 Geology Area

The view shows the distribution of magnesium number of olivines from kimberlitic rock samples. No olivine classification scheme is cited.

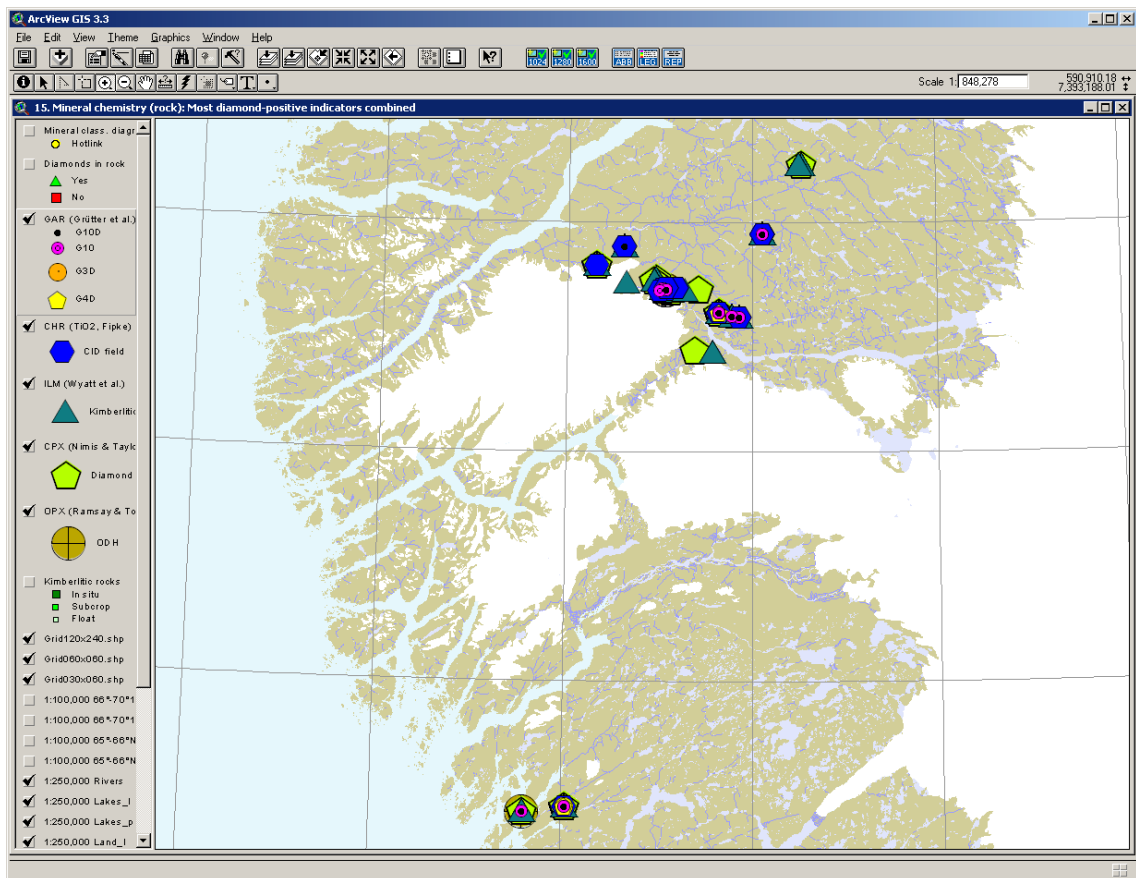
### 14. Mineral chemistry (rock): Other minerals

No screenshot sample

**Hotlinked themes:** Other minerals [sorted by mineral]  
Other minerals (no sorting)  
Kimberlitic rocks  
1:2,500,000 Geology Area

Other minerals include grains with chemistries that do not fit in the first six groups of minerals shown, and include 'Ti magnetite', 'Ti-Cr spinel' and 'Ti spinel'.

## 15. Mineral chemistry (rock): Most diamond-positive indicators combined



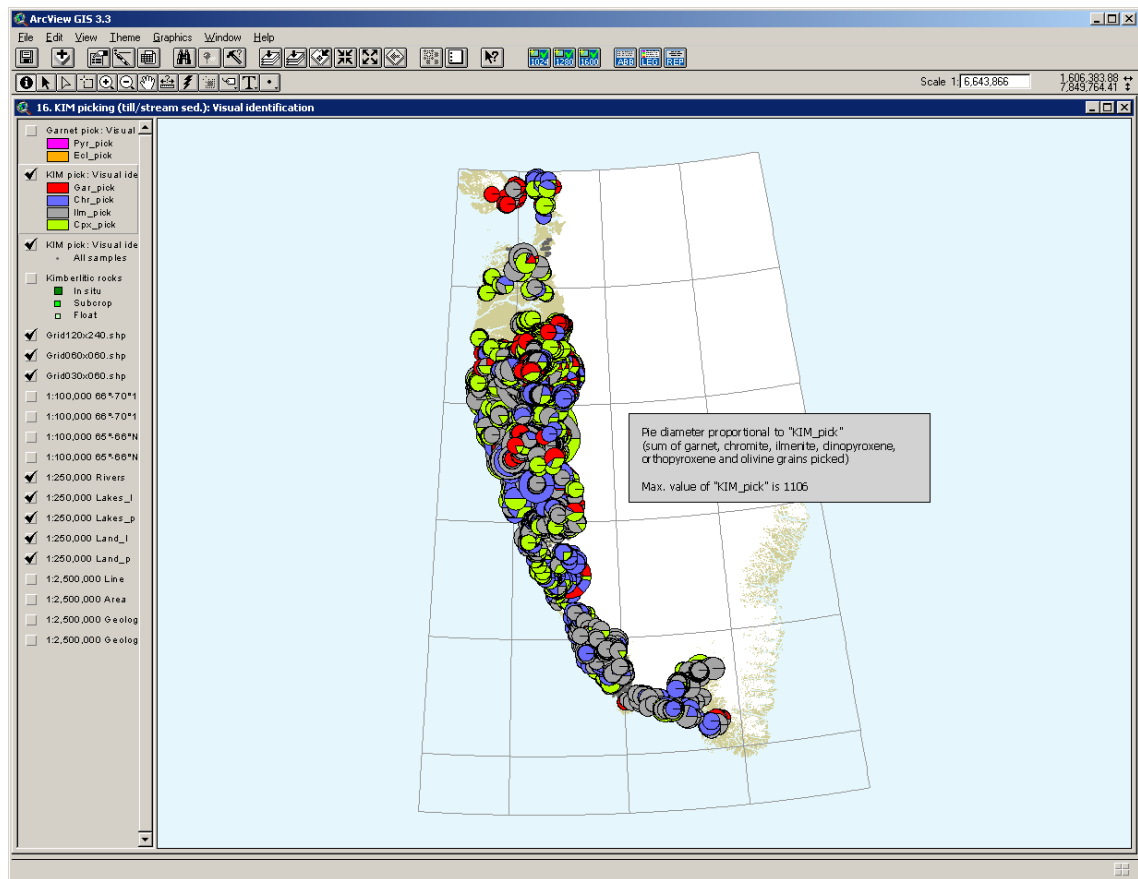
**Figure 17.** View of the most diamond-positive indicator minerals from kimberlitic rock samples combined: diamond-facies garnets (Grütter et al. 2004), diamond-inclusion chromites from  $\text{Cr}_2\text{O}_3\text{--TiO}_2$  diagram (Fipke 1994; Fipke et al. 1995), kimberlitic ilmenites (Wyatt et al. 2004), chrome-diopsides from within diamond stability field (Kennedy & Kennedy 1976; Nimis & Taylor 2000) and orthopyroxenes from diamondiferous harzburgite (Ramsay & Tompkins 1994).

**Hotlinked themes:**

- Mineral class. diagrams
- Diamonds in rock
- GAR (Grütter et al.)
- CHR (Fipke)
- ILM (Wyatt et al.)
- CPX (Nimis & Taylor, Kennedy & Kennedy)
- OPX (Ramsay & Tompkins)
- Kimberlitic rocks
- 1:2,500,000 Geology Area

The symbols for the different themes are sized and 'nested' so that all symbols will be visible, even if a sample contains all the minerals considered. This enables easy identification of the localities having the most matches with the diamond-favourable classification criteria.

## 16. KIM picking (till/stream sed.): Visual identification



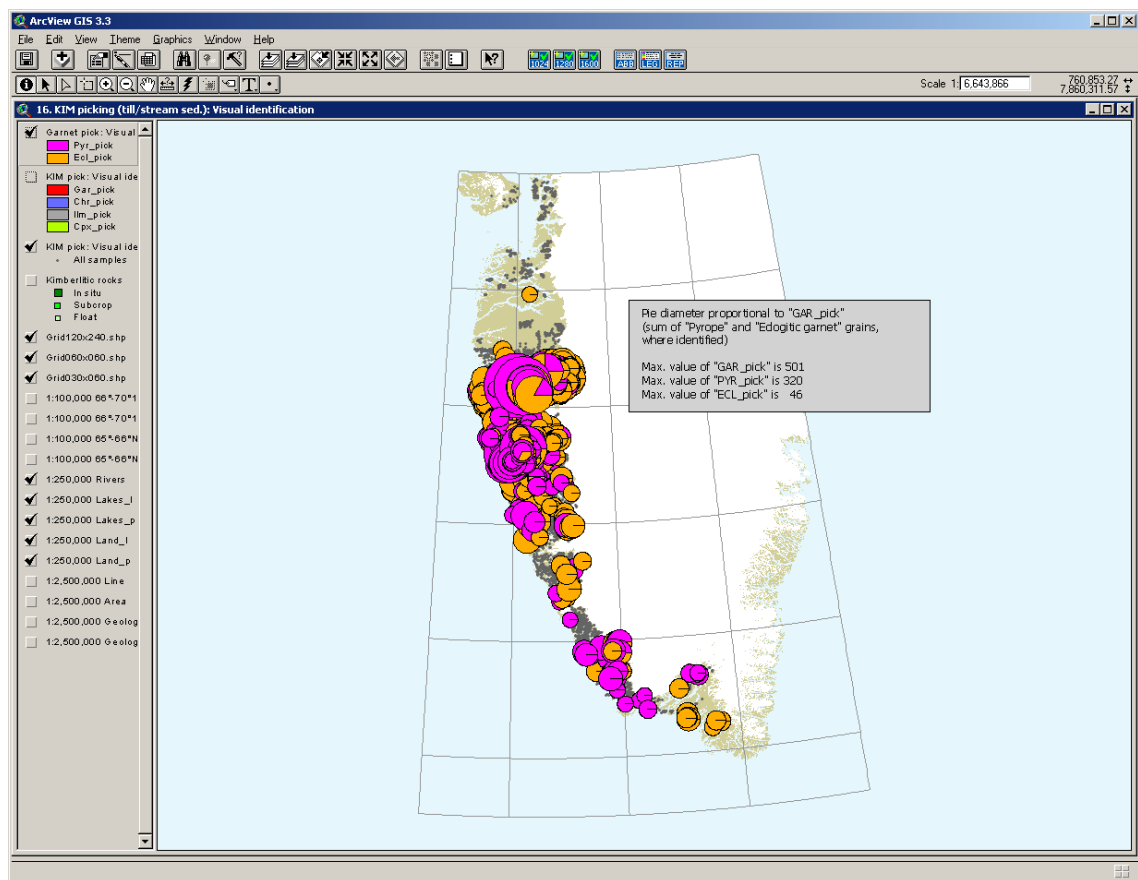
**Figure 18.** Kimberlite indicator mineral picking results from till and stream sediment samples, showing relative numbers of **visually** identified minerals for each sample.

**Hotlinked themes:**

- Garnet pick: Visual identification
- KIM pick: Visual identification [pie diagrams]
- KIM pick: Visual identification [all samples]
- Kimberlitic rocks
- 1:2,500,000 Geology Area

The pie diagrams in view 16 show the relative numbers of garnet, chromite, ilmenite and clinopyroxene grains visually identified in each sample, with pie diameters proportional to the sum of garnet, chromite, ilmenite, clinopyroxene, orthopyroxene and olivine grains.

