Polydat: Poly-Metallic Nodules GIS

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Miscellaneous Report 256

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1 Introduction

The International Seabed Authority is an autonomous international organisation established under the 1982 United Nations Convention on the Law of the Sea and the 1994 Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea. The Authority is the organisation through which States Parties to the Convention shall, in accordance with the regime for the seabed and ocean floor and subsoil thereof beyond the limits of national jurisdiction (the Area) established in Part XI and the Agreement, organise and control activities in the Area, particularly with a view to administering the resources of the Area.

The Authority came into existence on 16 November 1994, upon the entry into force of the 1982 Convention. The first Secretary-General of the Authority, Satya Nandan (Fiji) was elected in March 1996, and the Authority became fully operational as an autonomous international organisation in June 1996, when it took over the premises and facilities in Kingston, Jamaica previously used by the United Nations Kingston Office for the Law of the Sea since 1983

In view to administer the resources of the area, a group of pioneer investors under co-ordination by the United Nation Convention on the Law of the Sea department (UNCLOS) has already surveyed 2 areas located near the Clipperton fault in the Pacific and in the Indian Ocean. During the same period, numerous scientific cruises have collected mineral data all over the world.

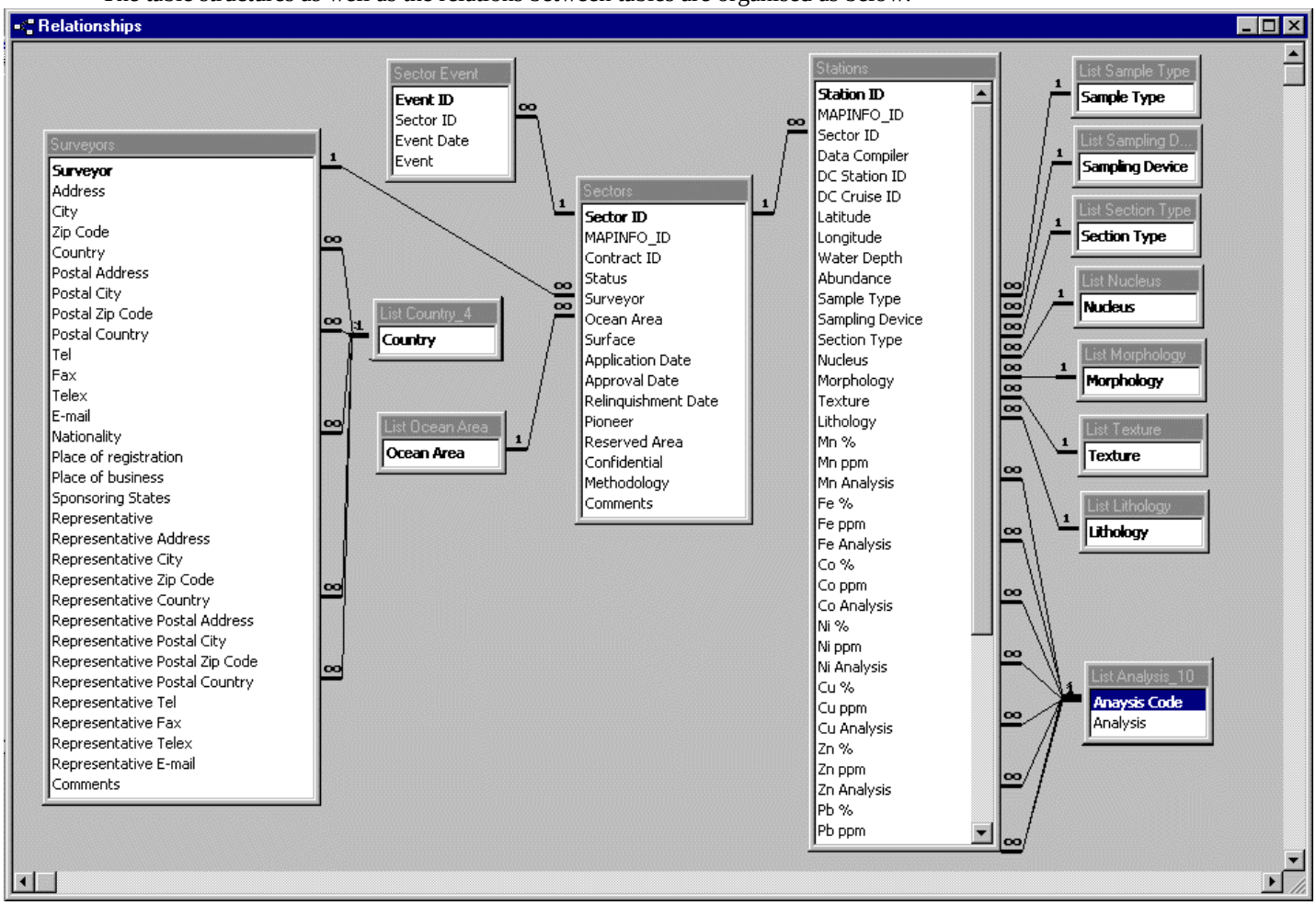
The Authority has collected this data and applications under various forms, mainly paper format. The current Geographic Information System (GIS), developed here has for purpose to finally organise the data collected during these years as to manage the future mining (by August 1997).

This GIS should create a synergy between potential investors and the Authority, offering a common interface for nodule and mineral data requests on the areas managed by the Authority. This GIS should finally promote the scientific and technical role of the authority to member countries, investors and the public in general.

2 Reference Manual

2.1 Relationships

The table structures as well as the relations between tables are organised as below:



2.2 Tables

The Polydat GIS is composed of 4 core tables:

- Sectors
- Sector Event
- Stations
- Surveyor

The subsequent tables prefixed by list are lookup tables to enforce data integrity in the core tables. These list tables dictate operator input.

Referential Integrity is enforced between the 4 core tables to ensure cascading changes when Identifiers and list values are modified.

2.2.1 Sectors

FieldName	Type	Size	Description

Sector ID	Text	50	Sector Identifier
MAPINFO_ID	Long	4	Mapinfo Internal Identifier link to geographic object
Contract ID	Text	50	Contract Identifier (eg Contract Number or Prospection
Status	Text	12	Status for the Area (Prospection, Exploration, Extension)
Surveyor	Text	50	Organisation identifier
Ocean Area	Text	50	Name of Ocean area where is the Area
Surface	Double	8	Surface of the Area in sqkm
Application Date	Date/Time	8	Date of the Application
Approval Date	Date/Time	8	Date of Authorisation
Relinquishment Date	Date/Time	8	Date of Relinquishment of the data
Pioneer	Yes/No	1	Pioneer Area
Reserved Area	Yes/No	1	Area is Reserved for the Entreprise
Confidential	Yes/No	1	Data is confidential
Methodology	Memo	0	Methodology of extraction and exploration
Comments	Memo	0	General Comments

This table describes the different reserved areas.

The sectors fall in several categories depending on the status of the application. The mining code specifies:

Mining code (ISBA/3/LTC/WP.1/Rev.1), Regulation 21

The Contractor shall relinquish portions of the area allocated to revert to the area, in accordance with the following schedule:

(a) 20 per cent of the area allocated by the end of the third year from the date of the contract;
(b) an additional 10 per cent of the area allocated by the end of the fifth year from the date of the contract; and
(c) an additional 20 per cent of the area allocated or such larger amount as would exceed the exploitation area decided upon by the authority, after eight years from the date of the contract.

In the case of registered pioneers, they fall in the same schedule starting at the time of their registration. However the status of the area should be flagged as a pioneer area.

The different categories which the areas will be classified are as follow:

(a) Prospecting
(b) Exploration Area applied
(c) Exploration Area after first Relinquishment
(d) Exploration Area after second Relinquishment
(e) Exploration Area after third Relinquishment
(f) Exploitation Area

Therefore the GIS, for mapping purposes, will hold several areas with the same contract number. Each area will be defined by the list of co-ordinates submitted to the Authority before application and after each relinquishment. The application date, approval date and date of relinquishment drive the monitoring of the contract. Areas active will be extracted by querying areas which approval date is earlier than the current date and which relinquish date hasn't yet expired. This system will allow fast confirmation by the Authority of free areas, which could be reserved.

The Sector ID and Contract ID are left to the Authority to decide which classification they will use for recording the different areas.

The table is mappable in MapInfo. The default co-ordinates system is geodesic co-ordinates referenced by the World Geodetic System of 1984 (WGS84). The MapInfo object will define the perimeter of the sector as well as its co-ordinates.

2.2.2 Sector Event

FieldName	Type	Size	Description
Event ID	Long	4	Automatic Identifier
Sector ID	Text	50	Sector Identifier
Event Date	Date/Time	8	Date of the Event
Event	Memo	0	Description of the Event

This table describes events associated with the management of the application, such as reception of reports, confirmation letters, reception of data and reception of various documents.

2.2.3 Stations

FieldName	Type	Size	Description
Station ID	Text	50	ISA Station Identifier
MAPINFO_ID	Long	4	MapInfo Internal Identifier link to geographic object
Sector ID	Text	50	Sector Identifier
Data Compiler	Text	50	Organisation compiling the Data
DC Station ID	Text	50	Data Compiler Station Identifier
DC Cruise ID	Text	50	Data Compiler Cruise Identifier if any
Latitude	Double	8	Latitude of the sample (WGS84)
Longitude	Double	8	Longitude of the sample (WGS84)
Water Depth	Double	8	Depth of the sampling collection (WGS4 spheroid)
Abundance	Double	8	Abundance of minerals in kg/sqm
Sample Type	Text	50	Sample Type
Sampling Device	Text	50	Sampling Device
Section Type	Text	100	Section Type
Nucleus	Text	50	Nucleus
Morphology	Text	50	Morphology
Texture	Text	50	Texture
Lithology	Text	50	Lithology of the seabed
Mn %	Double	8	Manganese percentage
Mn ppm	Double	8	Manganese parts per million
Mn Analysis	Text	2	Manganese analysis method
Fe %	Double	8	Iron percentage
Fe ppm	Double	8	Iron parts per million
Fe Analysis	Text	2	Iron analysis method
Co %	Double	8	Cobalt percentage
Co ppm	Double	8	Cobalt parts per million
Co Analysis	Text	2	Cobalt analysis method
Ni %	Double	8	Nickel percentage
Ni ppm	Double	8	Nickel parts per million
Ni Analysis	Text	2	Nickel analysis method
Cu %	Double	8	Copper percentage
Cu ppm	Double	8	Copper parts per million
Cu Analysis	Text	2	Copper analysis method
Zn %	Double	8	Zinc percentage
Zn ppm	Double	8	Zinc parts per million
Zn Analysis	Text	2	Zinc analysis method
Pb %	Double	8	Lead percentage

Pb ppm	Double	8	lead parts per million
Pb Analysis	Text	2	lead analysis method
Al %	Double	8	Aluminium percentage
Al ppm	Double	8	Aluminium parts per million
Al Analysis	Text	2	Aluminium analysis method
Si %	Double	8	Silicon percentage
Si ppm	Double	8	Silicon parts per million
Si Analysis	Text	2	Silicon analysis method
Ca %	Double	8	Calcium percentage
Ca ppm	Double	8	Calcium parts per million
Ca Analysis	Text	2	Calcium analysis method
Water Loss	Double	8	Water loss in percentage
Confidential	Yes/No	1	Data is confidential
Comments	Memo	0	General comments

This table records information about each sample or group of samples taken during the prospecting, exploration or exploitation phase of the reserved areas.

The table is mappable in MapInfo. The default co-ordinates system is geodesic co-ordinates referenced by the World Geodetic System of 1984 (WGS84)

2.2.4 Surveyor

FieldName	Type	Size	Description
Surveyor	Text	50	Surveyor Name
Address	Text	255	Surveyor Address
City	Text	50	Surveyor City
Zip Code	Text	50	Surveyor Zip Code
Country	Text	50	Surveyor Country
Postal Address	Text	255	Surveyor Postal Address (if different from above)
Postal City	Text	50	Surveyor Postal City (if different from above)
Postal Zip Code	Text	50	Surveyor Postal Zip Code (if different from above)
Postal Country	Text	100	Surveyor Postal Country (if different from above)
Tel	Text	50	Surveyor phone number
Fax	Text	50	Surveyor fax number
Telex	Text	50	Surveyor telex
E-mail	Text	200	Surveyor e-mail
Nationality	Text	100	Nationality of the applicant
Place of registration	Text	255	Place of registration if the Surveyor is a juridical person
Place of business	Text	255	Place of business if the Surveyor is a juridical person
Sponsoring States	Text	200	States sponsoring the Surveyor for exploration or exploitation
Representative	Text	50	Surveyor Designated representative (if different from above)
Representative	Text	255	Representative Address
Representative City	Text	50	Representative City
Representative Zip	Text	50	Representative Zip Code
Representative	Text	100	Representative Country
Representative Postal	Text	255	Representative Postal Address
Representative Postal	Text	50	Representative City
Representative Postal	Text	50	Representative Zip Code

Representative Postal	Text	100	Representative Country
Representative Tel	Text	50	Representative phone number
Representative Fax	Text	50	Representative fax
Representative Telex	Text	50	Representative telex
Representative E-mail	Text	200	Representative e-mail
Comments	Memo	0	Comments

This table records information about the prospector or explorer as specified in Annex 1 and Annex 2 of the Mining Code (ISBA/LTC/WP.1/Rev.1).