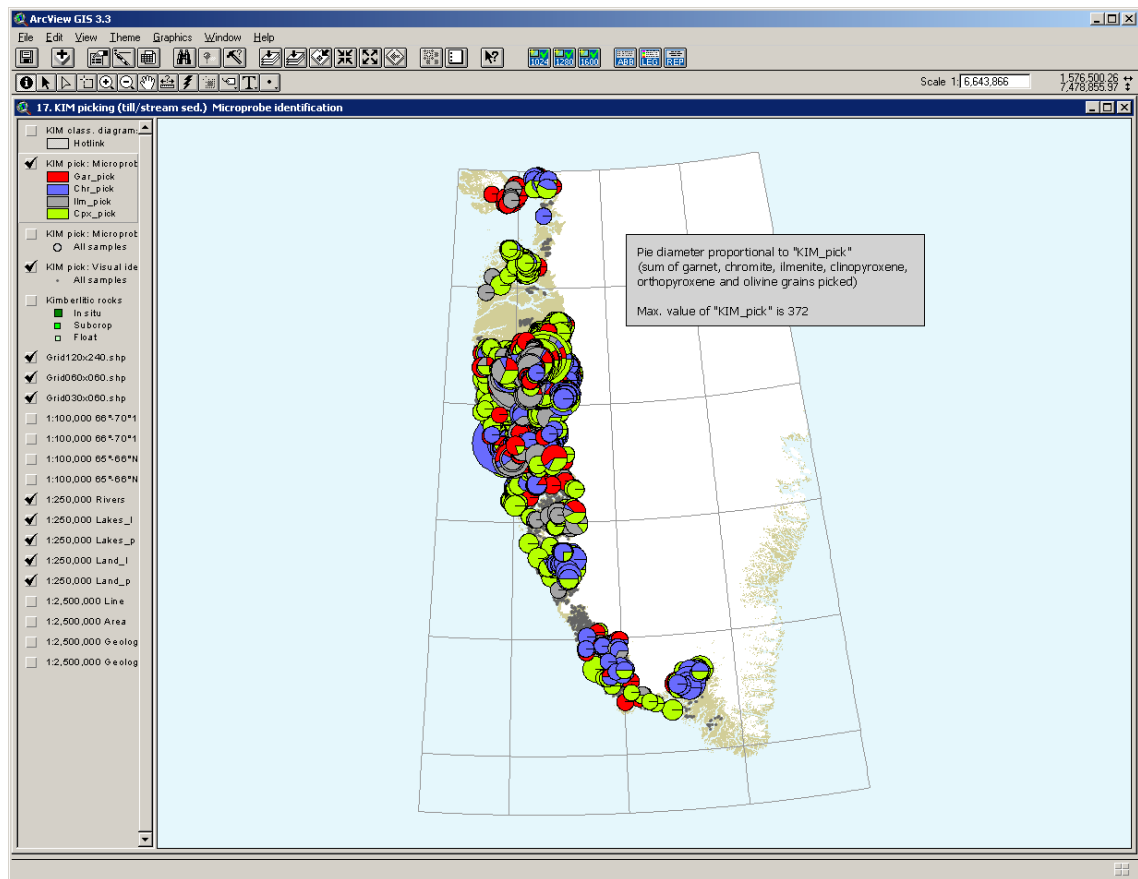
Statistics for visual picking of kimberlite indicator minerals are not available for any of the large number of till samples for which positions and mineral analyses are reported in GEUS Report Files 21700 (Dia Met Minerals Ltd. 1999a), 21701 (Dia Met Minerals Ltd. 1999b), 21724 (Ulansky 2000a), 21748 (Dia Met Minerals Ltd. 2000c) and 21761 (Dia Met Minerals Ltd. 2001). For all these samples, the number of mineral grains picked in the 'KIM\_Pick\_Visual\_Till-Ss' spreadsheet and shapefile has been set equal to the number of grains analysed, and as such is a minimum figure.



**Figure 19.** *Relative numbers of garnet grains visually identified as 'pyrope' or 'eclogitic' from each sample.*

In Figure 19, the topmost theme in view 16 has been made visible and activated, and the second theme has been made invisible. The view now shows the relative numbers of visually identified pyrope and eclogitic garnets in each sample, with pie diameters proportional to the total number of garnets. It is evident that not all assessment reports subdivide visually identified garnets into pyrope and eclogitic types, since there are fewer data points than shown in Figure 18.

## 17. KIM picking (till/stream sed.): Microprobe identification



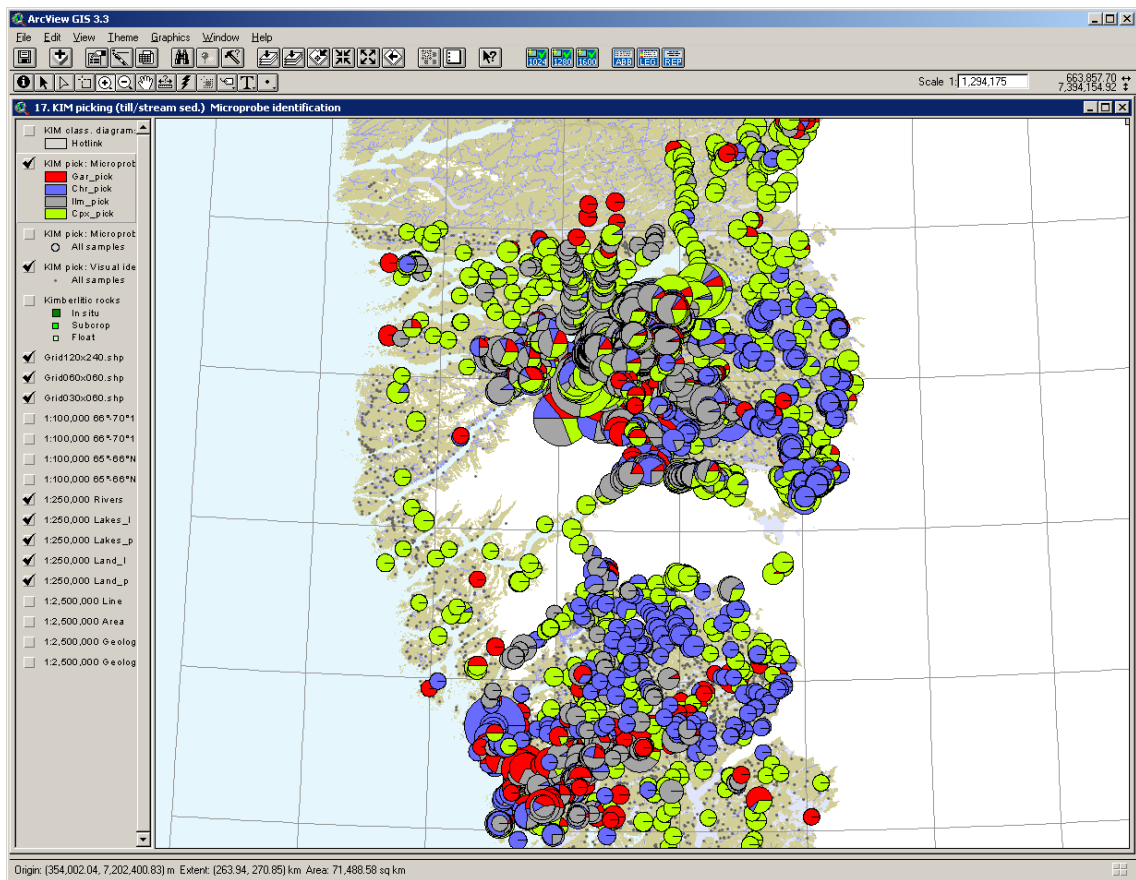
**Figure 20.** Relative numbers of microprobed garnet, chromite, ilmenite and clinopyroxene grains from each till or stream sediment sample.

**Hotlinked themes:**

- KIM class. diagrams
- KIM pick: Microprobe identification [pie diagrams]
- KIM pick: Microprobe identification [all samples]
- Kimberlitic rocks
- 1:2,500,000 Geology Area

The pie diagrams show the relative numbers of garnet, chromite, ilmenite and clinopyroxene grains identified by microprobe analysis in each sample, with diameters proportional to the sum of garnet, chromite, ilmenite, clinopyroxene, orthopyroxene and olivine grains.

Figure 20 shows the view zoomed to full extent, and at this scale there is a very high degree of overlap of the pie symbols. In a view zoomed to show the Sarfartoq and Maniitsoq regions only (Figure 21), the regional trends become distinguishable.

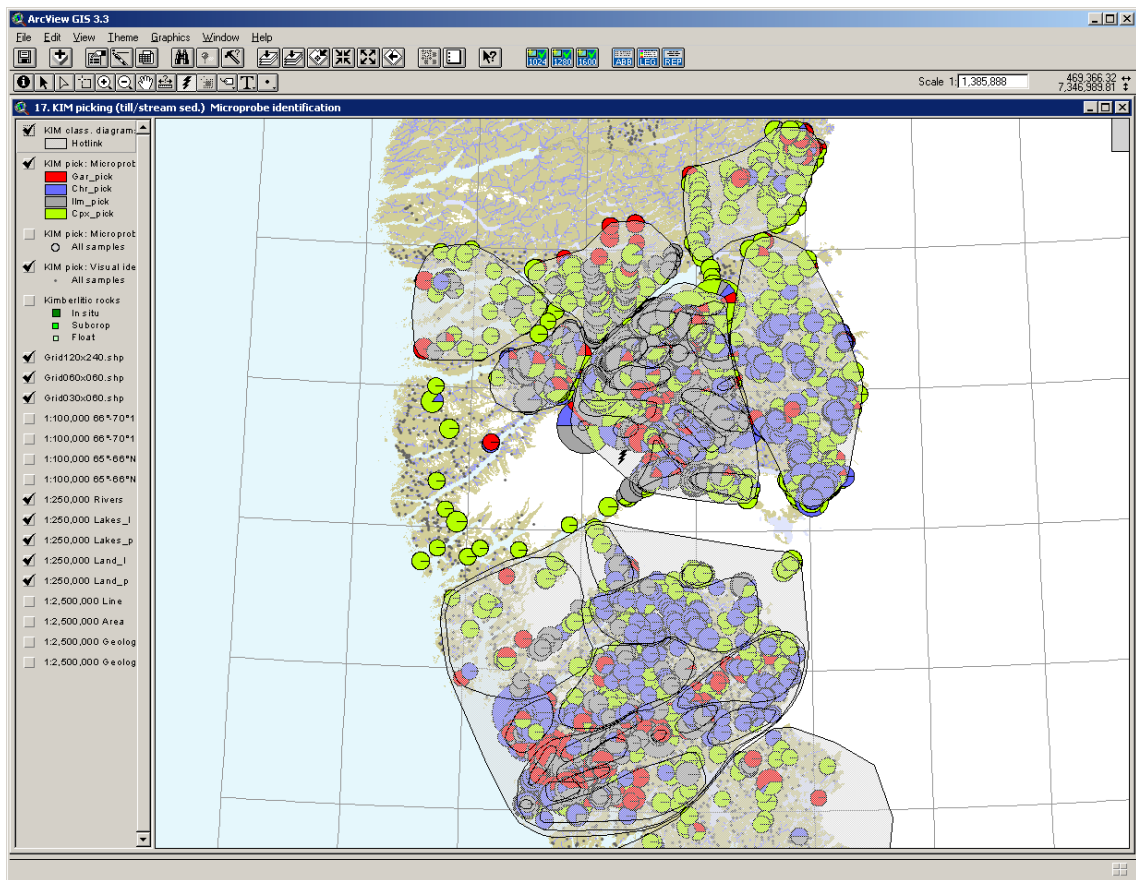


**Figure 21.** Same view as in Figure 20, but zoomed to show the Sarfartoq and Maniitsoq regions only. At this and larger map scales regional trends become distinguishable.

The topmost theme, 'KIM class. diagrams', provides hotlinks to kimberlite indicator mineral classification diagrams. Up to nine diagrams are provided in a PDF document for each of 54 subareas, as shown in Figure 22.

There is a high degree of subjectivity to the choice of outlines for these subareas, but it has been attempted to define tracts that are naturally coherent, based on input such as trends of kimberlitic dykes, topography, glacial transport direction and delineation of moraines.

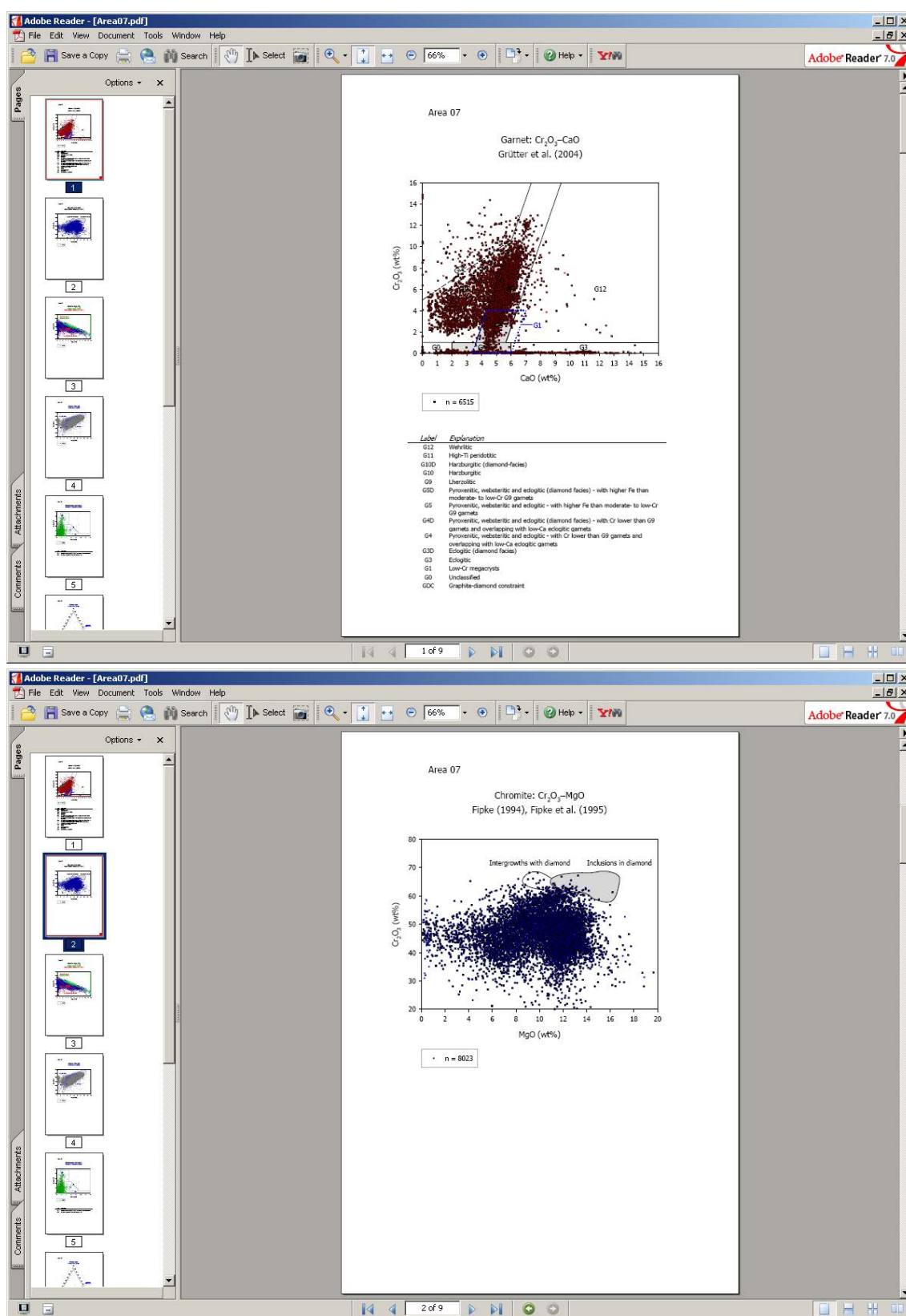




**Figure 22.** Zoomed view with the hotlinked theme 'KIM class. diagrams' visible and active. The hotlink tool used on any of the 54 semi-transparent polygons will open a PDF document with up to nine kimberlite indicator mineral classification diagrams particular to the samples from that area.

Examples of all nine diagrams from the same set of samples from 'Area 07' (indicated by position of hotlink tool in Figure 22) are shown in Figure 23. The example chosen shows classification diagrams for an area that encompasses most of the indicator mineral data from the Sarfartoq region, representing more than 2/3 of all available data.





**Figure 23.** Screenshots of PDF document with indicator mineral classification diagrams. Part 1 of 5.

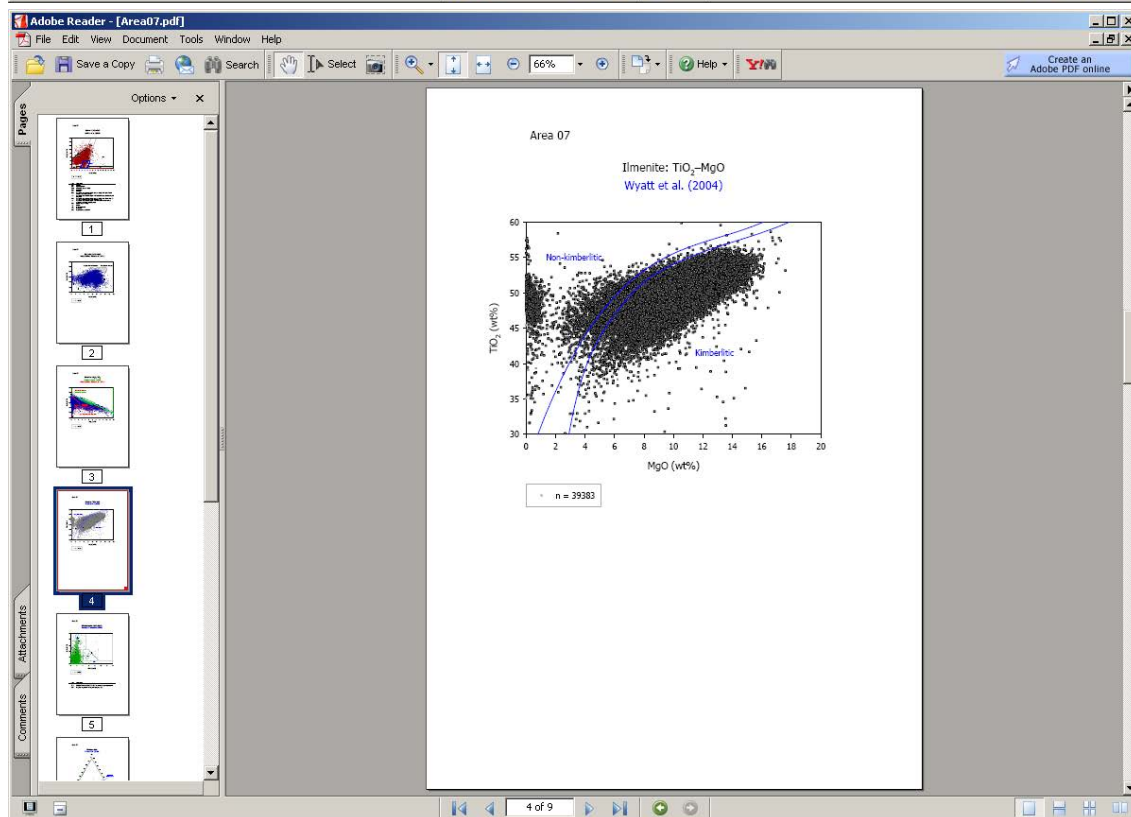
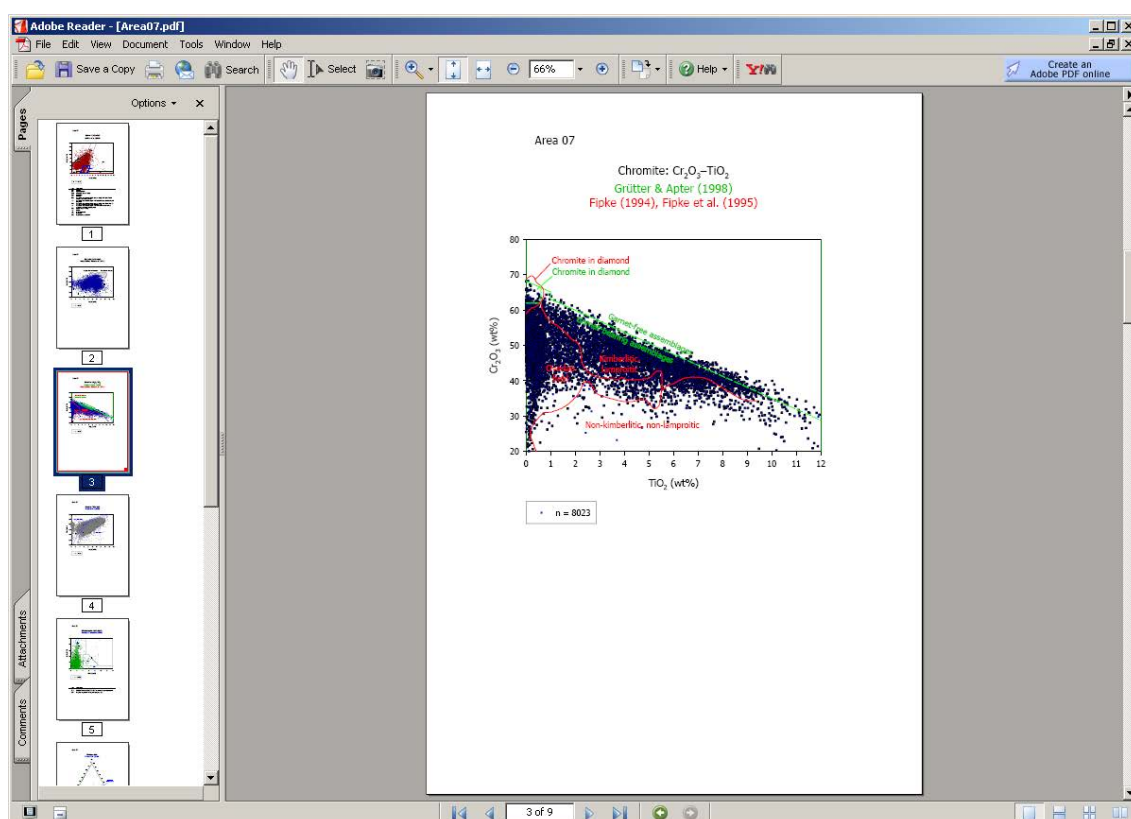


Figure 23. Continued...Part 2 of 5.

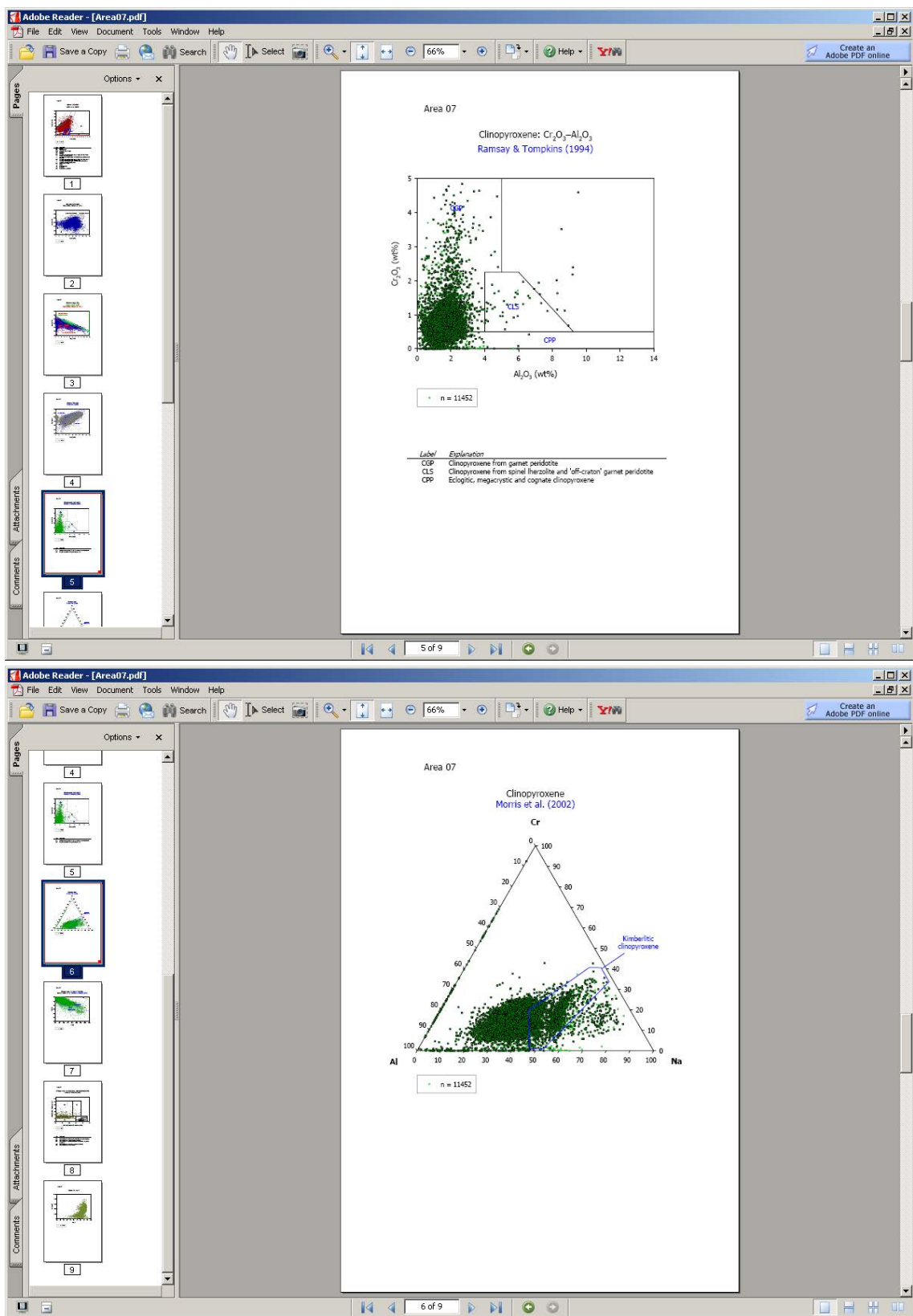


Figure 23. Continued...Part 3 of 5.