2.2.5 Lookup Tables

TableName	FieldName	Type	Size	Description
List Analysis	Analysis Code	Text	2	Analysis Code (NGDC)
List Analysis	Analysis	Text	100	Analysis method
List Country	Country	Text	50	Country name
List Lithology	Lithology	Text	50	Lithology of the seabed
List Morphology	Morphology	Text	50	Morphology of the sample
List Nucleus	Nucleus	Text	50	Nucleus Type
List Ocean Area	Ocean Area	Text	50	Ocean Area Name
List Sample Type	Sample Type	Text	50	Sample Type Name
List Sampling Device	Sampling	Text	50	Sampling Device
List Section Type	Section Type	Text	100	Section Type of the Nodule
List Texture	Texture	Text	50	Texture of the sample

Most of these lookup tables are based on the National Geographic Data Center (NGDC) codification, which is an extension of the codification, used by the Scripps Institute of Oceanography (SIO).

2.2.5.1 List Analysis

Analysis
PIXE (Proton Induced X-ray Emission)
Atomic Absorption spectrophotometry
Inductively coupled plasma atomic emission spectroscopy
x-ray diffraction, diffractometry
x-ray diffraction, powder camera
x-ray diffraction, single crystal
electron diffraction
Thermography
Alpha spectrometry
gamma ray spectrometry
UV spectrophotometry
calcimetry
Primarily ICP, except water, Platinum metals & oxides
wet chemical
specific ion electrode
atomic absorption spectroscopy (AA)
atomic absorption - graphite furnace
colorimetric
coulometric

CHN analyzer (Carbon/Hydrogen/Nitrogen)
ion chromatography
neutron activation
INAA
RNAA
mass spectrograph
fluorimetry
semi-quantative spectrograph
x-ray fluorescence
other, see documentation
unknown
EDXA
quantitative emission spectrograph
Direct quantitative emission spectrography
Induced quantative emission spectrography
calculation
fire assay - neutron activation
flame photometry
assay
microprobe analysis
x-ray emission used by SIO
gravimetric
polargraphy

2.2.5.2 List Lithology

Lithology
Biogenous Sediment
Calcareous clay
Calcareous ooze
Calcareous terrigenous material
Calcareous-siliceous ooze
Coral
Hardened sediment
Manganese pavement
Metalliferous Sediment
Pelagic clay
Phosphorite
Rock
Siliceous clay
Siliceous mud
Siliceous ooze
Terrigenous material (sand, silt, mud, gravel)
Volcanic ash
Weathered basalt
Zeolitic mud
Zeolitic Sediment

2.2.5.3 List Morphology

Morphology
Biological
Discoidal
Ellipsoidal
Faceted
Irregular
Poly (coaspheridal)
Pyramidal
Scoriaceous
Spheroidal
Tabular

2.2.5.4 List Nucleus

Nucleus
Altered basalt
Chert
Clay
Coral
Earbone
Glacial erratic
Metallic object
Nodule fragment
None apparent
Ooze
Palagonite
Pumice
Rock, unspecified
Sediment, unspecified
Tooth
Unknown
Volcanic
Zeolite

2.2.5.5 List Sample Type

Sample Type
metalliferous hydrothermal sediment
micronodules
micronodules in sediment
Mn coated organic material
Mn coated sediment
Mn crust or pavement
Mn encrusted sediment
Mn nodule in sediment
Mn nodule or nodules
nodules and micronodules
several crusts

stratiform deposit
unknown

2.2.5.6 List Sampling Device

Sampling Device
4-inch graviti core
5-inch Gravity Core
Accidental recovery, towed vehicle
Biological Box Core
Biological Grab
Box Core
Box Dredge
Box Grab
Bucket Dredge
Camera Core
Catcher Grab (on camera or core)
Chainbag Dredge
Combined Chain & Pipe Dredge
Compressed Air Core
Core Catcher
Dart Core
Deeptow Photograph
Drill Core
Drill Sludge Sample
Explosive Core
Free Fall Grab
Free-fall Core
Gravity Core
Gravity Core with Heat Flow Thermistors
Gravity Oriented Core
Heat Probe
Manipulator (mechanical arm)
Miscelaneous Core
Miscelaneous Dredge or Drag Haul
Miscelaneous Grab
Multiple Core, up to 5 Gravity Cores
Multiple Photograph (>1 frame same station)
Orange Peel Grab
Peterson Grab
Phleger Core
Pipe Dredge
Piston Core
Piston Oriented Core
Push Core
Rock Dredge
Rotary Core
Sanpper Grab

Scoop Bag
Shipek Grab
Side Wall Core
Soft Sediment Sampler
Sounding Grab
Spade Core
Submersible Undifferentiated
Survey (>1 frame, different stations)
Television or motion picture
Trawl
Trip Core (with Piston Core)
Triple Core (pre-1971)
Undifferentiated Deep Sea Drilling Project
Undifferentiated Grab Sampler
Unknown
Unspecified Dredge or Drag Haul
Unspecified Photograph (camera station)
Van Veen Grab
Vibrating Core
Von Herzen Core

2.2.5.7 List Section Type

Section Type
bulk composition - represents total material at surface location
composite 2-5 nodules or micronodules analyzed together
composite 6-12 nodules or micronodules analyzed together
composite of > 12 nodules or micronodules anlyzed together
core or nucleus of nodule
cross-section nodule
fragments or pieces
half nodule
inner part, without outer layer
layer adjacent to core of nodule
middle layer of nodule
nodule without core
one eighth of a nodule
outer layer or outer crust
point analysis (eg. Micropobe)
quarter nodule
sediment substrate
side of nodule or crust
split of bulk sample
topside of nodule or crust
underside of nodule or crust
unknown
whole nodule or crust

2.2.5.8 List Texture

Texture
Botryoidal
Cavernous
Microbotryoidal
Rough (granular/microbotryoidal)
Smooth

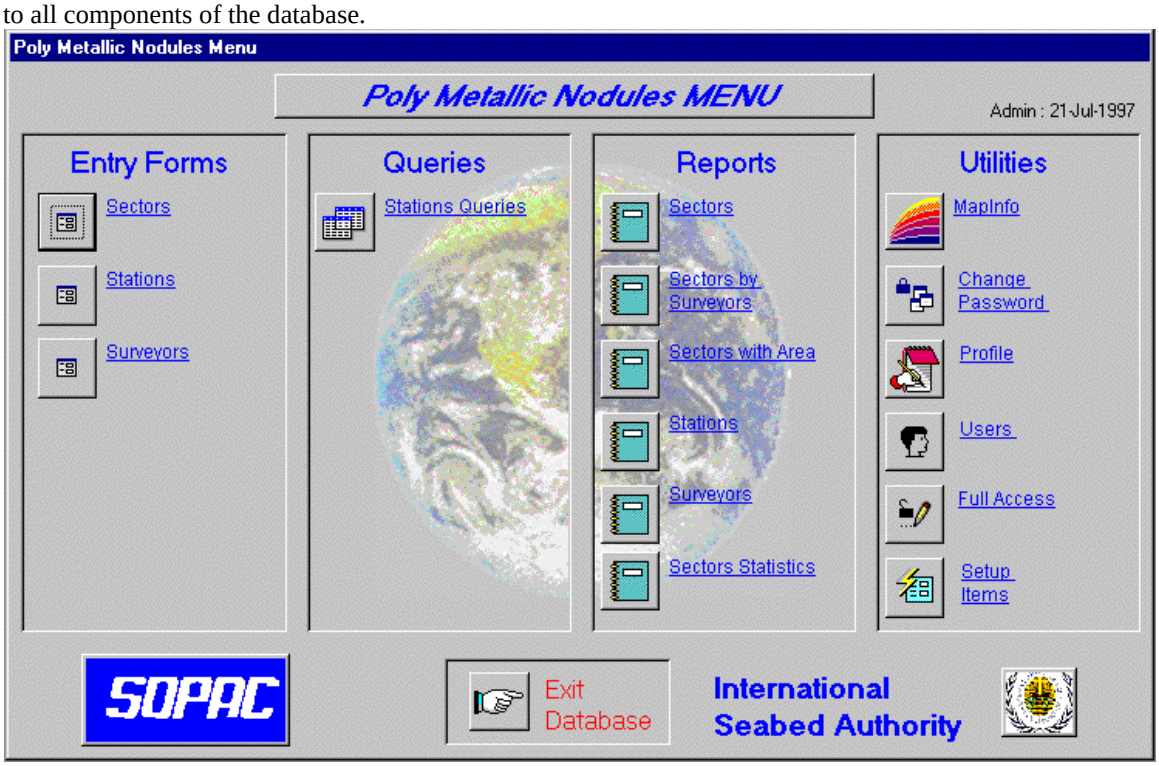
3 User Manual

3.1 Entering PolyDat Database

Polydat database is directly accessible from the hard drive. It is called polydat.mdb. Ms-Access 97 must be installed on the computer.

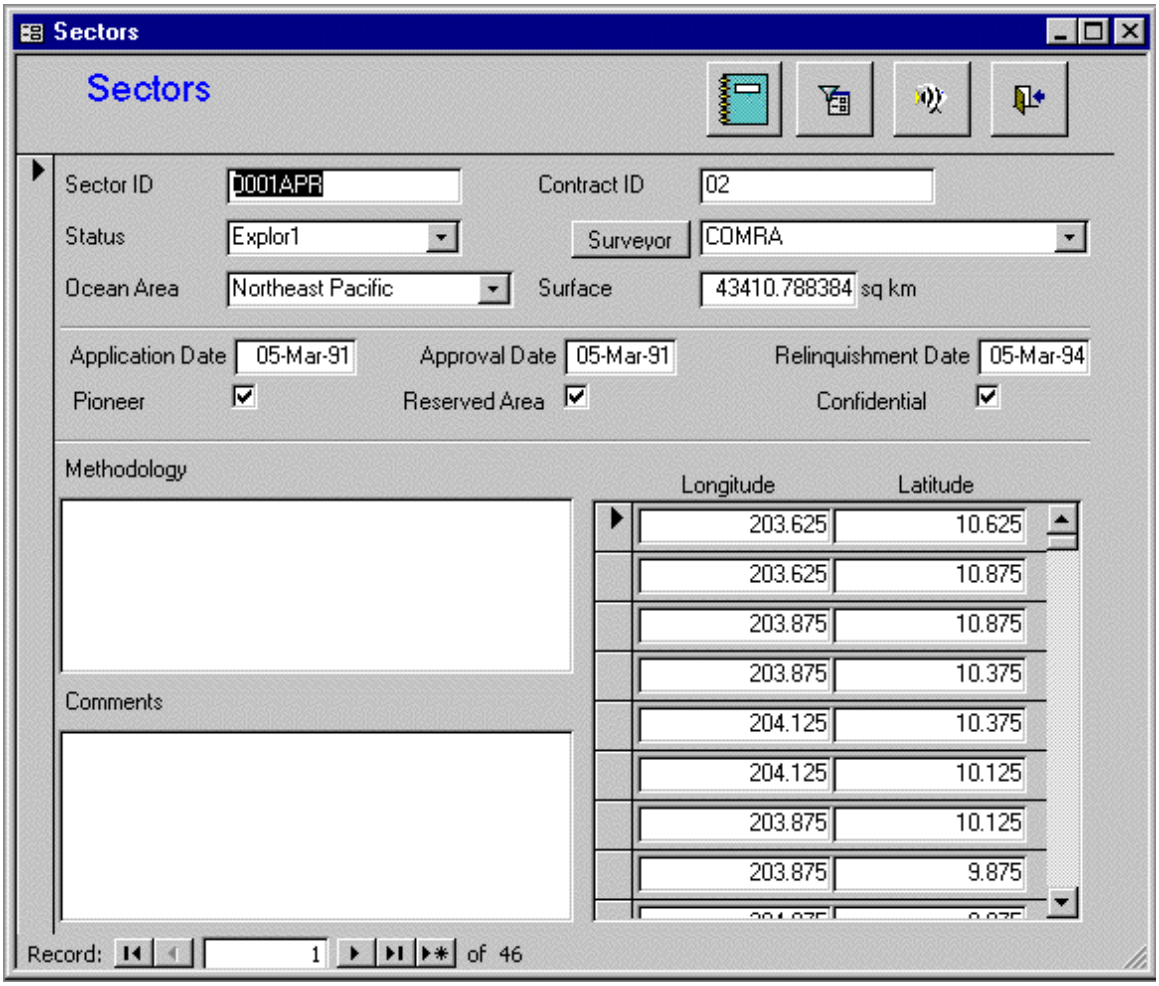
3.1.1 Main Menu

The PolyDat Menu is composed of 4 parts. The first one allows the user to access the data entry and consultations forms. The second part allows the user to formulate advanced queries. The third part allows the user to print reports. The last part allows the user to switch to MapInfo as well as to manage the access to all components of the database.



3.1.2 Data Entry

3.1.2.1 Sectors Form

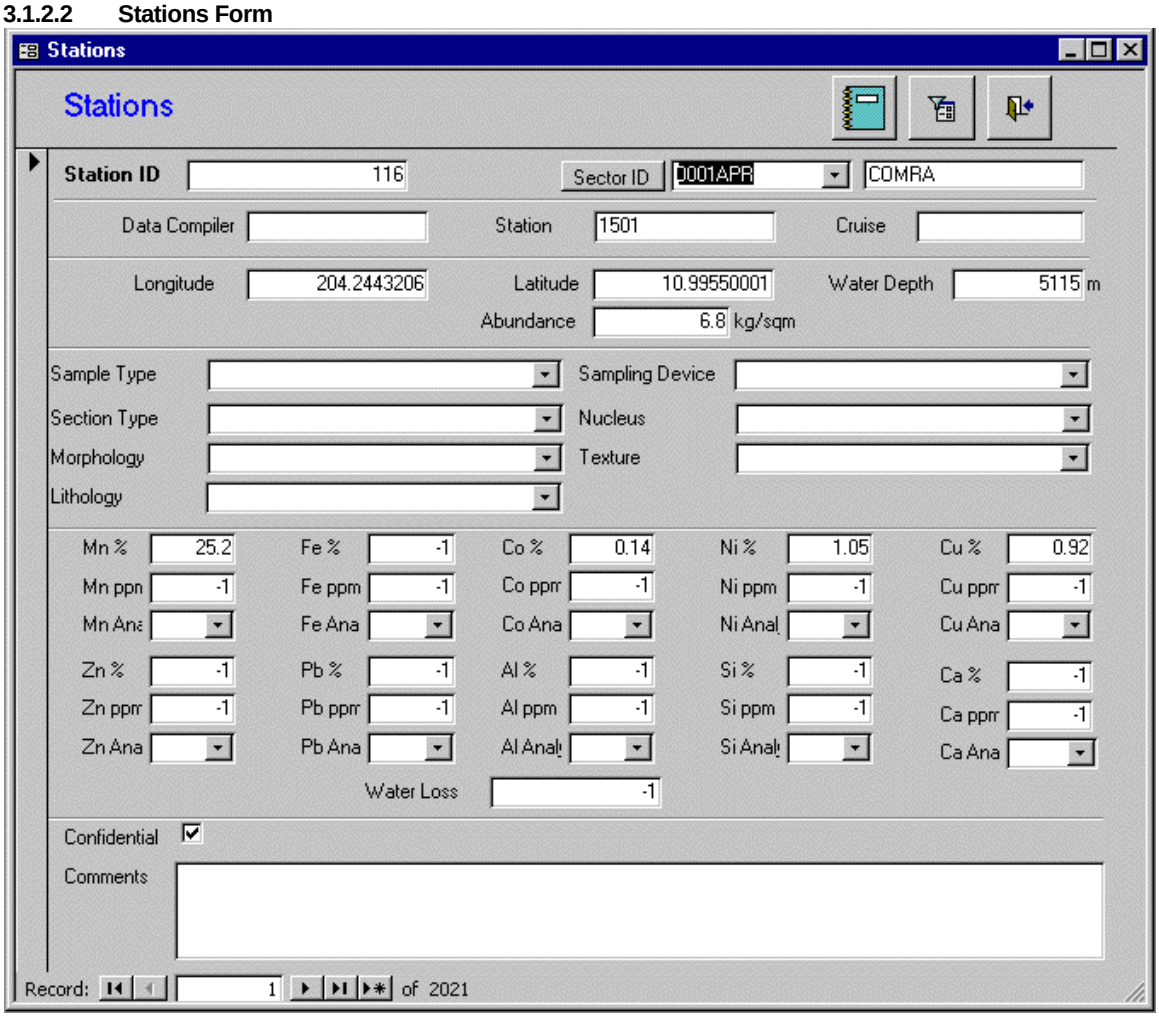


The sectors form records each sector and its derived relinquished sectors. Each sector is valid until its relinquishment date unless it is a reserved area. When a sector is relinquished, the operator should create a new sector with the same number in the Sector ID, but different letters classification. It will therefore be possible to follow each sector and its future relinquishment through the first 4 character of the Sector ID. The operator mustn't enter the relinquished area, but the area still reserved to the surveyor after it has been relinquished.

> *The Sector ID codification is as follow:*
>
> *DDDDAAB*
>
> *DDDD: Sequential number unique for each Sector.*
>
> *AA: AP Application; R1 sector after first relinquishment; R2 Sector after second relinquishment; R3Sector after third relinquishment; EX; Exploration; MN: Mining*
>
> *B: R Reserved to the Authority; P Pioneer investor sector; N Normal.*

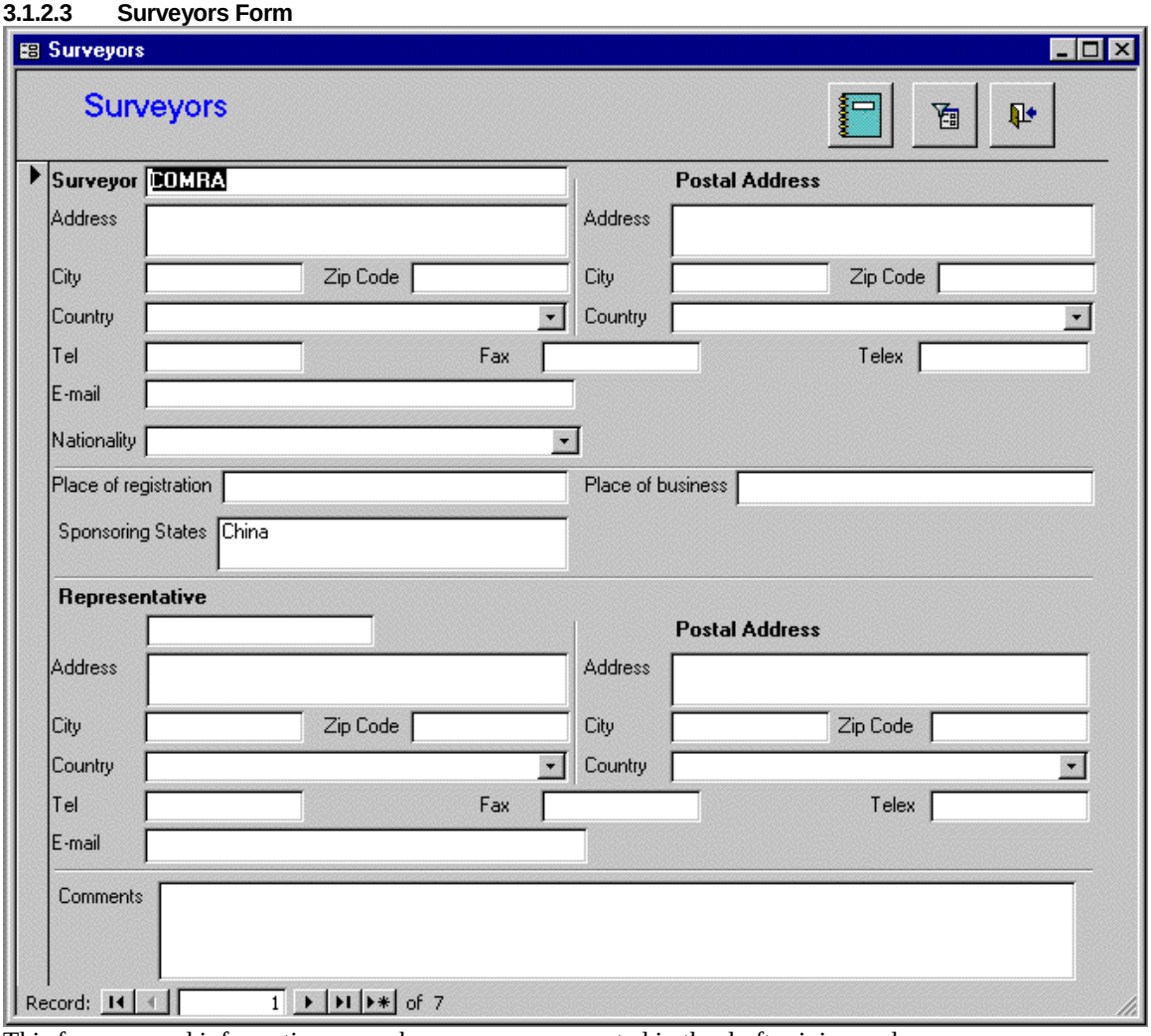
For Example:
0023APN Original sector
0023R1N Same sector minus first relinquishment area
0023R2N Sector minus second relinquishment area
0023MNN Sector with a mining licence

3.1.2.2 Stations Form



Each Sector contains a number of Stations collecting information about the seabed nodules. For element analysed, a value of –1 means that the element was not analysed while a value of 0 means no traces of this particular element were found.

3.1.2.3 Surveyors Form



This forms record information on each surveyor as requested in the draft mining code.

3.1.3 Notes on Forms

Forms are designed to be user-friendly, and the user should be aware of the following:

- Fields - these are the items of information to be stored in the database. Each time a new record is entered on a form, a new line of data is put into one or more underlying tables.
- Status Bar - If the user is not sure what to enter in a field, the status bar at the base of the screen will display the definition of the field that currently has the focus (i.e. which box on the form contains the cursor).
- Navigation buttons - these help the user to move or 'navigate' through the records.
- Other Buttons - these are usually located at the top right-hand side of the screen. Different symbols mean different actions e.g. closing door means 'close the form.' A pair of binoculars means 'Find a particular record.'
- Combo boxes - A combo box can make data entry easier, quicker, and more accurate by presenting a scrollable list from which values can be directly picked.

- Error Messages - to ensure data quality, there are built-in rules concerning the values data can be stored as. Some of these are summarised below.

Error Message	Applies to:
"The value you entered isn't appropriate for the field"	Fields whose underlying data type is different from the data you tried to enter. For example if you tried to enter text into a field whose data type is defined as a Number.
"The value you enter must match an entry in the list"	This applies to Combo Boxes when you try to enter a value that is not in the list, which is not acceptable for the list.
"The value you entered isn't in the list - do you want to add it?"	This applies to Combo Boxes when you enter a value that does not occur in the list, but which is accepted if you want to add it.
# Name?	The name entered as the source of the value in the field is invalid. For example, you may have entered an invalid name or expression for the ControlSource property: The name may be misspelled, you may have omitted the equal sign (=) before the expression, or the source itself may have been deleted. Other causes include the following: The field name may not match the name of a field in an underlying table or query. A control may have the same name as one of the fields in the underlying table or query. An expression designed to calculate a sum for a control might include a Sum function (which can be used to calculate sums for fields only, not controls).
# Error	Microsoft Access can't evaluate an expression used.
# Deleted	If you are working on the database at the same time as somebody else, this is the message that is displayed for a record that no longer exists because it has been deleted.
Custom Messages e.g. "Value must be either App1, initial application, Ren1, first renewal or Ren2, second renewal.	These depend on the underlying validation rule; in this case, the data that can be entered into this field is restricted to one of three values.

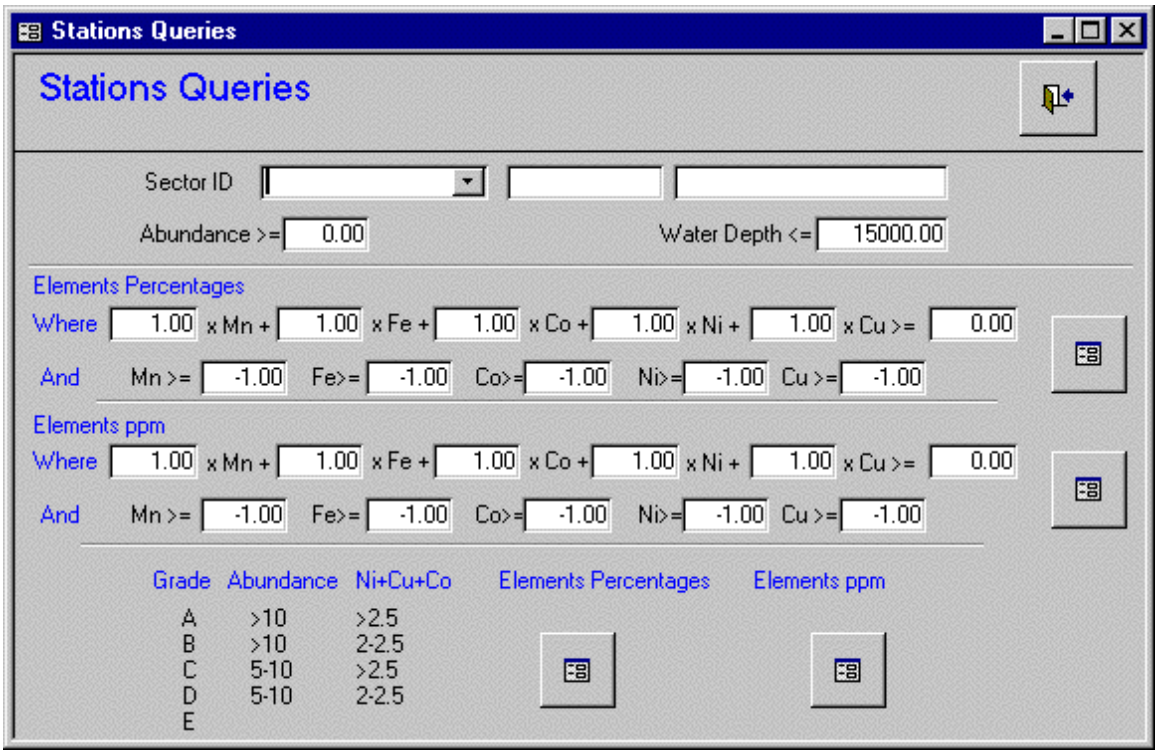
3.1.4 Queries

3.1.4.1 Filter By Form Queries

Each from contains a filter by form button. This button allows simple queries by filling values in a blank form. For instance to select all records in the Indian Ocean, click on the filter by form button, select Indian Ocean in the Ocean Area combo box, and apply the filter.