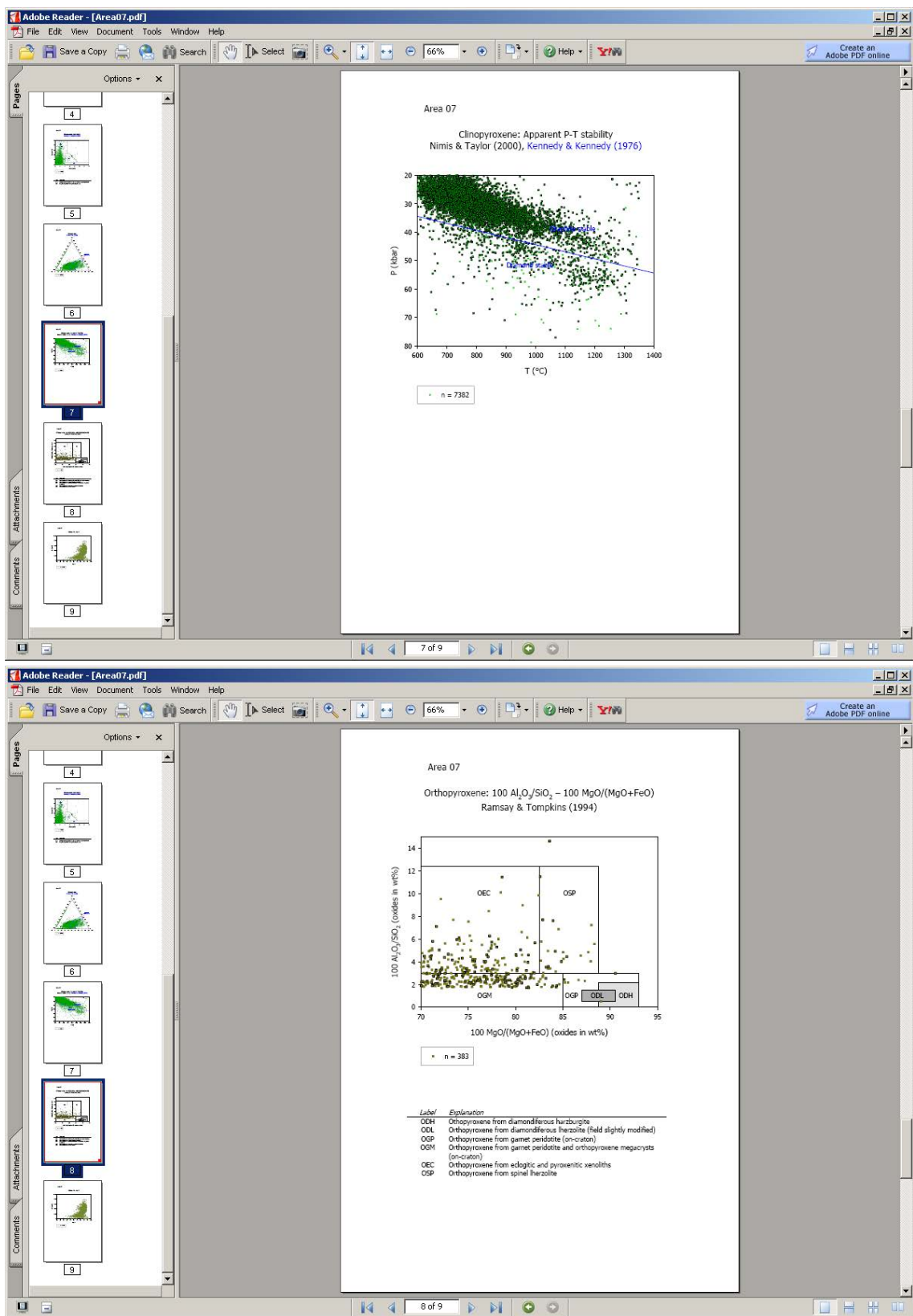
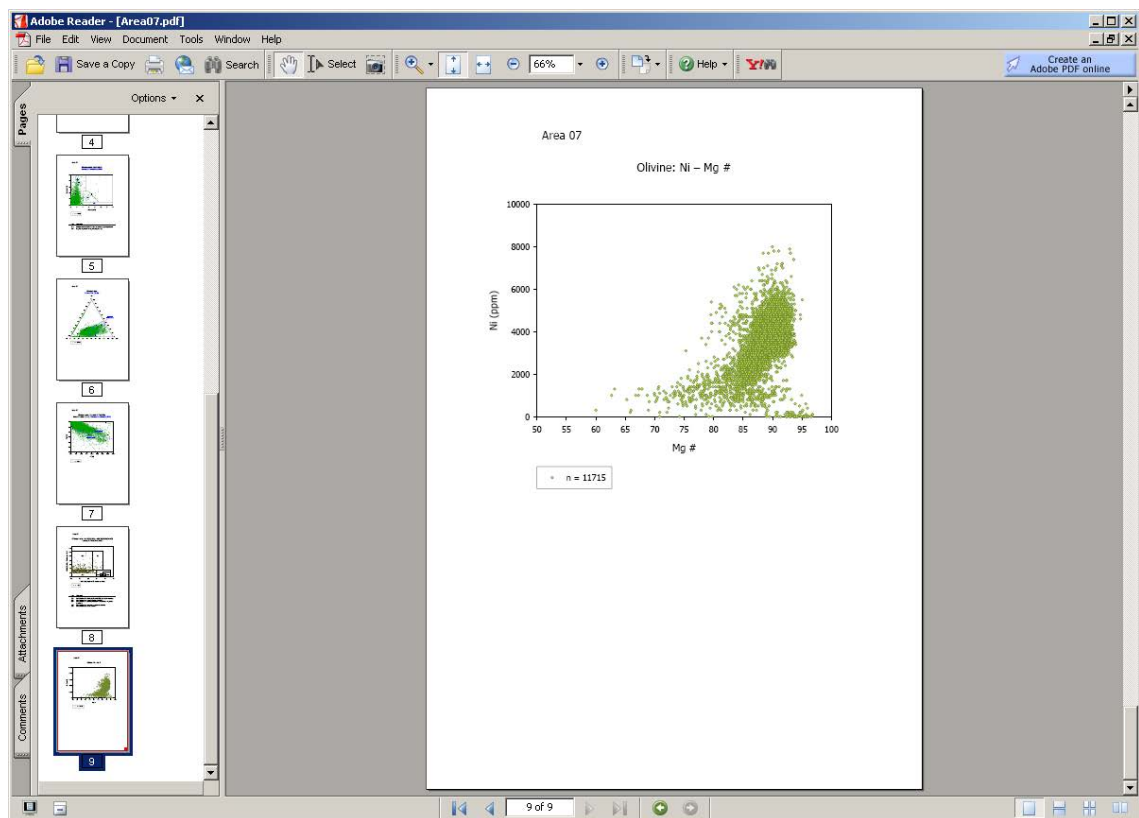
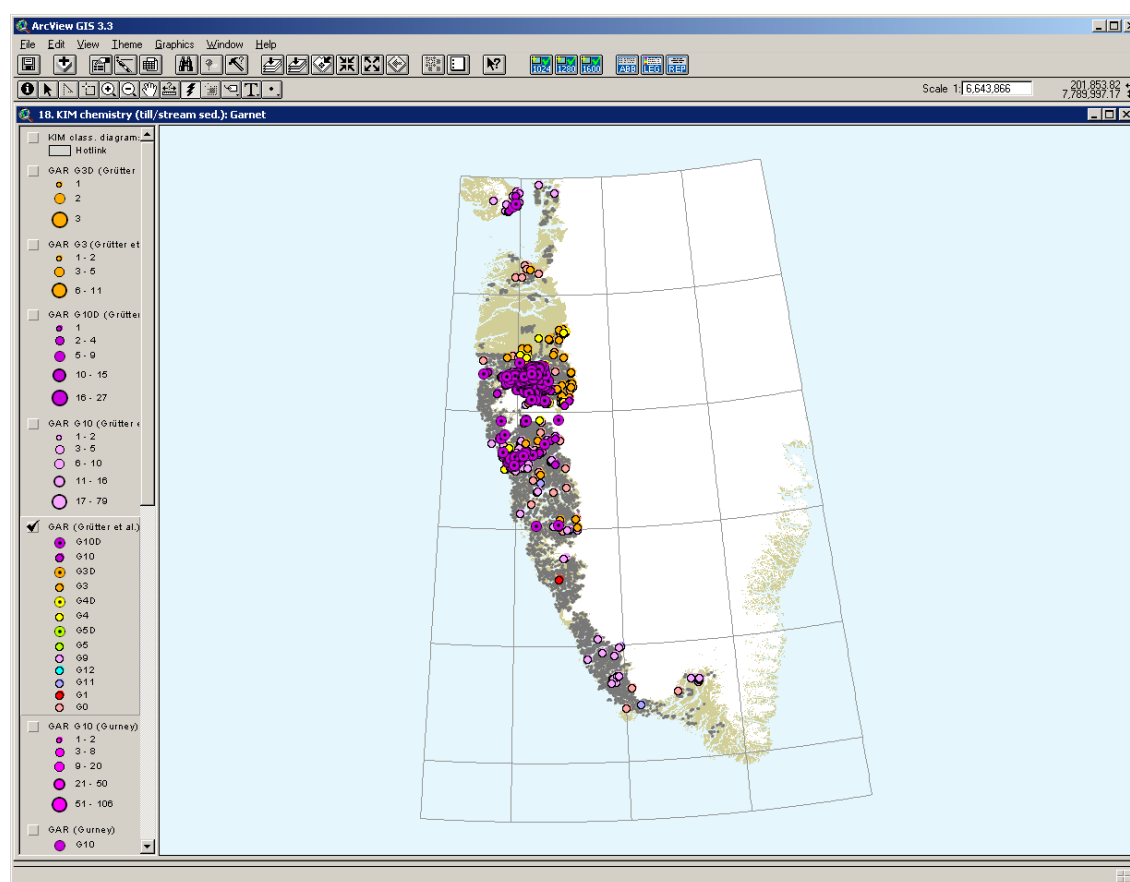


Figure 23. Continued...Part 4 of 5.



**Figure 23.** *Continued...Part 5 of 5.*

## 18. KIM chemistry (till/stream sed.): Garnet



**Figure 24.** Distribution of garnets from till and stream sediment samples, classified according to Grütter et al. (2004).

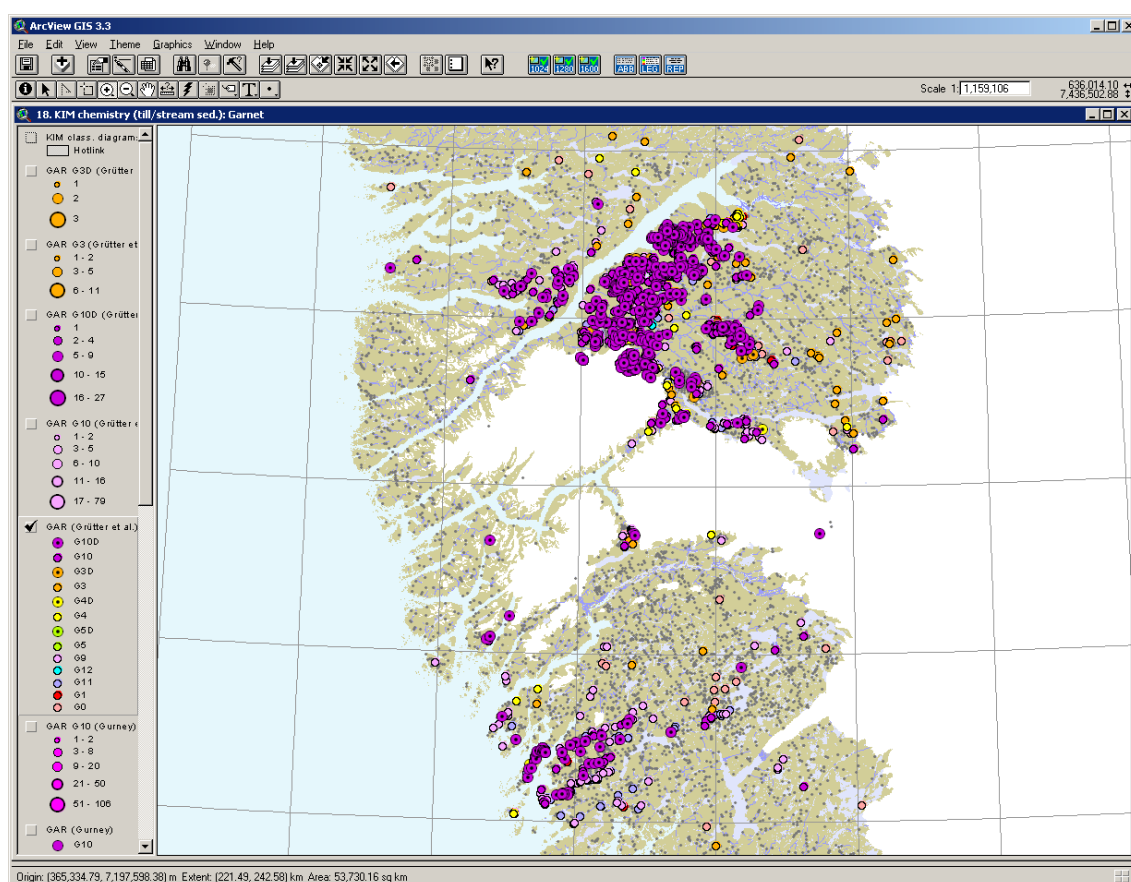
**Hotlinked themes:**

- KIM class. diagrams
- GAR G3D (Grütter et al.)
- GAR G3 (Grütter et al.)
- GAR G10D (Grütter et al.)
- GAR G10 (Grütter et al.)
- GAR (Grütter et al.)
- GAR G10 (Gurney)
- GAR (Gurney)
- GAR (Dawson & Stephens)
- GAR (no sorting)
- KIM pick: Visual identification [all samples]
- Kimberlitic rocks
- 1:2,500,000 Geology Area

The themes with numerals and symbols of increasing size in their legend show the number of garnets of a specific class analysed from each till or stream sediment sample.

Themes with text labels in their legend show the distribution of all garnet classes in a specific classification scheme. The records have been sorted so that grains from the classes of highest interest always plot on top.