3.1.4.2 Stations Queries

This forms allows high level queries such as compute a market value of the nodules, and sort nodules by cut-off values, as well as display the grade of each nodule.



3.1.5 Reports

3.1.5.1 Forms report

Each form contains a report button. The report created contains all the records currently visible in the form. It is a great tool to select records with the filter by form button and then produce a corresponding report.

3.1.5.2 Sectors report

This report lists all sectors with their turning points as in the sector form.

3.1.5.3 Sectors by Surveyors report

This report classes the sectors by surveyor name and in 2 categories depending of the sector status if it is reserved for the Authority or not.

3.1.5.4 Sectors with Area Report

This report is particularly useful for verifying the turning points of each Sector.

3.1.5.5 Stations report

This report prints information of each station in the same format as the form.

3.1.5.6 Surveyors report

This report prints information for each surveyor in conformance with the mining code.

3.1.5.7 Sectors statistics report

This report prints statistics on each sector: average abundance, potential mining…

3.1.6 Utilities

There are five buttons, providing different facilities which are summarized briefly below:

- MapInfo - starts a MapInfo session
- Change Password - allows the user to change their password
- Profile - allows the user to set the correct drive path for loading data into MapInfo and in Access.

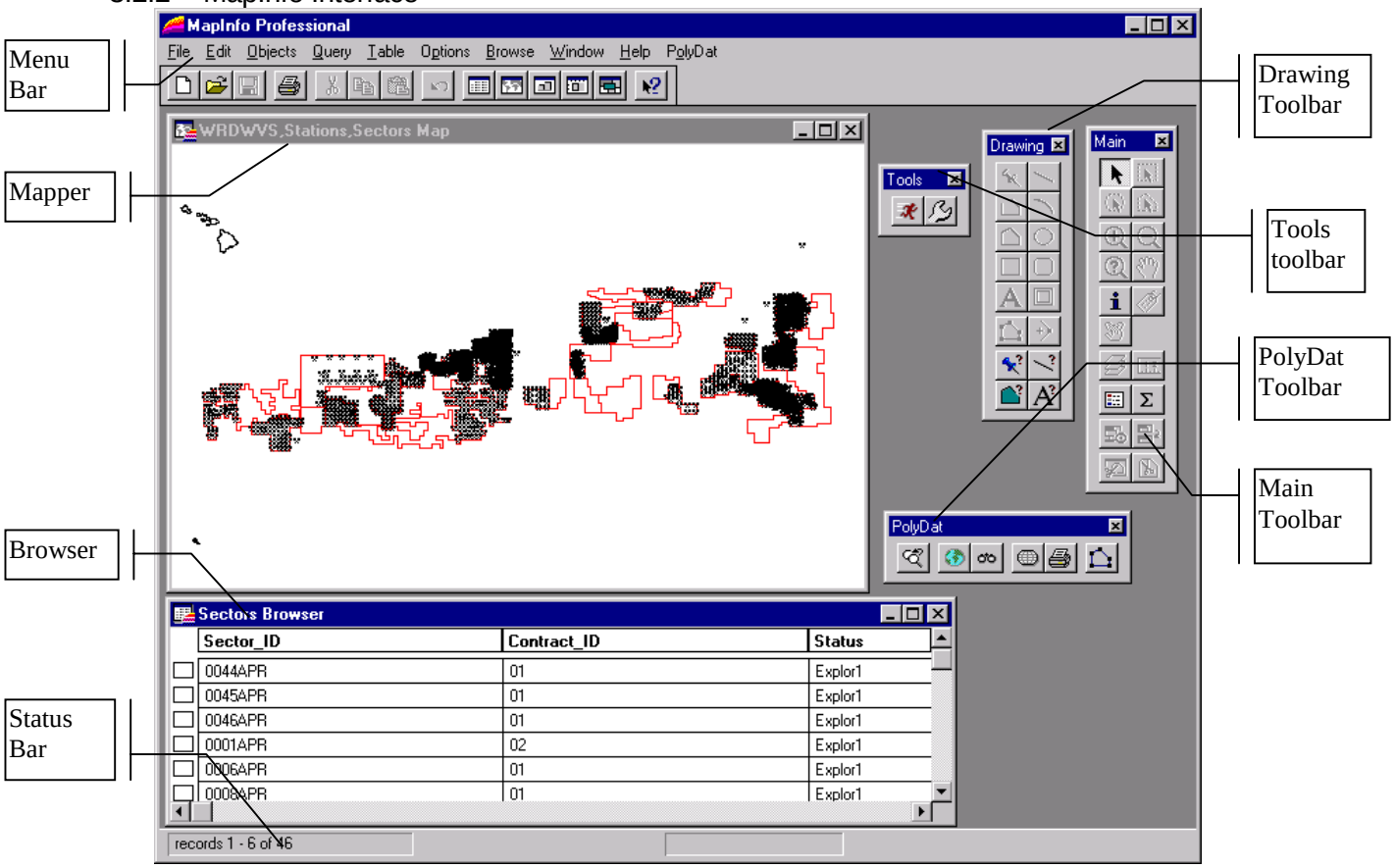
- User Management - assign a new user or change permissions - Database Manager only.
- Full Access - access to the actual workings of the database - Database Manager only.
- Setup Items – Create a shortcut in the start menu on Windows 95 for easy access to the database.

3.2 Entering PolyDat GIS

3.2.1 The Map System

To ensure the maximum coverage of the oceans, all data is stored in the longitude range: 0-360 degrees. All co-ordinates are in the World Geodetic System of 1984 (WGS1984). MapInfo allows changing projections and spheroid, but the operator must respect the coherence of the raw data to this datum.

3.2.2 MapInfo Interface



3.2.2.1 Opening a Table

Menu Bar -> File -> Open Table

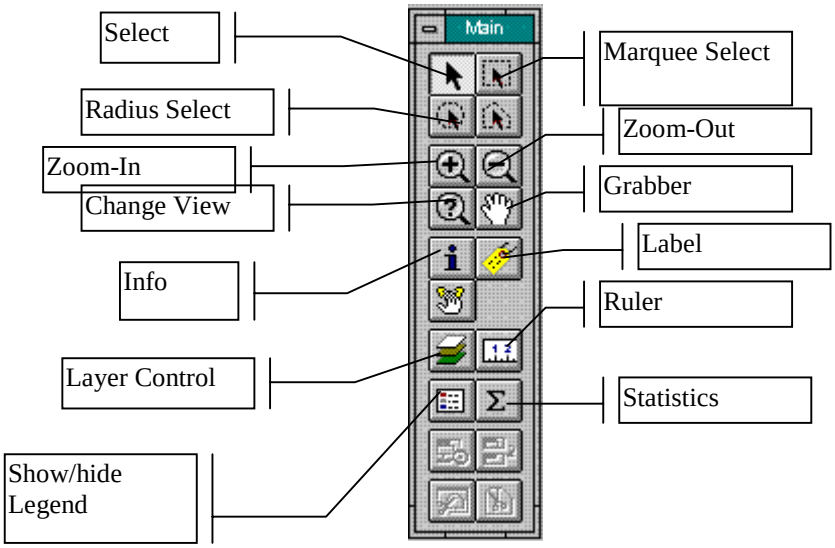
Several tables may be open at any one time; MapInfo regards all information as Tables, whether the file is a MapInfo table, an ASCII file, an Excel or Lotus 1-2-3 worksheet, a dBASE table or a raster image. If the data is tabular, the information will be presented in a browser, whereas if the selected file is a raster image, then it will either be added to the current mapper, or will appear in a new one.

3.2.2.2 Opening a Workspace

Menu Bar -> File -> Open workspace

A workspace enables a user to save their activity to a file, which when opened resumes tasks as they were left at the end of the previous session. Any objects left open at the end of the previous session will reappear in the same position in the MapInfo window.

3.2.2.3 The Main toolbar



3.2.2.3.1 The Info Tool

On selecting an object in the mapper, the info tool presents tabular data relating to the identified object.

3.2.2.3.2 The Select Tool

This appears as a pointer on screen, with which objects are selected by clicking the mouse.

3.2.2.3.3 The Marquee Select Tool

Objects within the mapper are selected within a user-defined rectangle by clicking and dragging with the mouse.

3.2.2.3.4 The Radius Select Tool

Objects within the mapper are selected within a user-defined circle.

3.2.2.3.5 The Zoom In Tool

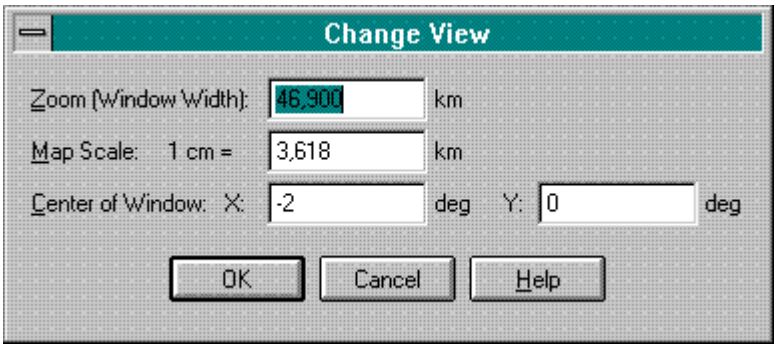
This can be used to magnify all or part of objects in the mapper.

3.2.2.3.6 The Zoom Out Tool

This does the opposite of the above tool.

3.2.2.3.7 The Change View Tool

Allows the user to specify the centre of the mapper as well as the scale.



3.2.2.3.8 The Grabber Tool

This allows a map to be moved around interactively.

3.2.2.3.9 The Layer Control Tool

This controls which layers are visible in the mapper window.

3.2.2.3.10 The Ruler Tool

Allows distances to be measured between two points on a map.

3.2.2.3.11 The Label Tool

This is used to label objects in a mapper.

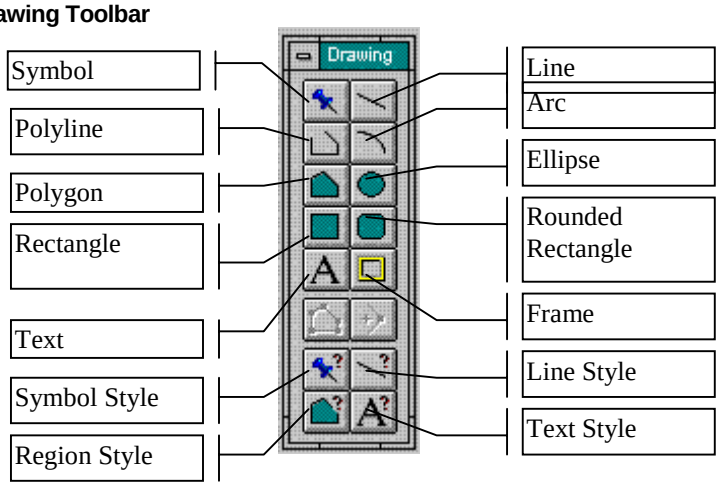
3.2.2.3.12 The Statistics Tool

Displays statistics of selected objects.

3.2.2.3.13 The show/hide legend tool

Displays the legend window.

3.2.2.4 The Drawing Toolbar



3.2.2.4.1 Adding Frames

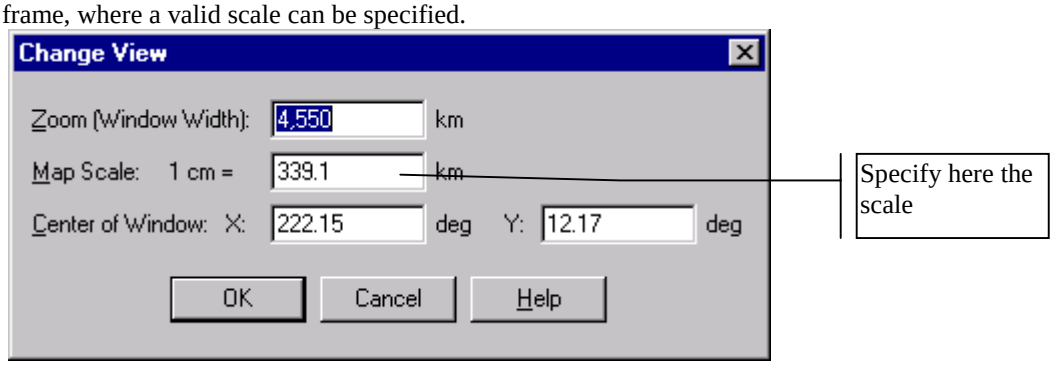
The frame tool enables the addition of a further mapper or other window available within the MapInfo Workspace

3.2.2.4.2 Adding Text on the Layout

Text or graphics may be added to the layout.

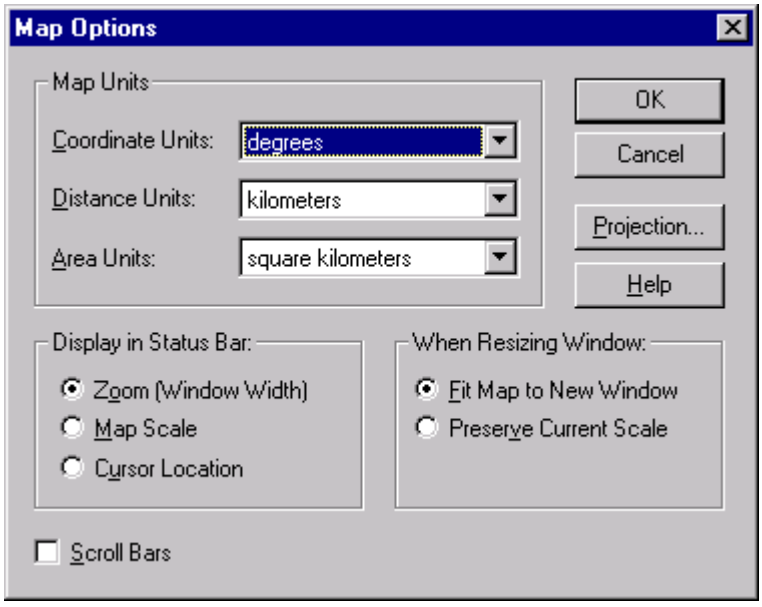
3.2.2.4.3 Selecting the Scale

Double clicking on the frame containing the mapper presents a window containing the parameters of the frame, where a valid scale can be specified.



3.2.2.5 Changing the view of a map

Menu Bar -> Map -> Options



3.2.2.5.1 Changing Map Units

Here the default unit system of the mapper can be changed.

3.2.2.5.2 Changing the Projection

A different projection for the mapper can be selected, although since some projections are only local, care should be taken when selecting alternative projections for wider maps.

3.2.2.5.3 Changing the information in the status bar

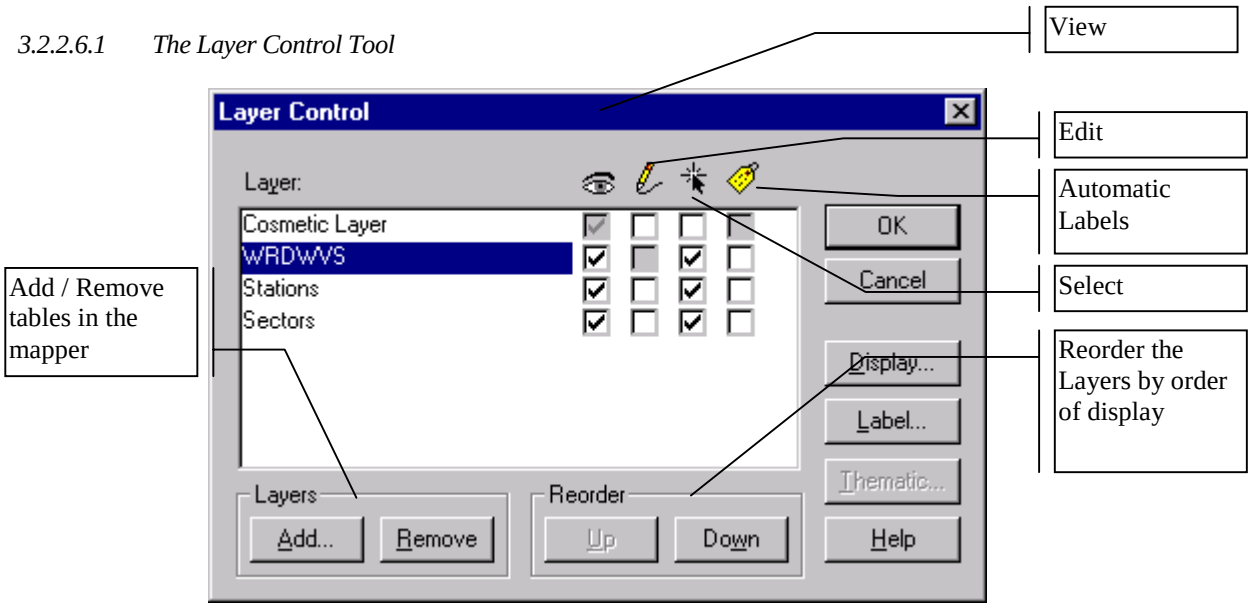
The status bar displays either the Zoom (width of the window), the location of the mouse in mapper coordinates, or the map scale.

3.2.2.5.4 Mapper behaviour when Zooming

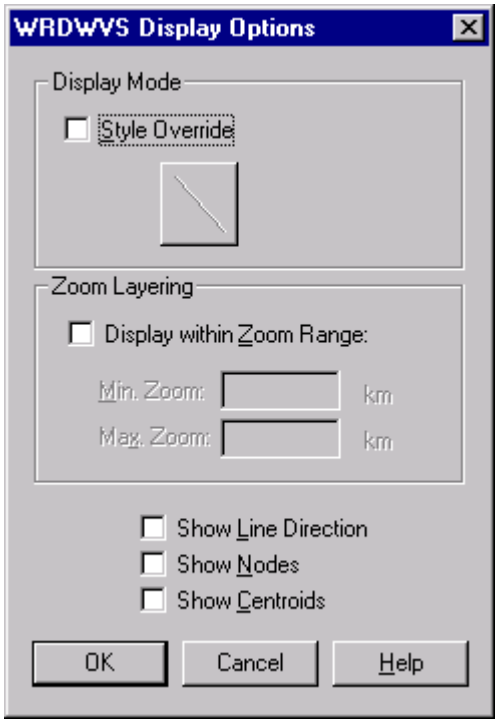
MapInfo either attempts to preserve the scale of the map in a mapper or displays the map at its best in the mapper despite the size of the window.

3.2.2.6 Displaying Data

3.2.2.6.1 The Layer Control Tool



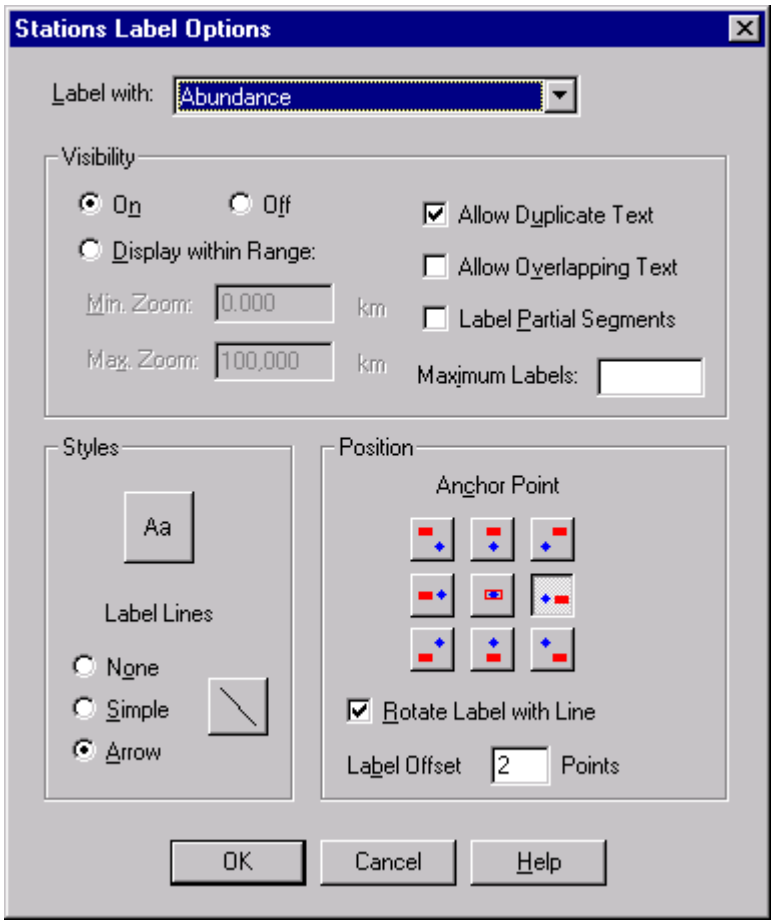
3.2.2.6.2 The Display button



In this instance, the default symbol assigned to the Station layer can be changed by checking the Style Override box, and then selecting a new symbol by clicking the button next to it.

3.2.2.6.3 The Label button

This Window specifies the default for the Auto Labelling of the layer.



3.2.2.6.4 The Open New map menu

> *Menu Bar -> Window -> Open New Map*

Allows you to open a new mapper with the selected tables.

3.2.2.6.5 The Open New Browser menu

> *Menu Bar -> Window -> Open New Browser*

Open the Browser view of the selected table. This view is more the “database view” of the data.

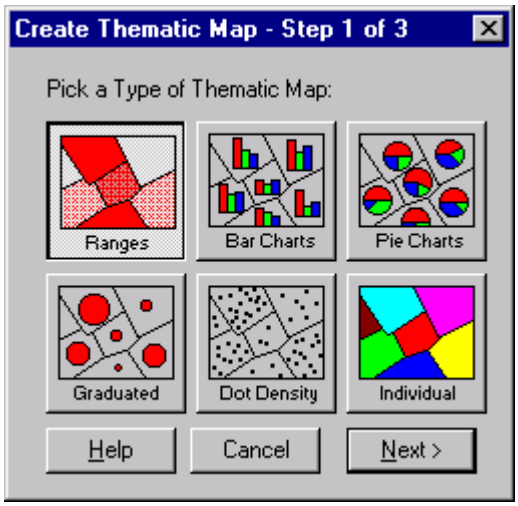
3.2.2.6.6 Find Data

> *Menu Bar -> Query -> Find Selection*

This zooms to the location of an object when it has been selected in either the browser or mapper view.

3.2.2.7 Create Thematic maps

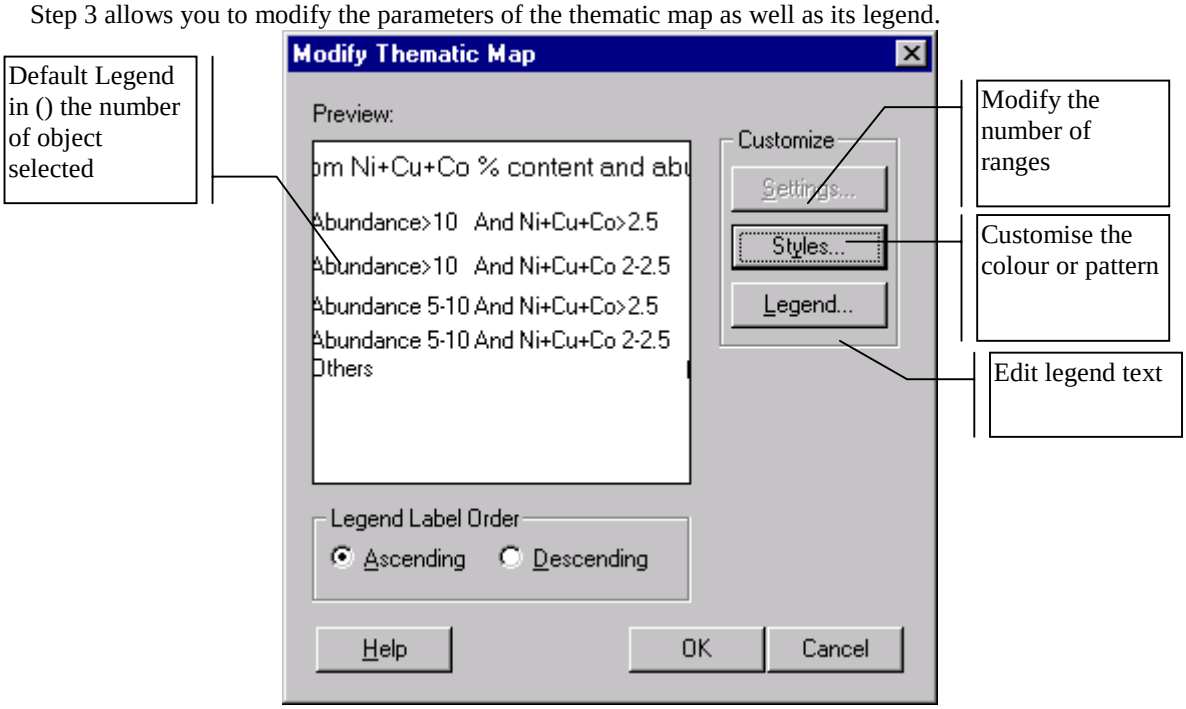
> *Menu Bar -> Map -> Create Thematic Map*



Six categories of thematic maps are available:

- Ranges: The colour represents the value of one column of a table.
- Bar Charts: to display several columns together
- Pie Charts: to display percentages
- Graduated: to display the value of one column as a symbol, of which the size is proportional to the value of the column
- Dot Density: one dot is a defined quantity in one column
- Individual: one object by colour

Step 2 of the thematic map allows you to specify the columns of which table to display.
Step 3 allows you to modify the parameters of the thematic map as well as its legend.