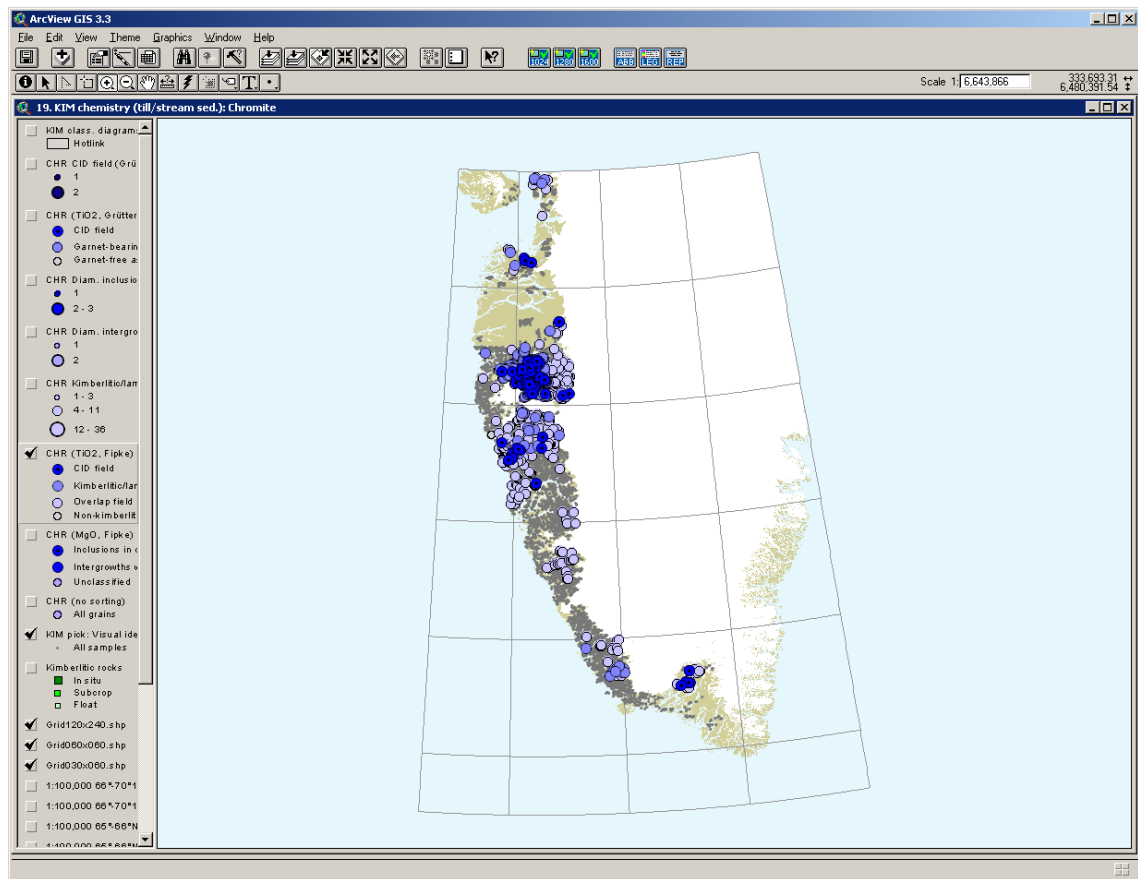
**Figure 25.** Same view as in Figure 24, but zoomed to show the Sarfartoq and Maniitsoq regions only.

The distribution of G10D garnets in Figure 25 quite accurately outlines a WSW-ENE trending corridor in the coastal areas of the Maniitsoq region with large known kimberlitic dyke systems. The apparent continuation of the trend east towards the Inland Ice has gained some substance by fields of kimberlitic boulders, one of which has yielded one microdiamond, a clear white macle (Aber Resources Ltd. 1997a).

The total number of G10D garnets in samples from the Sarfartoq region is very much higher, but it is generally more difficult to see trends that can be related to known kimberlites. The apparent barrenness of the area between the largest cluster of points and a smaller cluster to the east is thought to primarily reflect a very uneven density of till and stream sediment sampling in the Sarfartoq region. As can be seen from the distribution of all samples (the small grey dots), the apparently barren area is only represented by few samples.

A conspicuous concentration of G10D garnets from areas with Cretaceous–Palaeocene sediments on the island of Disko (northernmost cluster of points in Figure 24) was noted at an early stage (Charter Consolidated Ltd. 1983). However, little exploration has been carried out, and no occurrences of kimberlite are known on the island.

## 19. KIM chemistry (till/stream sed.): Chromite



**Figure 26.** Distribution of chromite classes determined from  $\text{Cr}_2\text{O}_3$ – $\text{TiO}_2$  diagram (Fipke 1994; Fipke et al. 1995).

**Hotlinked themes:**

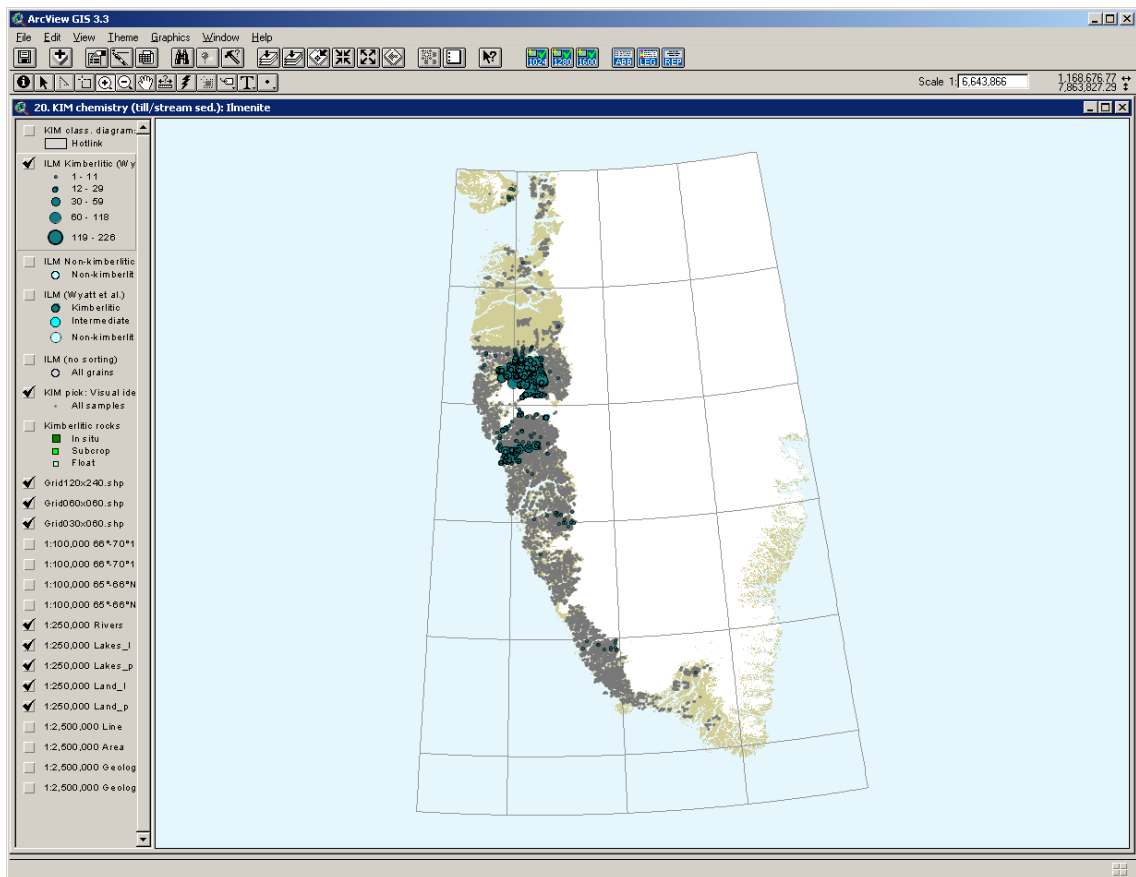
- KIM class. diagrams
- CHR CID field (Grütter & Apter)
- CHR (TiO<sub>2</sub> , Grütter & Apter)
- CHR Diam. inclusion (Fipke)
- CHR Diam. intergrowth (Fipke)
- CHR Kimberlitic/lamproitic (Fipke)
- CHR (TiO<sub>2</sub>, Fipke)
- CHR (MgO, Fipke)
- CHR (no sorting)
- KIM pick: Visual identification [all samples]
- Kimberlitic rocks
- 1:2,500,000 Geology Area

The themes with numerals and symbols of increasing size in their legend show the number of chromites of a specific class analysed in each kimberlitic rock sample.

Themes with text labels in their legend show the distribution of all chromite classes in a specific classification scheme. The records have been sorted so that grains from the classes of highest interest always plot on top.



## 20. KIM chemistry (till/stream sed.): Ilmenite



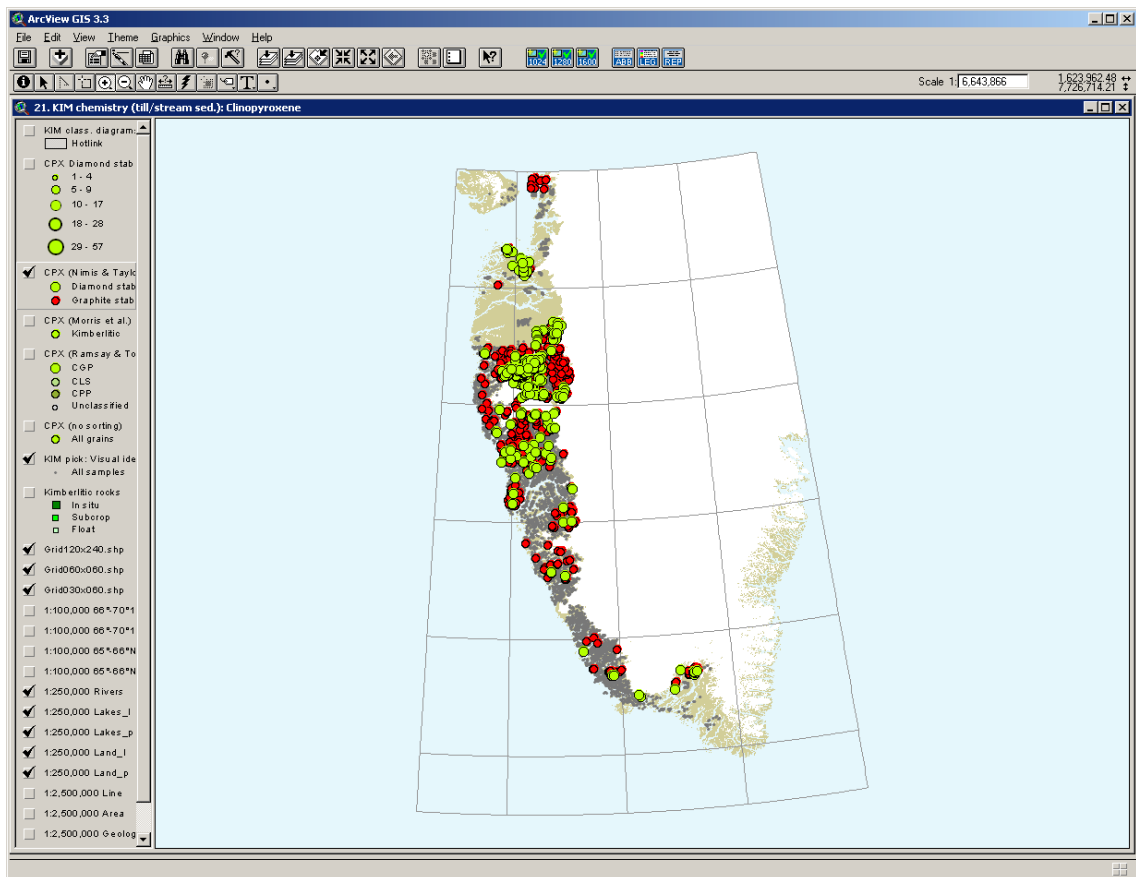
**Figure 27.** Distribution of kimberlitic ilmenites (Wyatt *et al.* 2004) from till and stream sediment samples. The size of the symbols is proportional to the number of grains from each sample.

**Hotlinked themes:**

- KIM class. diagrams
- ILM Kimberlitic (Wyatt *et al.*)
- ILM Non-kimberlitic (Wyatt *et al.*)
- ILM (Wyatt *et al.*)
- ILM (no sorting)
- KIM pick: Visual identification [all samples]
- Kimberlitic rocks
- 1:2,500,000 Geology Area

As many as 39 649 (or 92 %) of the total of 43 318 analysed ilmenites from till and stream sediment samples are 'kimberlitic' in the classification of Wyatt *et al.* (2004). With few exceptions, the distribution of kimberlitic ilmenite on a regional scale mimics the distribution of known kimberlitic rocks. Within the kimberlite areas, especially the Sarfartoq region, the kimberlitic ilmenites are so plentiful that it is difficult in most cases to see clear relationships with the distribution of known kimberlitic occurrences.