At any time you can modify a thematic map:

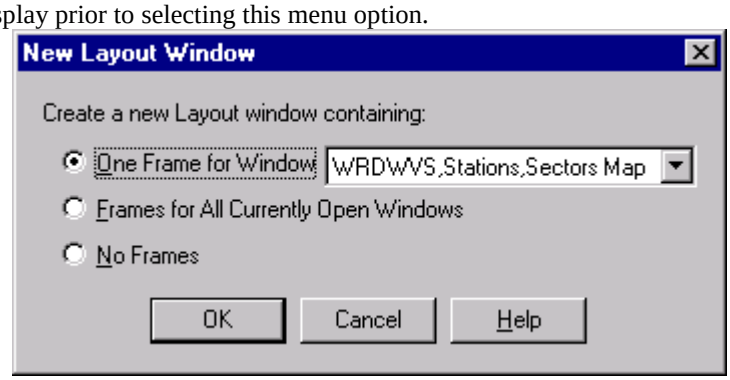
Menu Bar -> Map -> Modify Thematic Map

3.2.2.8 Create and print maps

3.2.2.8.1 The Open New Layout Menu

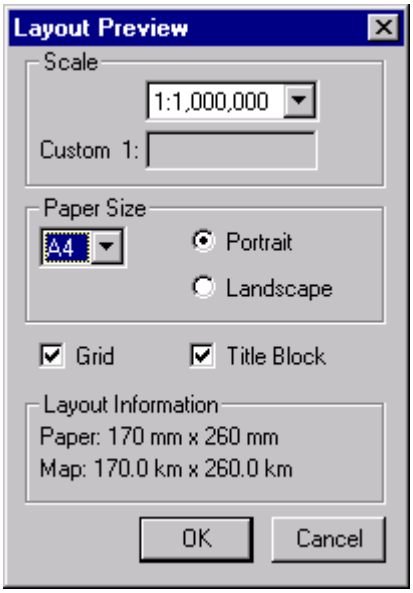
Menu Bar -> Window -> Open New Layout

Prior to printing the layout, objects in the MapInfo window should be displayed exactly as they are required in the printed copy. Therefore, the user should zoom in or out as necessary in order that the relevant portion of the map is on display prior to selecting this menu option.



3.2.2.8.2 The Automatic Map Creation

Menu Bar -> PolyDat -> Layout Preview



An automatic map tools has been designed to ease the burden of creating maps. This tool requests the user to select the paper format and the orientation. It will then display a rectangle on the current mapper, that the user will be able to place on the desired area. After accepting the position, the tools will automatically draw a grid, a title block, and put the different elements on the paper. The final output is a map with an automatic scale and information about the projection used.

3.2.3 Data Manipulation

3.2.3.1 SQL Select

This is a powerful way of querying data, accessible from the Query menu. and is available when at least one table is open. By using one or more database tables to make selections based on certain criteria, it can be used to generate query tables, join tables, or to create derived columns, e.g. to calculate the sum of all values in a selected column, etc.

The following requirements are necessary in order to formulate a query:
1. Name the tables that are to be used
2. Select columns from the tables to be used
3. Specify a 'where' condition

Further conditions are optional and depend on the nature of the query, which are:
4. Group by (to create subtotals, etc)
5. Order by (to place the columns that are output into a particular order)

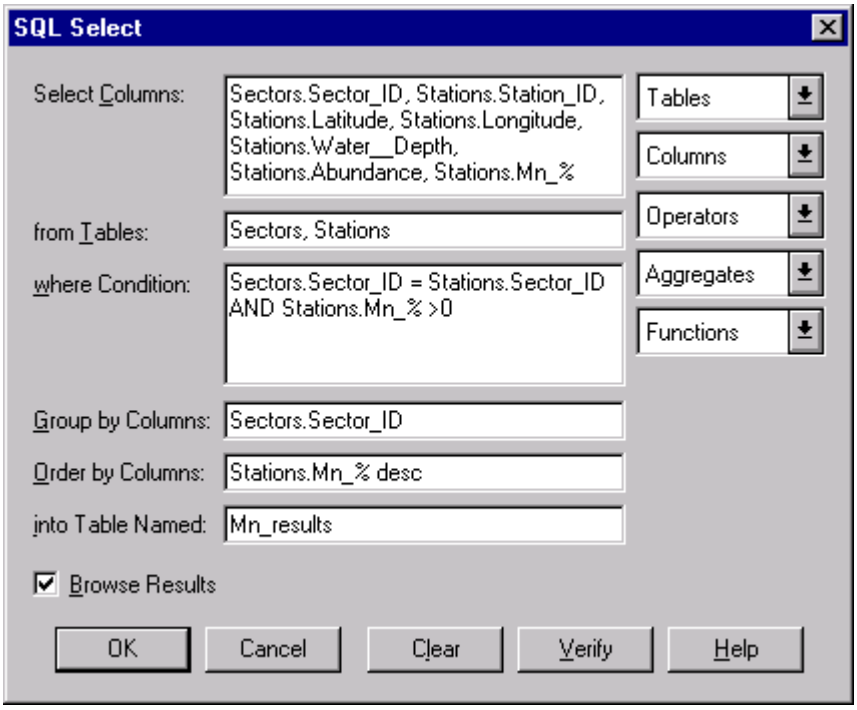
3.2.3.1.1 Structuring a query

Select Columns	List the columns that are required in the output query. However, until the tables have been selected, an asterisk appears in the list, which will select all columns. In order to select specific columns, choose a table from the next box and then come back to the Select Columns box, which will then display a list of all available columns.
from Tables	Select from a list of tables from the drop-down list.
Where condition	This specifies which records from the table(s) are to be included in the output. A Where condition is necessary if selection involves more than one table. This is in order that the tables are joined properly. The Where condition is comparable to two sides of an equation, with the values in one field of table A are equal to the values of a field in table B.
Group by Columns	This groups rows in the query table so that all rows with the same values for specified columns are grouped together.
Order by Columns	Specify the order that MapInfo lists or sorts the records in the query table. By default, MapInfo orders records in ascending order. This can, of course be set to descending order if the user requires this.
into Table Named	This gives the query table a name, otherwise MapInfo assigns a default name of 'Selection', and windows based on this table will be labeled as 'Query1', "Query2' etc. However, although a name may have been given to the table, it is still temporary and must be saved in order to preserve it.

Example

Select Columns	Sectors.Sector_ID, Stations.Station_ID, Stations.Latitude, Stations.Longitude, Stations.Water__Depth, Stations.Abundance, Stations.Mn_%		Selection of columns from two different tables. Note that since more than one table is being used that Mapinfo automatically prefixes each column with the name of the table it is from. Note also that each selected column is automatically separated from the next by a comma.
from Tables	Sectors, Stations		The selected tables for use in this query
Where condition	Sectors.Sector_ID Stations.Sector_ID	= AND	Selects information from each table on the basis of the records being connected by the

	Stations.Mn_% >0	same Sector number (Sector_id), and only returns those records with a value for Manganese that is greater than zero.
Group by Columns	Sectors.Sector_ID	Group the records together by Sector number.
Order by Columns	Stations.Mn_% desc	Return those records with the highest Manganese value first. Note that the usual default is ascending order.
into Table Named	Mn_results	Copy records into a table with this name.



3.2.3.1.2 Aggregate Functions

These are useful for summarizing data, and are used in the Select Columns box in the SQL Query dialogue. For example, the Samples table contains a large amount of analytical data. The user may wish to find out how many samples from the total number have been recorded as containing above a certain concentration of a given element, and also what the average value is.

Examples of typical queries using Aggregate Functions:

1. How many samples taken in Santo contain more than 3 ppm gold?
2. Of the samples containing above this threshold, what is their average gold value?
3. Of the samples containing any gold , what are the maximum and minimum values?

Solutions:

1.
```
SELECT COUNT(*)
FROM STATIONS
WHERE TEXTURE = "Smooth" AND Mn_ppm > 3
```
2.
```
SELECT AVG(Mn_ppm)
FROM STATIONS
WHERE TEXTURE = "Smooth" AND Mn_ppm > 3
```
3.
```
SELECT MIN(Mn_ppm), MAX(Mn_ppm),
FROM STATIONS
WHERE TEXTURE = "Smooth" AND Mn_ppm > 0
```

A summary table of available aggregate functions is listed below.

Aggregate Function	**Description**
Avg()	Finds the mean value of data in a specified field
Count(*)	Counts the number of rows fulfilling certain criteria
Min()	Finds the minimum value in a group of records for a specified field
Max()	Finds the maximum value in a group of records for a specified field
Sum()	Finds the sum of values within a group of records for a specified field
WtAvg()	Finds the weighted average in a group of records for a specified field

For all functions other than Count(*) the field name is inserted between the brackets as they are applicable to individual fields. Count applies to all records and so * is the only possible argument that can be held between the brackets.

3.2.3.1.3 Joining two tables

This is required when records in one table contain related records in another table. For example, a user may wish to retrieve details of samples relating to a specific licence area.

Example

```
SELECT
SECTORS.SECTOR_ID,
STATIONS.STATION_ID,
STATIONS.LONGITUDE,
STATIONS.LATITUDE,
STATIONS.SAMPLE_TYPE,
STATIONS.MN_PPM,
STATIONS.FE_PPM,
FROM STATIONS, SECTORS
WHERE STATIONS.SECTOR_ID = SECTOR.SCTOR_ID AND SECTORS.SECTOR_ID ="0001APR"
```

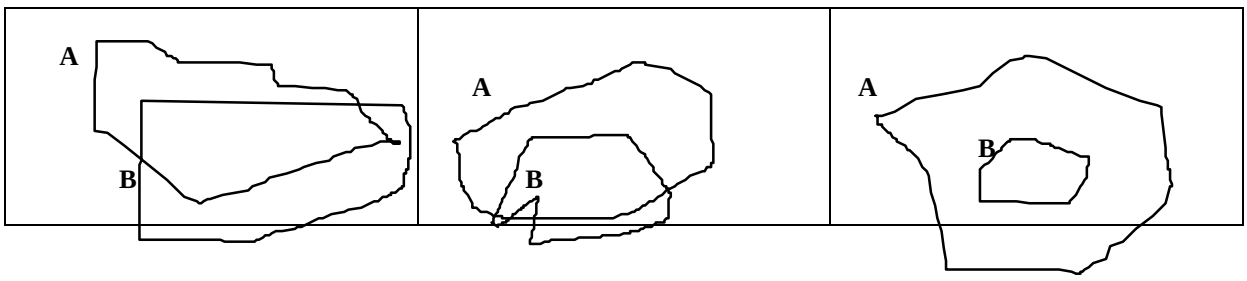
Note how each column is prefixed with the name of the table it belongs to. Also note the joining of equivalent fields on SECTOR_ID. This is known as an 'equi-join' since records will only be returned if they exist in both tables for the same SECTOR_ID.

3.2.3.1.4 Geographic Operators

These allow the user to select objects on the basis of their spatial relationship to some other object. MapInfo has a special keyword that is used with geographical operators, which is "obj" or "object", which tells MapInfo to select values based on graphical objects.

A summary table of available geographical operators is listed below.

Operator	**Description**
Contains	Object A contains Object B if B's most central point is anywhere within the boundary of Object A.
Contains Entire	Object B is entirely contained within Object A if B's boundary is completely contained with the boundary of A.
Within	Object A is within Object B if A's most central point is anywhere within the boundary of Object B.
Entirely Within	Object A is entirely within Object B if A's boundary is entirely within the boundary of Object B.
Intersects	Object A intersects Object B if they have at least one point in common or if one of them is entirely within the other.



Object A contains Object B Object B within Object A	Object A intersects Object B Object B intersects Object A	Object A contains entire Object B Object B is entirely contained within Object A

Example

Here is a query that will pick up all samples that are contained within a given licence area.

```
SELECT
STATIONS.STATION_ID,
STATIONS.LONGITUDE,
STATIONS.LATITUDE,
STATIONS.SECTOR_ID,
SECTORS.SECTOR_ID,
FROM STATIONS, SECTORS
WHERE STATIONS.OBJ WITHIN SECTORS.OBJ
AND SECTORS.SECTOR_ID = "0002APR"
```

Result

STATION_ID	LONGITUDE	LATITUDE	STATION.SECTOR_ID	SECTORS.SECTOR_ID
3	166.58250	14.80180	0001APR	0002APR
4	166.55372	14.79613	0002APR	0002APR
5	166.55282	14.80372	0002APR	0002APR
6	166.55167	14.80632	0002APR	0002APR
7	166.63864	14.81109	0002APR	0002APR
8	166.63849	14.81269	0002APR	0002APR
9	166.55328	14.80604	0002APR	0002APR

Note that although a specific SECTOR_id was quoted in the syntax of this query, any station that have been collected within the bounds of that Sector area are returned in the result, which is particularly useful as it gives the user a detailed perspective of all data connected with a particular geographical region.

3.2.3.1.5 Logical Operators

These enable the user to make a query more specific, and allow logical expressions to be added to the structure of the query.

Operator	Description
=	Equal to
<>	Greater or less than
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to
+	Plus
-	Minus
*	All
/	Divided by
And	e.g. WHERE TEXTURE="Smooth" **AND** Mn_% > 0
Or	e.g. WHERE OCEAN_AREA ="Indian Ocean" **OR** "Northeast Pacific"
Not	e.g. WHERE Mn_% **NOT** < 3
Like	e.g. WHERE SURVEYOR **LIKE** "%IOM%" Note: the % symbols either side of the word 'IOM' tell MapInfo to search through the records and identify strings containing this word in the Surveyor field.

3.2.3.1.6 String Operators

Strings must be enclosed in double quotes. Also, when structuring an SQL Select query to include certain fields, attention must be given to the data type of those fields; for example, the data type of SECTOR_id is

Text, meaning that this field can contain both alphabetical or numerical characters. Therefore, when searching for a specific SECTOR_id in a query, the value must be enclosed in double quotes.

Example

```
SELECT *
FROM SECTORS
WHERE SECTOR_ID = "0001APR"
```

*3.2.3.1.7 Wildcards % and **

As seen earlier above, the % symbol was used to narrow down criteria within a search string, i.e. %IOM% means that Mapinfo will scan through all records containing this word in the specified field. Another wildcard that is often used in SQL Select is the * (shift-8) symbol, e.g. SELECT * FROM SECTORS, means 'select all records from table SECTORS.

3.2.3.1.8 Derived columns

A derived column is a column that contains the results of calculations performed on another column or columns.

An example of such a derived value might be the calculation of the ratio between two elements in sample in order to identify possible trends in the underlying pattern of mineralisation.

Example

```
SELECT STATION_ID, LONGITUDE, LATITUDE, Mn_ppm, Ni_ppm, Mn_ppm/Ni_ppm
FROM STATIONS
WHERE Mn_ppm > 0 AND Ni_ppm > 0
```

Output:

STATION_ID	LONGITUDE	LATITUDE	Mn_ppm	Ni_ppm	Mn_ppm/Ni_ppm
1	168.38467	17.54024	0.38000	260.00000	684.21053
2	168.38565	17.54280	0.00500	425.00000	85000.00000
3	168.38580	17.54368	0.03500	195.00000	5571.42857
4	168.38538	17.54591	0.00800	125.00000	15625.00000
5	168.38510	17.54862	0.01200	270.00000	22500.00000
6	168.38515	17.54925	0.02200	500.00000	22727.27273
7	168.38402	17.55122	0.02000	430.00000	21500.00000
8	168.38410	17.55216	0.00800	400.00000	50000.00000
9	168.38408	17.55259	0.01500	30.00000	2000.00000
10	168.38724	17.55518	0.01200	115.00000	9583.33333
11	168.38578	17.56004	0.01200	900.00000	75000.00000
12	168.38651	17.56259	0.01700	310.00000	18235.29412
13	168.35639	17.54442	0.01300	270.00000	20769.23077
14	168.35862	17.54464	0.00700	180.00000	25714.28571
15	168.36131	17.54802	0.02800	325.00000	11607.14286

3.2.3.1.9 Column Aliases

When MapInfo creates a derived column, the expression used in the calculation is used as the title for the column. Since this can often look untidy and unintelligible, an alias can be used.

For example, the alias would be created thus within the above SQL statement:

```
SELECT STATION_ID, LONGITUDE, LATITUDE, Mn_ppm, Ni_ppm, Mn_ppm/Ni_ppm “Ratio of Manganese to Nickel”
FROM STATIONS
WHERE Mn_ppm > 0 AND Ni_ppm > 0
```

The required calculation would be done and the result stored in a new column with title “Ratio of Manganese to Nickel”.

3.2.3.1.10 Keywords

These keywords can be used in SQL Select expressions, and their uses are summarized below.

Keyword	**Meaning**
Any	To select any item in a set of items
In	To select records relating to a list of possible values
Between	To select records containing values within a certain specified range

Any

```
SELECT *
FROM SECTORS
WHERE OCEAN_AREA = ANY ("INDIAN OCEAN", "NORTHEAST PACIFIC", "SOUTH PACIFIC ")
```

In

```
SELECT SECTOR_ID, SURVEYOR, OCEAN_AREA
FROM SECTORS
WHERE OCEAN_AREA IN ("INDIAN OCEAN","NORTHEAST PACIFIC")
```

Between

```
SELECT *
FROM STATIONS
WHERE Mn_ppm BETWEEN 100 AND 200
```

3.2.3.2 Using Surfer contouring software to visualize geochemical data

This software enables the user to convert sample point data into interpolated areas, in order that any chemical trends become more apparent. This is particularly useful in the identification of regions of high concentration of a particular chemical element.

1. In MapInfo, make sure that the Stations layer is visible. For a particular cluster of stations that are of interest, click the Marquee select button, and then click and drag to select stations points. Then, click the Browser button to view the selected stations. This viewer will be labeled at the top left-hand corner with the name of the query, e.g. Query1.
2. In order to use Surfer, data needs to be in an X Y Z format, where X and Y are locational parameters, in this case Longitude and Latitude, and Z is the value to be modeled, which in this case will be the abundance. Therefore, in order to put the data into the required format, SQL Select is used to extract only those columns that are needed.
   From the MapInfo Query menu, choose option SQL Select.
   An example of typical syntax might be:
   SELECT LONGITUDE, LATITUDE, ABUNDANCE
   FROM QUERY1
   WHERE ABUNDANCE>=0
   followed by OK.
3. The resulting browser would then be exported in ASCII format; from the Table menu, select Export, naming the table as Abundance for example. When using ASCII, a tab delimiter is used to separate the columns, so make sure that this is selected in the resulting dialogue window, and check the box that reads 'Use first line for column titles'.
4. Now leave MapInfo by either closing open objects or by minimizing the window. Start Surfer by navigating to Golden Software, Surfer32 from the Start button located at the bottom left-hand corner of the screen in the Windows 95 interface.

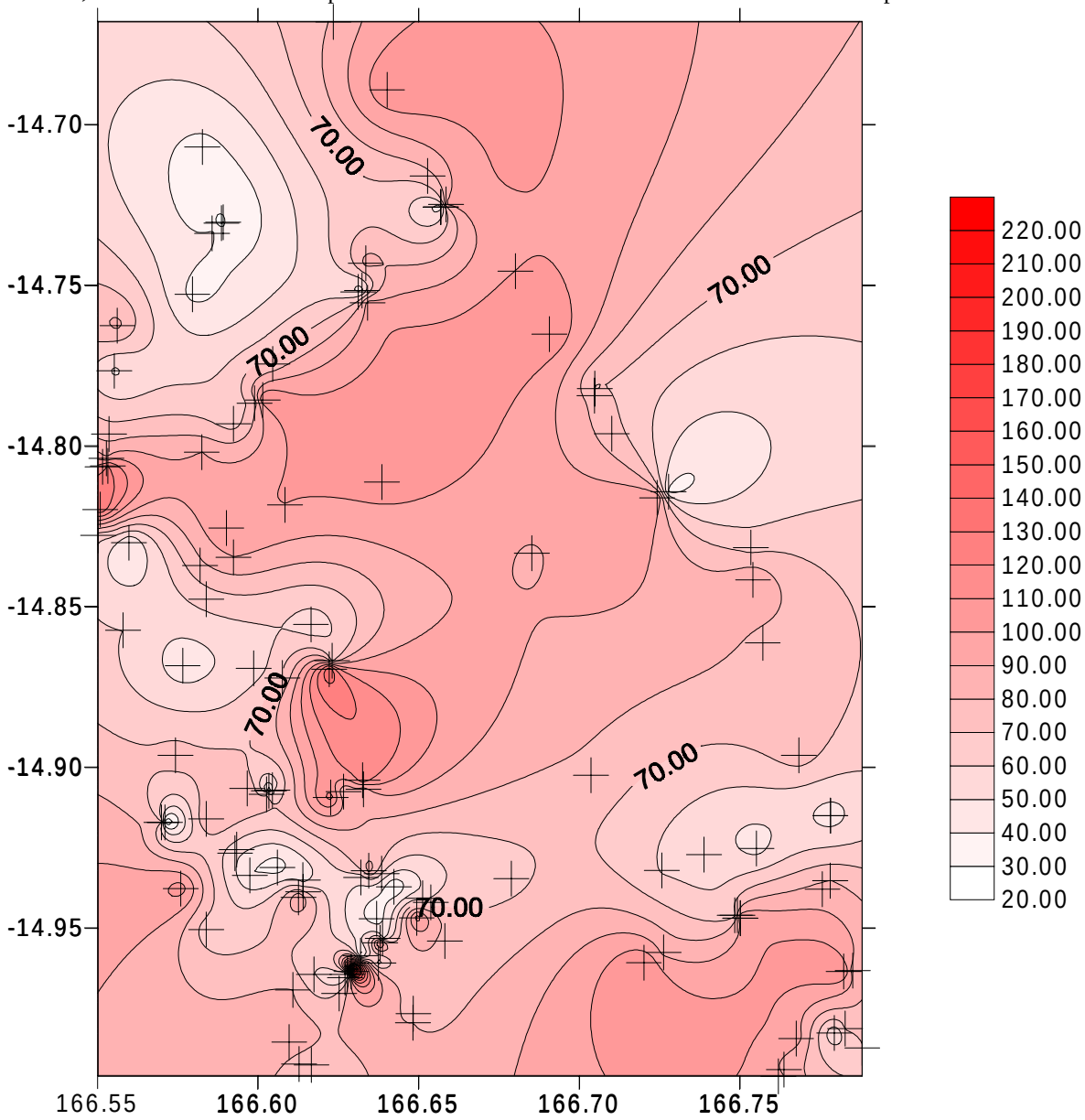
Prior to a contour, surface or other plot being produced, the data has to be gridded. This is in order that a regularly spaced pattern of Z values can be produced from data that may not have been sampled on a regular grid spacing, and therefore the gridding procedure generates a Z value at each X, Y location on the grid by interpolation or extrapolation, i.e. gridding fills in the gaps where no Z value data exists.

5. To produce a grid, select menus options Grid, Data, and navigate to the directory where the ASCII file is stored, select it and press the OK button. A window will now be visible; at the top there are three boxes for the user to indicate which columns from their ACSII file will be used as X, Y and Z. There is also a Grid Line Geometry section which determines the grid spacing. This is usually pre-determined by the program, but can be altered by the user.

The gridding method can be selected from a drop-down list. However, Kriging is the default gridding method because it generates the best overall interpretation of most data sets and is flexible in that it can be used to grid almost any type of data set, whether the data is regularly or irregularly spaced.
Another likely gridding method to use with large geological data sets would be Triangulation with Linear Interpolation. The main advantage of this method is that if there is enough data, any break lines that exist will be preserved. For example, if a fault is delimited by enough points on either side of the fault line, the grid generated by triangulation will reveal its presence.

6. Finally, prior to the grid being produced, the user must assign a name to the grid file, by clicking the Browse button and navigating to the directory where the grid file is to be stored. To start gridding, press the OK button.

When a grid has been produced, the resultant data can be visualized in a number of ways, including contour, shaded relief or surface plots. The commands for these are accessed from the Map menu.



An example of a contour plot displaying Abundance of Nodules concentration in kg/sqm and Stations points as crosses.

3.2.4 Polydat Menu and Toolbar

3.2.4.1 PolyDat Menu

This menu has several options, which are summarized below.

3.2.4.1.1 Rebuild All

This option should be taken if the user has just finished entering both Sectors and Station information from within the database in Access. This command looks up new records, which have been input to the Sectors and Stations tables, and builds spatial objects from Latitude and Longitude values in these tables.

3.2.4.1.2 Rebuild Sectors

This option should be selected if the user has entered Sectors data. This command will then build polygon objects representing the additional Sectors areas. The system stores also the sector area in the appropriate field in the sectors table.

3.2.4.1.3 Rebuild Stations

This option should be selected if the user has entered sample data. This command will then build point objects representing the additional Stations.

3.2.4.1.4 Stations Entry

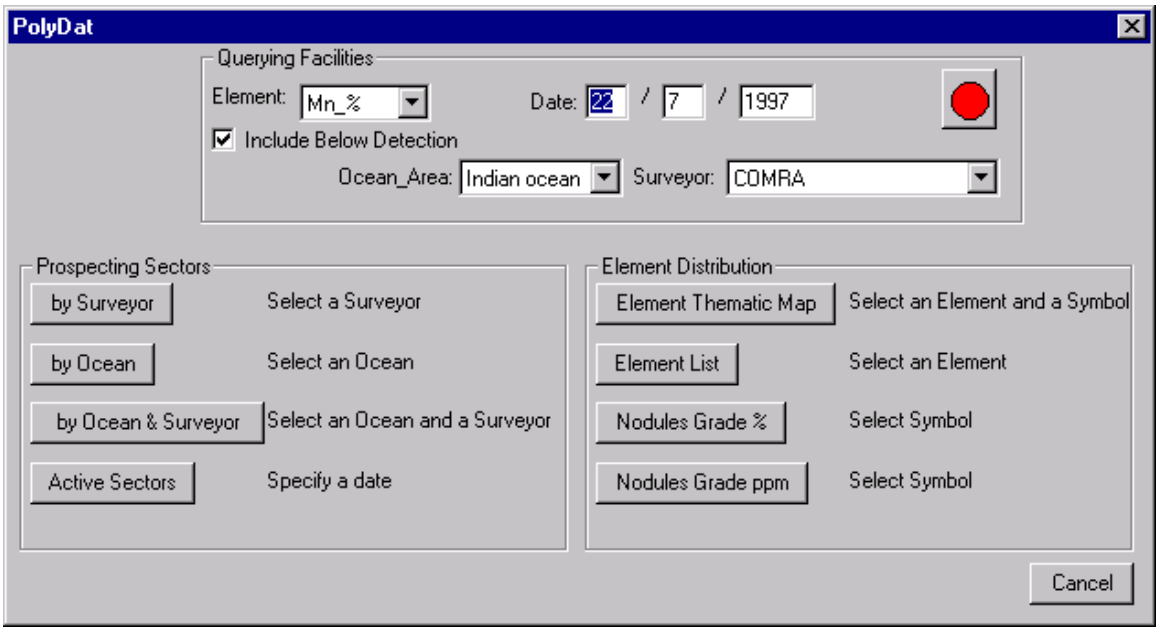
On selecting the Stations entry command from the PolyDat menu in MapInfo, the operator works on the Stations Table in Read/Write Mode. A browser corresponding to the Stations Table opens and the operator should select the Station to be located and then immediately shift to the map view where the Station location should be pinpointed. Care should be taken to ensure that Stations that have already been referenced are not re-referenced by mistake.