## 21. KIM chemistry (till/stream sed.): Clinopyroxene



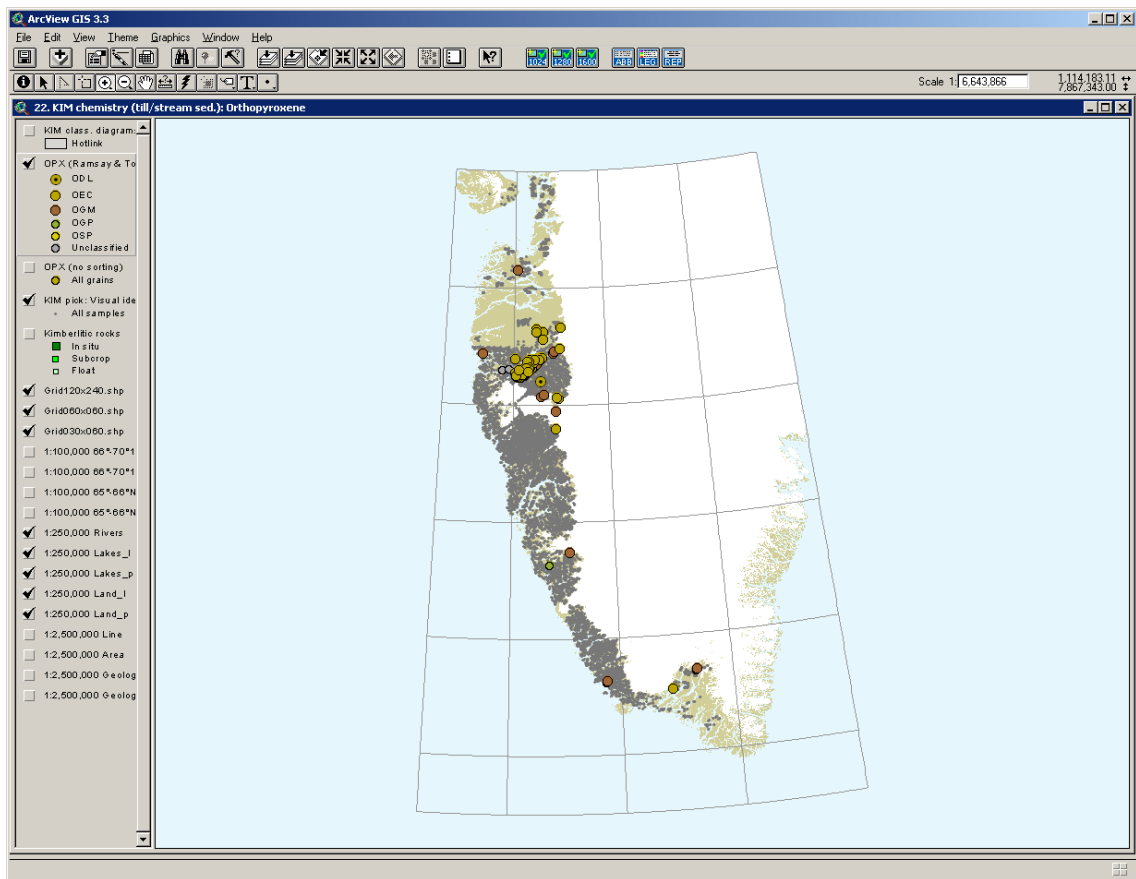
**Figure 28.** Apparent diamond or graphite stability of chrome-diopsides from till and stream sediment samples, based on  $P$ – $T$  estimation procedure of Nimis & Taylor (2000) and diamond–graphite stability curve of Kennedy & Kennedy (1976).

**Hotlinked themes:**

- KIM class. diagrams
- CPX Diamond stability (Nimis & Taylor, Kennedy & Kennedy)
- CPX (Nimis & Taylor, Kennedy & Kennedy)
- CPX (Morris et al.)
- CPX (Ramsay & Tompkins)
- CPX (no sorting)
- KIM pick: Visual identification [all samples]
- Kimberlitic rocks
- 1:2,500,000 Geology Area

The apparent stability of diamond or graphite determined by the  $P$ – $T$  estimation procedure of Nimis & Taylor (2000) and the diamond–graphite stability curve of Kennedy & Kennedy (1976) has only been applied to grains that were first categorised as ‘clinopyroxene from garnet peridotite’ in the classification of Ramsay & Tompkins (1994). The distribution of clinopyroxene with apparent diamond-stable compositions coincides with the fields of known kimberlitic occurrences, but also includes several areas with no known kimberlite.

## 22. KIM chemistry (till/stream sed.): Orthopyroxene



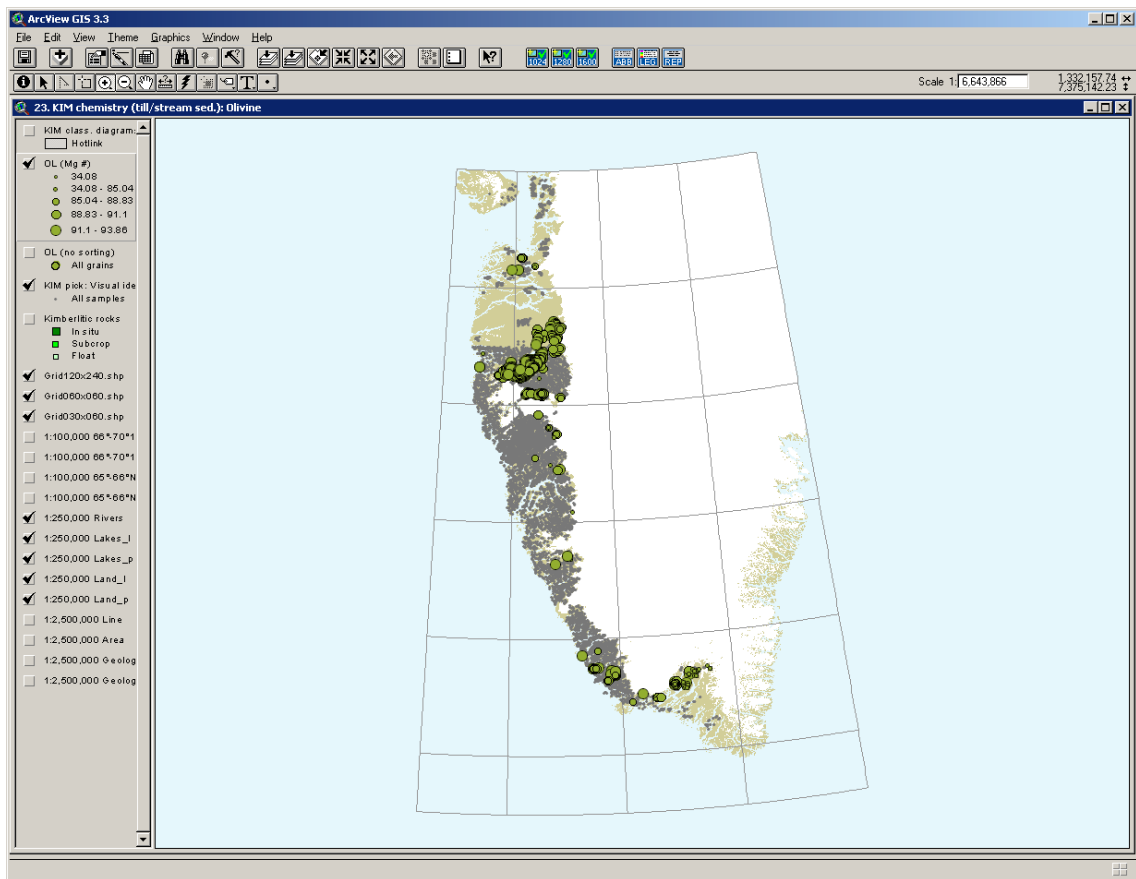
**Figure 29.** *Distribution of orthopyroxene classes after Ramsay & Tompkins (1994).*

**Hotlinked themes:**

- KIM class. diagrams
- OPX (Ramsay & Tompkins)
- OPX (no sorting)
- KIM pick: Visual identification [all samples]
- Kimberlitic rocks
- 1:2,500,000 Geology Area

The conspicuous concentration of analysed orthopyroxenes around and SW of Kangerlussuaq reflects that only samples collected by Dia Met Minerals Ltd. and joint venture partners appear to have been systematically picked for orthopyroxene. The following assessment reports contain orthopyroxene data from till and stream sediment samples: Rose & Grootenboer (1996b), Grootenboer & Boyle (1997c), Read (1998), Bizzarro (1998e), Ferguson (1999), LeCouteur (1999b), Dia Met Minerals Ltd. (1999b), Ulansky (2000a) and Dia Met Minerals Ltd. (2001).

## 23. KIM chemistry (till/stream sed.): Olivine



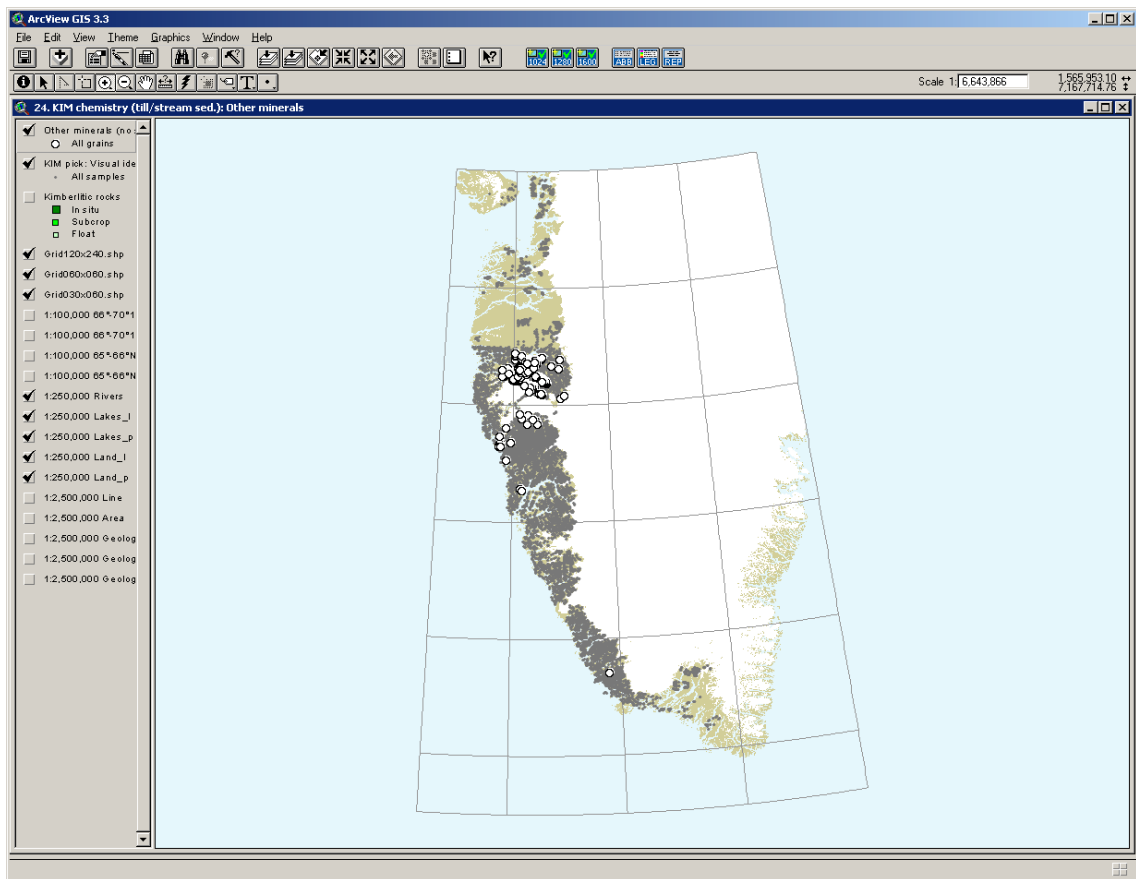
**Figure 30.** Distribution of olivine from till and stream sediment samples. The size of the symbols is proportional to the magnesium number of the olivines.

**Hotlinked themes:**

- KIM class. diagrams
- OL (Mg #)
- OL (no sorting)
- KIM pick: Visual identification [all samples]
- Kimberlitic rocks
- 1:2,500,000 Geology Area

The conspicuous concentration of analysed olivines around and SW of Kangerlussuaq reflects that only samples collected by Dia Met Minerals Ltd. and joint venture partners appear to have been systematically picked for olivine. More than 95 % of the 12 734 olivine analyses from till and stream sediment samples are from the following three assessment reports: Dia Met Minerals Ltd. (1999b), Ulansky (2000a) and Dia Met Minerals Ltd. (2001).

## 24. KIM chemistry (till/stream sed.): Other minerals



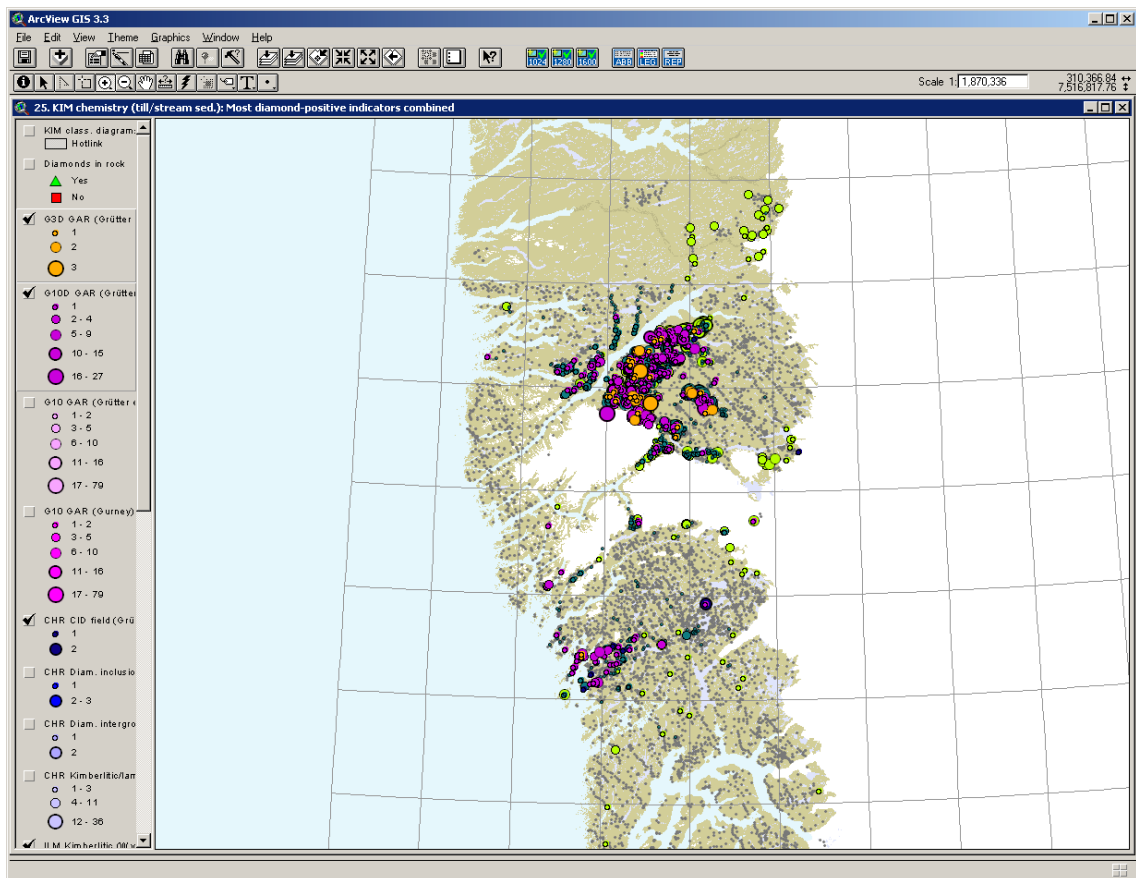
**Figure 31.** Distribution of till and stream sediment samples with analyses of minerals with chemistries that do not fit to the previous six groups (garnet, chromite, ilmenite, clinopyroxene, orthopyroxene and olivine).

**Hotlinked themes:**

- Other minerals (no sorting)
- KIM pick: Visual identification [all samples]
- Kimberlitic rocks
- 1:2,500,000 Geology Area

'Other minerals', determined mainly by their chemistries, include: magnetite, Cr magnetite, Ti magnetite, Ti-Cr magnetite, spinel, Ti-Cr spinel, perovskite, rutile, corundum, feldspar and quartz.

## 25. KIM chemistry (till/stream sed.): Most diamond-positive indicators combined



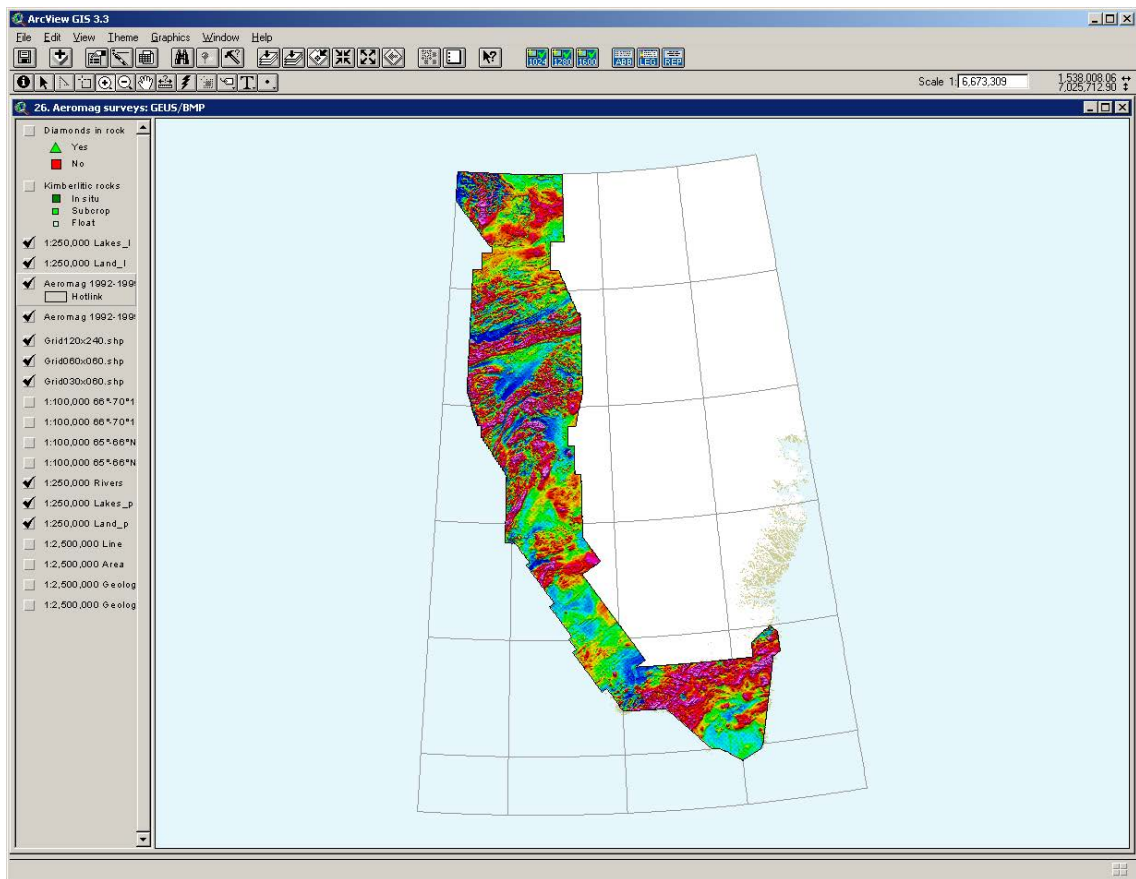
**Figure 32.** Zoomed view showing the quantities of the most diamond-favourable garnets, chromites, ilmenites and clinopyroxenes from till and stream sediment samples.

**Hotlinked themes:**

- KIM class. diagrams
- Diamonds in rock
- G3D GAR (Grütter et al.)
- G10D GAR (Grütter et al.)
- G10 GAR (Grütter et al.)
- G10 GAR (Gurney)
- CHR CID field (Grütter & Apter)
- CHR Diam. inclusion (Fipke)
- CHR Diam. intergrowth (Fipke)
- CHR Kimberlitic/lamproitic (Fipke)
- ILM Kimberlitic (Wyatt et al.)
- CPX Diamond stability field (Nimis & Taylor, Kennedy & Kennedy)
- KIM pick: Visual identification [all samples]
- Kimberlitic rocks
- 1:2,500,000 Geology Area

The themes in this view emphasise the quantitative distribution of some of the most diamond-favourable indicator minerals.

## 26. Aeromag surveys: GEUS/BMP



**Figure 33.** Overview of aeromagnetic surveys flown for GEUS and BMP.

**Hotlinked themes:**

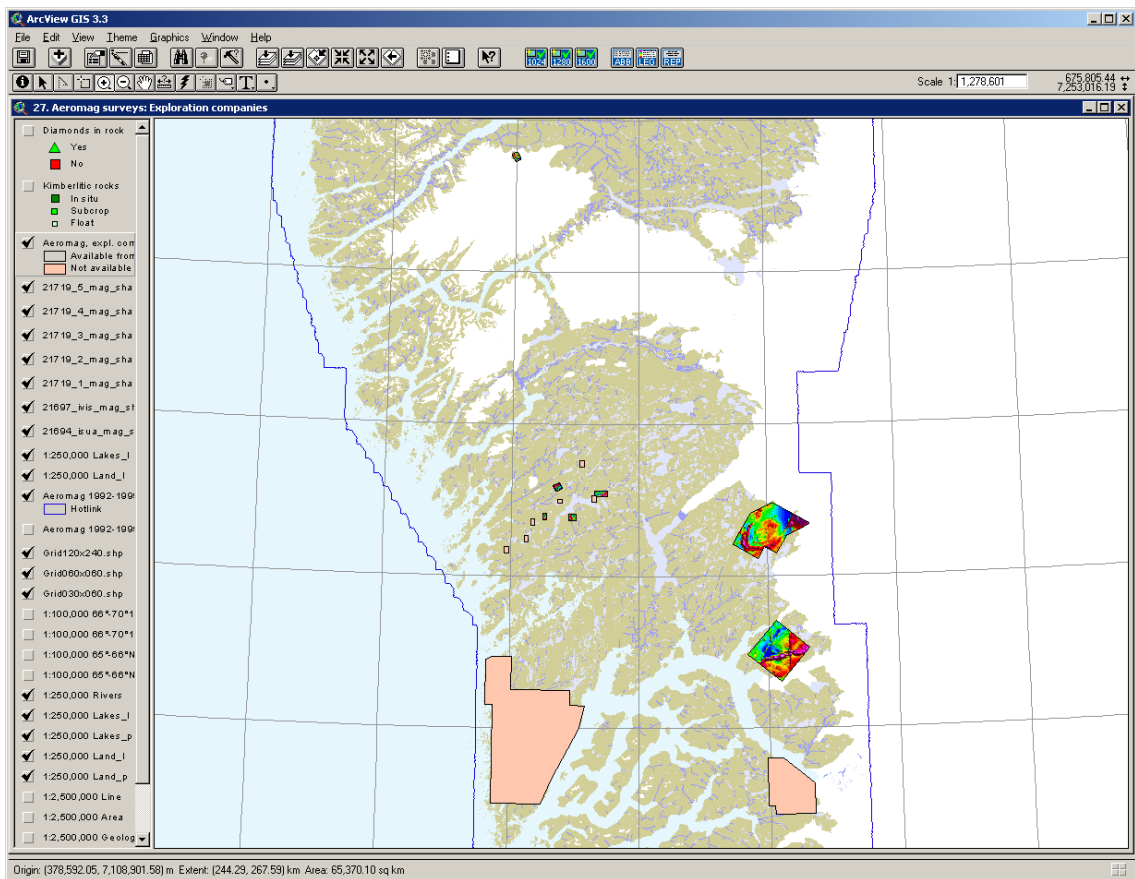
- Diamonds in rock
- Kimberlitic rocks
- Aeromag 1992-1999 [hotlink]
- 1:2,500,000 Geology Area

This view presents a merged image of the total magnetic fields from Government-funded aeromagnetic surveys conducted between 1992 and 1999. Metadata and hotlinks are in the polygon theme 'Aeromag 1992-1999 [Hotlink]' (the active theme in Figure 33).

Reviews of the 'Aeromag 1992–1999' surveys can be found in Rasmussen *et al.* (2003) and Rasmussen & van Gool (2000).

Digital data are available from GEUS.

## 27. Aeromag surveys: Exploration companies



**Figure 34.** Zoomed view showing aeromagnetic survey areas flown for exploration companies.

**Hotlinked themes:**

- Diamonds in rock
- Kimberlitic rocks
- Aeromag, expl. companies
- Aeromag 1992-1999
- 1:2,500,000 Geology Area

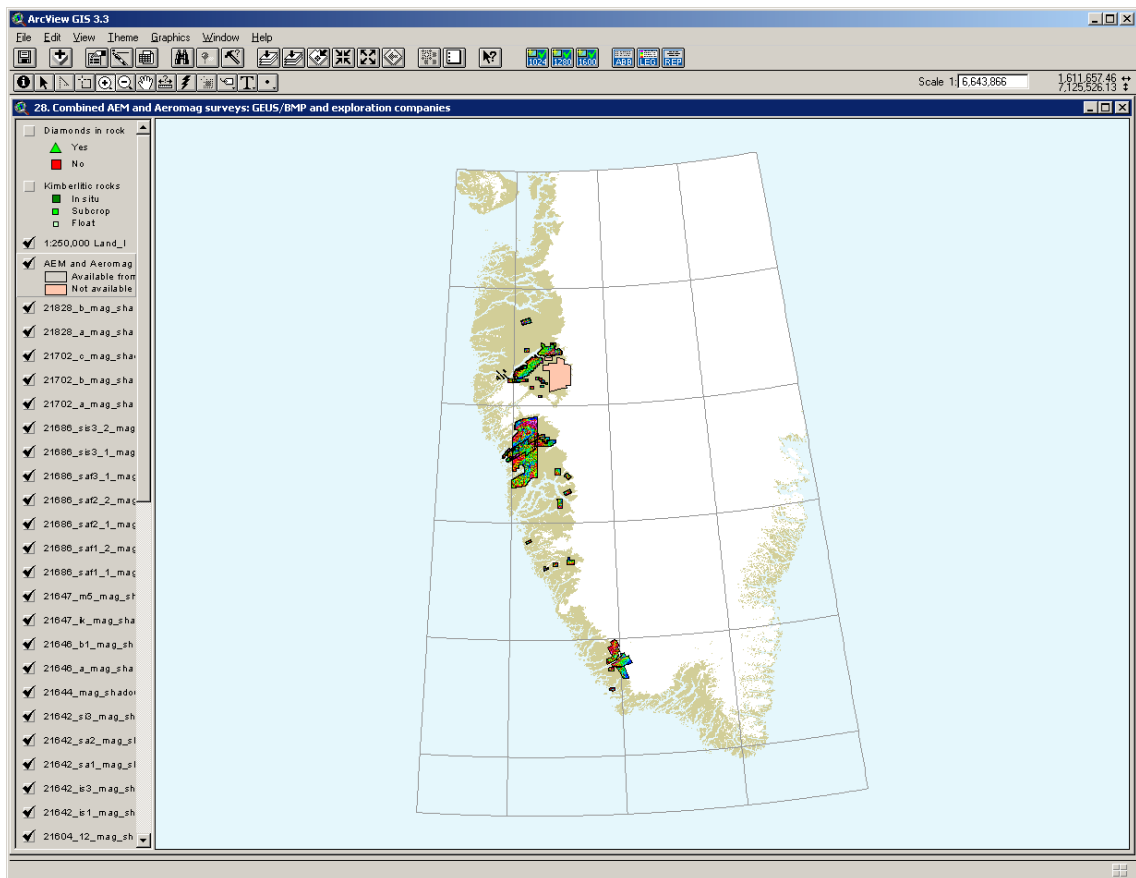
This view presents aeromagnetic surveys flown for exploration companies. The images show the total magnetic fields from individual survey areas.