3.2.4.1.5 Geocode Stations

When all Stations have been referenced, the operator must then select this command, which fills in the Longitude/Latitude fields in the Stations Table by picking up the values in MapInfo and transferring them into the Stations table in the database.

3.2.4.1.6 Querying Facilities

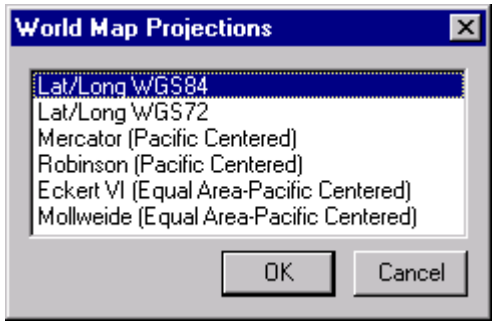
This provides the user with a menu screen on which many options can be set in order to execute a number of custom queries. The user selects a variety of combinations of these values from picking lists and then presses the appropriate query button to obtain the required information.



After selecting the required criteria and the relevant button, the menu commands **Query**, **Find Selection** enables the result to be viewed. Also, three of the queries involve the creation of thematic maps, and a symbol has to be selected in addition to the other criteria prior to the running of the query. If a symbol is not selected, the default is used, as seen above.

3.2.4.1.7 Map Projection

On clicking this option, a window opens, containing useful map projections of the world, which the user can select and view on-the-fly.

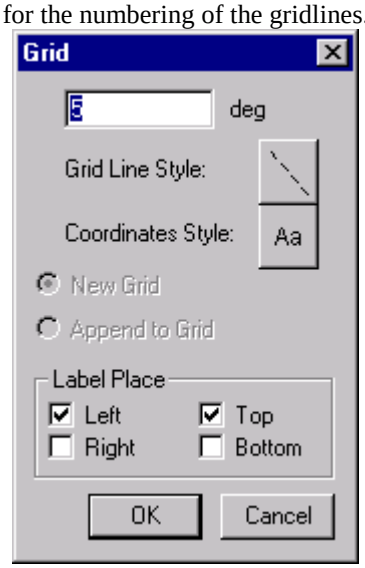


3.2.4.1.8 Map View

On selecting this option, the user is presented with a window containing a list of ocean area. The mapper automatically zooms in when one has been selected.

3.2.4.1.9 Grid

This enables a grid to be included in the mapper view. The user selects options from the Grid window, including the line style and font size for the numbering of the gridlines.

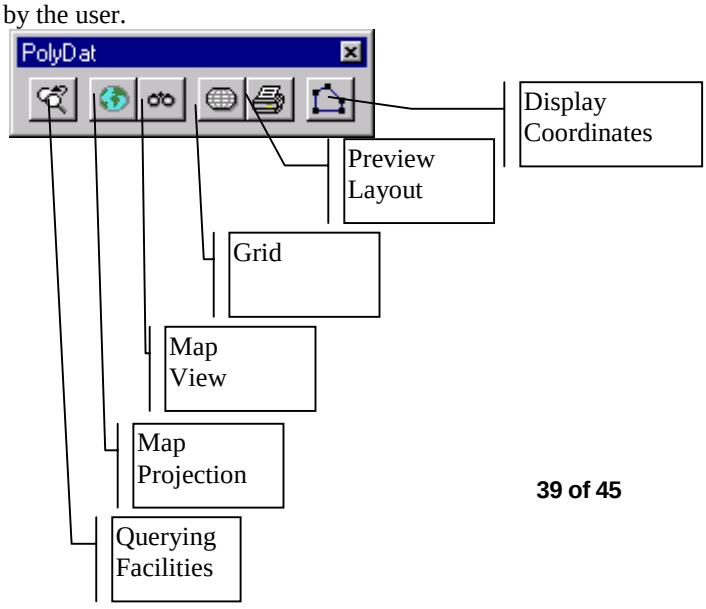


3.2.4.1.10 About and Exit

The About command presents the user with an information window and Exit quits the user from the application.

3.2.4.2 PolyDat Button bar

Many of the options from the Minerals menu are available from a custom toolbar. The last button is available only in the toolbar, it allows the user to retrieve turning points co-ordinates of the sector selected by the user.



4 Recommendations

4.1 Data Format

The data format to be supplied to the authority should be based on the description of the tables Sectors and Stations. The data should be saved in this order of preference: MapInfo Interchange Format, Excel or ASCII delimited. Station co-ordinates and turning points should be added to the file if the format doesn't recognise geographical objects.

4.2 Printer Memory

The DesignJet 650C should receive as soon as possible more memory, as it was clearly identified in the beginning of the mission that the printer was lacking resources for PolyDat output and map production.

4.3 Acquire Surfer

For the moment ISA uses an evaluation copy of Surfer from Golden Software. It is suggested that ISA acquires as soon as possible a licensed version of Surfer.

4.4 Methodology Application

It is recommended that ISA apply as soon as possible a methodology for data and information reception to all participants in Polydat as to ensure the accuracy of the data entered. This methodology should be submitted to the Legal and Technical commission for approval.

4.5 Creation of a GIS Unit

A Computer System Manager should be recruited as soon as possible to allow the current persons to concentrate on GIS work and data entry. It is important that the unit is left with autonomous responsibilities on the accuracy of the data and that the maintenance of the computer system should be under the responsibility of the Computer System Manager with its own budget, and purchase orders… It has been detected that the computer system may fail due to administrative interference.

4.6 Marine Geologist

A marine geologist should be attached to the GIS unit, to interpret the data and produces relevant documentation in conformity with the goal of the ISA. This marine geologist will ensure the independence of the interpretation of the data and will preserve the confidentiality.

4.7 GIS Unit active at the Legal and Technical commission

The GIS unit should be an active part at the legal and technical commission to ensure that the recommendations are understood and applied. Also, the GIS Unit should be able to inform the legal and technical commission about the resources available in the ISA.

4.8 Acquisition of classification criteria for queries.

It is recommended that ISA collect a set of criteria for nodule classification to implement in Polydat. Unfortunately this information was hardly available from the geologist consultant and basic classification criteria were applied. The recruited Marine Geologist should be able to supply such classification criteria.

4.9 Collect and enter supplemental data

It is recommended that the ISA seeks copies of the data of the non-reserved area as well as for other areas part or not of the Area. This data should be entered as soon as possible in PolyDat so ISA would own a complete dataset.

4.10 Cooperation with National Agencies

The ISA should seek cooperation with National agencies such as the NOAA and the USGS, to exchange data and avoid duplication of resources in nodules GIS. It is noted that it is not clearly known which data sets the former east block owns, and it could be an advantage for ISA, if these nodules and marine related data sets could be included in PolyDat.

4.11 Map Production

ISA should start to produce a map set to promote the potential of nodules exploitation to all its member countries. This map set should be of professional quality with the help of a cartographer and through printing services.

5 Glossary of Terms

Attribute
Term used in database design to describe different pieces of information about an entity; for example, a Sector is an Entity (something that information is stored about) and an example of one of its attributes would be the Sector ID.

Bound Control
An object on a form or report whose contents is based on a field in an underlying table or query.

Command Buttons
A button on a form that carries out a certain function; for example, all forms in Polydat have a Close button. Some forms have other buttons on them that open other forms.

Caption
The name that is displayed at the top of a form or report window, or the label of a field on a form.

Check Box
A control on a form that stores a 'Yes/No' value. For example, the Report Form has check boxes on it in order that the data inputted can record whether or not a report contains maps or field notes etc. When checked, a cross appears in the box, which is stored as a 'Yes.'

Combo Box
This is a scrolling list of values that the user can pick from when inputting data, and its advantages are similar to a List Box, except with many Combo Boxes, the user can input a new value if the required one is not already in the list.

Criteria
A set of limiting conditions used in a query to restrict the output to a specific group of records. For example, many of the queries in Polydat require the user to select a value from a list prior to running their selected query.

Data Type
This determines what kind of values are allowed in a field. For example, text cannot be stored in a field with the Number data type.
Common data types include, Text, Number, Date/Time and Yes/No, but there are many more.

Datasheet
Data from a table, form or query displayed in a row-and-column format, similar to a spreadsheet.

Design View
A window displaying the design of a table, form, query or report. In this view, existing objects can be modified, and new ones can be created.

Entity
Term used in database design to describe something about which information is known. For example, A Prospecting Licence is an Entity, and its attributes include the Prospecting Licence Number, Date of issue, Fee paid etc.

Focus
This refers to the most current cursor position on a form. Whichever field on a form has the cursor in it is said to have the focus.

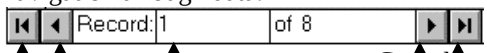
Form

A form is a screen where a user can input and edit information. The form is based on a table, meaning that when data is typed into the form, it is stored in the underlying table. Forms may sometimes be based on more than one table, i.e. a query.

Form View
This is the view of the form that the user sees when opening a form and entering data. Forms have two other kinds of view; design view, which is the layout of the form's design without the display of underlying data, and datasheet view, which is a view of the data the form is based on, in row-and-column format, similar to a spreadsheet.

List Box
This is a simple list of values that the user can select from, instead of having to type them in. The main advantage is that data will always be input correctly and consistently if a list is used.

Navigation Buttons
In form view at the base of the screen, there is a horizontal scroll bar containing buttons that are used to aid navigation through data.



Go to last record
Go to next record
Go to specific record (user types which one in box shown)
Go to previous record
Go to first record

One-to-many Relationship
A one-to-many relationship is the most common type of relationship in a relational database. In a one-to-many relationship, a record in Table A can have more than one matching record in Table B, but a record in Table B can only have one matching record in Table A. A typical example of this kind of relationship is that between Sector and Station in Polydat; a Sector may have one or more Station associated with it, but in order for a Station to be stored in the database, it must be linked to a Sector.

One-to-one Relationship
In a one-to-one relationship, a record in Table A can have no more than one matching record in Table B, and vice verse. This kind of relationship is unusual, but an example might be of a database containing employee salary details, with one table containing personal details such as name and address etc, and the other table containing the person's name, manager and current salary; in this instance there would be a one-to-one relationship between the two tables.

Query
Queries enable the user to retrieve data from their database that matches certain conditions or criteria; the data that is retrieved depends on the structure of the query. Queries are an efficient way of viewing related data from several different tables at once.

Read-only
In Polydat, some of the results of queries are all set to be 'read-only' meaning the data cannot be altered, but only viewed on screen.

Record Selector
Within a data entry form, the left-hand side of the form often has a small box containing different symbols denoting the status of a record in the database, i.e.


Record that is currently being viewed, which has already been saved


New Record


Record edited but not yet saved - changes can be undone by pressing 'Esc'


Record being edited by another user

Relationship
An association between common fields (columns) in two tables. For example, the Sector and Sample tables are related on Sector ID.

Report
Output of data from a query or table in Microsoft Access in document form.

Scroll Bars
A typical Windows-style control, which aids the user to view different parts of the screen or navigate their way through a combo box. Scroll bars can either be vertical, appearing at the right-hand side of the screen, or horizontal, appearing at the base of the screen.

Security
A set of features used to specify or restrict the access that specified users or user groups have to data and objects in a database.

Source
Each form, report, query and every individual field on each of these objects has this property, referring to which underlying table or part of a table its data is derived from.

Switchboard
The initial screen that the user is presented with after logging onto Polydat Database. It is from this screen that they navigate their way around the system.

Tab Order
The order in which the cursor moves from one field to the next on a form on pressing the Tab or Enter key.

Table
The fundamental structure of a relational database management system. In Microsoft Access, a table is an object that stores data in records (rows) and fields (columns). The data is usually based on one particular category, or 'entity.'

Text Box
A control that provides a place to enter or view text in a form or report.

Validation Rule
A rule that sets limits or conditions on what can be entered in one or more fields. Validation rules can be set for a field, record or control on a form. The rule is checked when the focus moves from one field or control to the next. Microsoft Access displays a different message whenever the rule is violated.

Wizards
A Microsoft Access tool that asks the user questions and creates an object according to his or her responses; for example, tables, queries, reports, forms, and controls on forms such as buttons and combo boxes can all be created quickly using Wizards.