The theme 'Aeromag, expl. companies' contains metadata on the individual surveys and hotlinks to legends to the magnetic maps. From the legends there are further links to the full reports from which the data were extracted.

Digital data are available from GEUS, except for areas shown in pink.



## 28. Combined AEM and aeromag surveys: GEUS/BMP and exploration companies



**Figure 35.** All combined AEM and aeromagnetic surveys flown for GEUS and BMP, and for exploration companies.

**Hotlinked themes:**

- Diamonds in rock
- Kimberlitic rocks
- AEM and Aeromag surveys
- 1:2,500,000 Geology Area

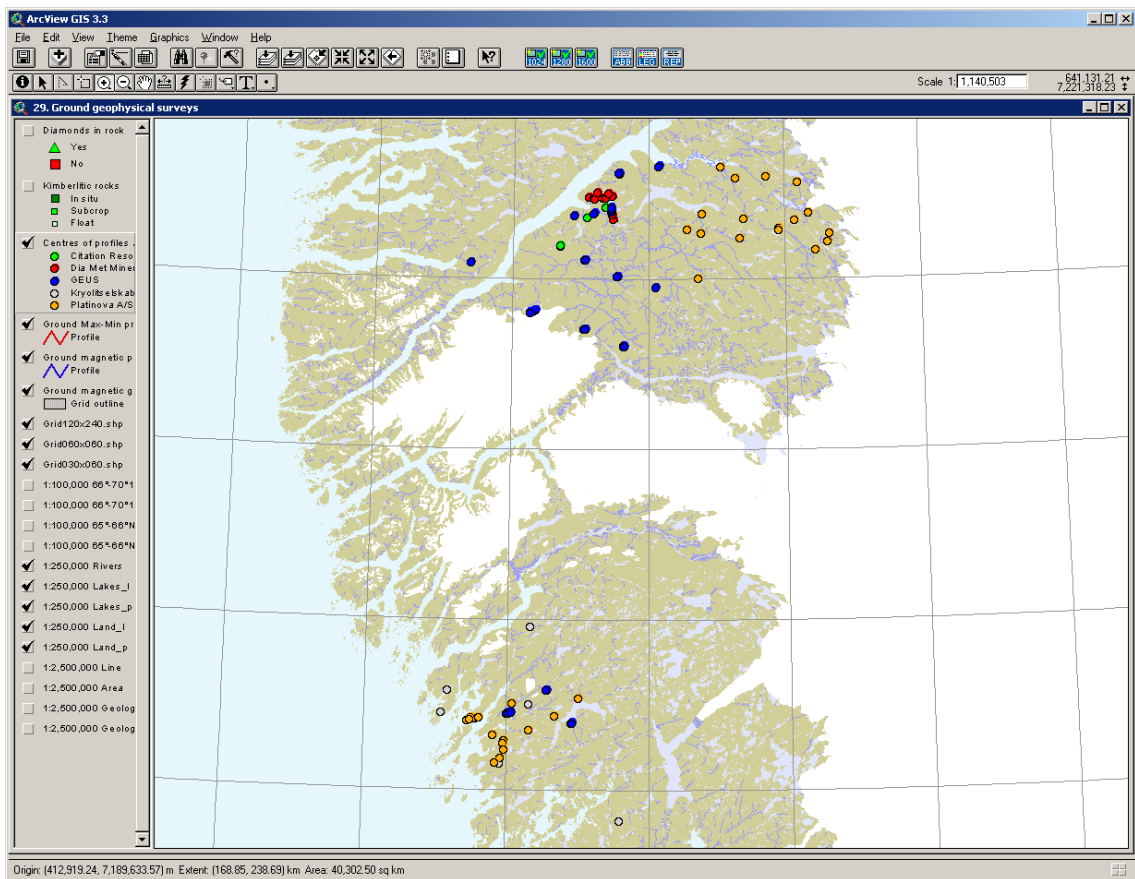
This view presents combined airborne electromagnetic and aeromagnetic surveys flown for GEUS and BMP, and for exploration companies. The images show total magnetic fields from individual surveys.

The theme 'AEM and Aeromag surveys' contains metadata on the individual surveys and hotlinks to legends to the magnetic maps. From the legends there are further links to the original reports from which the data were extracted.

A summary of public funded surveys flown for GEUS and BMP within the regions of interest, 'AEM Greenland 1995' and 'AEM Greenland 1996', is provided in Rasmussen *et al.* (2001).

Digital data are available from GEUS, except for survey areas shown in pink.

## 29. Ground geophysical surveys



**Figure 36.** Zoomed view showing all ground geophysical surveys, classified by operator.

**Hotlinked themes:**

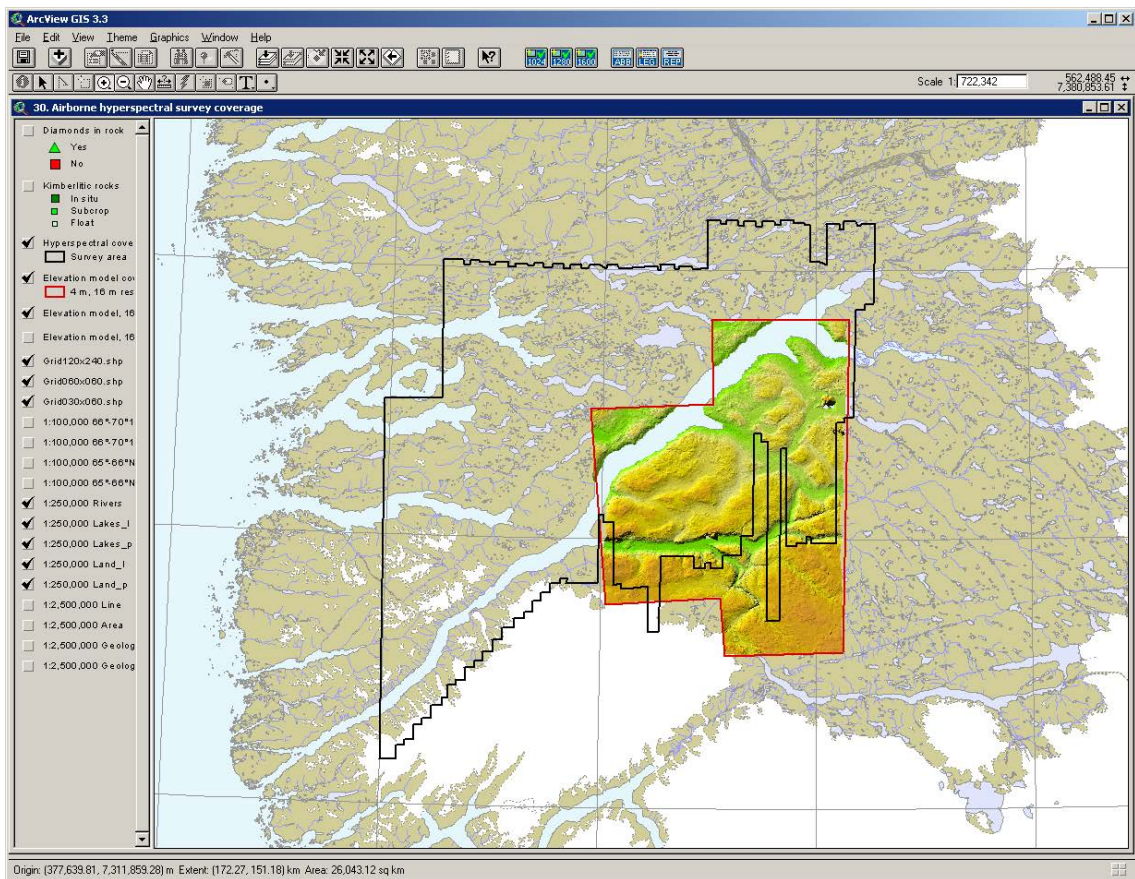
- Diamonds in rock
- Kimberlitic rocks
- Centres of profiles and grids
- 1:2,500,000 Geology Area

All metadata on the ground geophysical surveys and hotlinks to reports are in the point theme 'Centres of profiles and grids'.

The two line themes 'Ground Max-Min profiles' and 'Ground magnetic profiles' and the polygon theme 'Ground magnetic grid outlines' only become visible at large magnification.

For availability of digital data, consult the theme table to 'Centres of profiles and grids', using ArcView's identify tool, or open the spreadsheet \Excel data\Geophysics\_ground.xls. A report detailing GEUS' ground magnetic surveys will be available shortly (Rasmussen & Jensen 2004).

## 30. Airborne hyperspectral survey coverage



**Figure 37.** Outlines of airborne hyperspectral data coverage from survey flown in 2002, and high-resolution elevation model coverage.

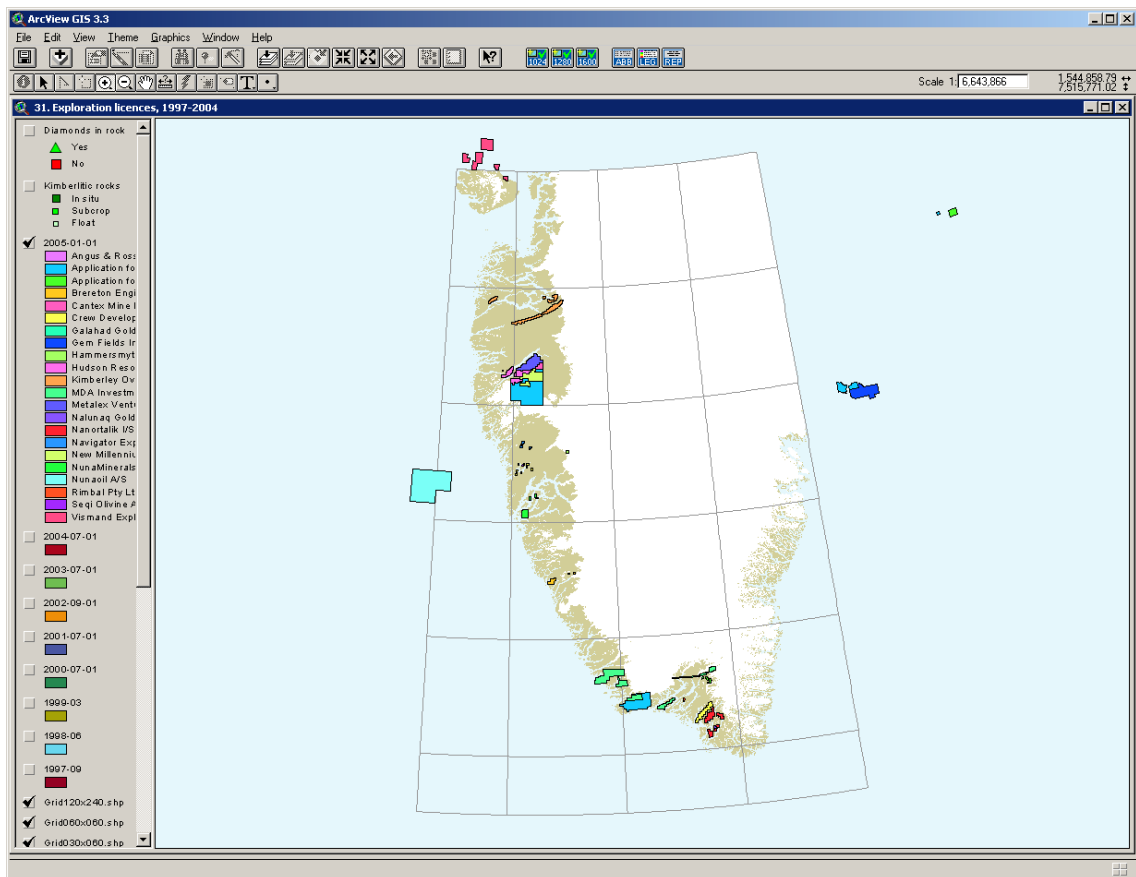
**Hotlinked themes:**      Diamonds in rock  
                                 Kimberlitic rocks  
                                 1:2,500,000 Geology Area

The view shows the coverage of an airborne hyperspectral survey flown for GEUS and BMP in 2002, and coverage of 4 m and 16 m resolution elevation models (16 m model shown).

Field reflectance spectra of various surfaces, including several varieties of kimberlitic rocks and weathering material, were measured simultaneously with the airborne survey in 2002 (Tukiainen *et al.* 2003).

Processed and interpreted hyperspectral data are available from the area of overlap between the polygons with black and red outlines (Tukiainen & Krebs 2004).

## 31. Exploration licences, 1997–2004



**Figure 38.** View showing exclusive exploration licence coverage.

**Hotlinked themes:**      Diamonds in rock  
                                  Kimberlitic rocks  
                                  1:2,500,000 Geology Area

General trends in exploration activity over the past seven years can be seen by activating the themes for exclusive exploration licences of September 1997, June 1998, March 1999, 1 July 2000, 1 July 2001, 1 September 2002, 1 July 2003, 1 July 2004 and 1 January 2005.

Shapefiles for many more licence application batches than shown in the view are available in subfolders to \Shapefiles\_Geo\Licences.

To categorise themes by licensee, as in the most recent licence theme shown above, choose 'Unique' as Legend Type and 'Licensee' as Values Field under ArcView's Legend Editor.

## Acknowledgements

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The company assessment reports that are the source of data in this compilation are listed below along with other sources of information relevant to diamond exploration in Greenland. The assessment reports are identified as 'in archives of the Geological Survey of Denmark and Greenland, GEUS Report File 2xxxx'. The general list of references is followed by a separate list of company assessment reports sorted by GEUS Report File number.

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