PREFACE

Welcome to the FieldLog 3 Manual!

A Field Data Management Program for Geologists

FieldLog is a software module that runs with AutoCAD, the premier personal computer and workstation drafting software program. Together they provide an extensive set of cartographic and data analysis tools for field-based geologists. Fieldlog is designed to:

- Provide a consistent and efficient data-entry environment for all field data
- Provide a powerful yet flexible organization scheme for field data
- Extend the capabilities of field researchers by providing a simple search environment that enables them to ask questions about data in the field
- Seamlessly handle coordinate issues such as map projections and user grids
- Seamlessly integrate existing data sources both towards field research questions and building a final map product
- Simplify the problem of regional compilation by providing geological glossaries of terms that may be consistent between many projects
- Provide a painless export mechanism so that data can be passed on to other users or cartographic specialists for final map production

FieldLog delivers all of these functions and many more, in an easy to use and efficient package. Furthermore, FieldLog provides long term benefits to users via:

- Simple and complete GIS export and data import capabilities
- Consistent interface and operation across multiple operating system platforms and between local and corporate databases

About AutoCAD

AutoCAD is primarily designed for the cartographic drafting of objects that are not specially located on the earth's surface. As a result, while many of its tools are useful for cartography, it has fundamental limitations when it comes to geological map construction. These limitations include:

- no support for real world coordinate systems
- limited support for managing data external to the map
- no extensions for geological data handling

The first limitation is a reflection of AutoCAD's inability to accommodate for the curvature of the earth's surface. Most field projects cover large enough areas that this will introduce significant errors into a map. The second limitation has to do with AutoCAD's limited tools for managing databases attached to maps. The third limitation reflects the fact that AutoCAD is not tailored for geological data entry, query or analysis. These problems are solved by having FieldLog provide tools for map projections, geological database management and analysis.

Thus, AutoCAD makes a suitable foundation for field mapping only if projections and other geologic tools are built in. These form a significant part of FieldLog, as you will see through this introductory manual.

About This Manual

This manual is the first of two covering the FieldLog system. In this volume you will find a tutorial covering basic use of the FieldLog system, installation and customization instructions, and notes on using AutoCAD for preparing maps.

Volume 2, the FieldLog 3 Reference Manual, covers all aspects of the FieldLog user interface in detail, discusses theoretic aspects of the FieldLog data model, provides background information to geographic information systems technology, and covers aspects of relational database theory as well.

Geographic Information Systems technology draws upon a wide variety of source fields, ranging from mathematics through cartography and computer science. As we cannot hope to cover all of this material in the FieldLog manuals, Volume 2 also contains an annotated bibliography to key references for further learning about GIS.

We don't expect that FieldLog will be the final repository of all geological information you will collect. In fact, most users eventually migrate their data to a desktop GIS such as ArcView or MapInfo, or to a full GIS such as ArcInfo, for integration with remotely sensed data, geophysical and geochemical imagery, and so on. This tutorial briefly covers the export of data from FieldLog to other systems; this is dealt with in more detail in the Reference Volume.

Organization of the Tutorial

The chapters herein are quite short, and you should be able to find a topic by chapter title relatively quickly. Boxed information delivers details that the average user might not need to know. When in doubt, start reading the box, and if you don't see the need to continue, stop! In effect, the boxes are appendix material that we've inserted in the text to elaborate on aspects of the text.

There are three sections in this volume:

- Section 1: Introduction and User Overview

  This section explains exactly where FieldLog fits in relative to other software tools you may have used or seen, and what role it addresses in the organization.
- Section 2: Tutorial

  With geological field data and maps from a project in northern Manitoba, the tutorial will get you up and running with FieldLog quickly and efficiently.
- Section 3: Integration, Installation and Customization

  This section covers the use of AutoCAD for map preparation, installation of FieldLog under AutoCAD 12, 13, and 14, and a brief introduction to customizing FieldLog to serve your specific needs.

Font Conventions

Text in courier font indicates a command that you type. For example, to log on to FieldLog:

> Type `fl-logon,` then press Return.

Bold text in Times-Roman font indicates an action you can carry out using either your mouse and the pull down menus, or the keyboard. For example, to save a file:

> Choose **File>Save** from the AutoCAD menu or type `save` at the command line and then press Return.

A Note On FieldLog Platforms

FieldLog currently runs only with AutoCAD for Windows and DOS. Currently supported versions include AutoCAD 12 for DOS, and 12 through 14 for Windows 95 and NT. There are currently no plans to port FieldLog to other systems.

There have been dramatic changes to AutoCAD across the supported platforms, and we cannot hope to cover all of the detailed differences. This manual was written to explain the use of FieldLog 3 running with AutoCAD 12 for Windows. All screen captures included are from that system. FieldLog's appearance will remain fairly constant across all of the supported platforms, but the background window appearances may differ somewhat.

Differences between the AutoCAD versions that affect installation, setup, and database connectivity are covered in the installation notes.

Where there are significant differences between the functionality of different version of FieldLog, we explain this in clearly labelled sidebars to the main topic of discussion.

CHAPTER 1

Why Use FieldLog?

Introduction

What exactly is FieldLog and what can it do for you? Why is it worth the effort of taking a computer into the field and reading a manual such as this one? Where does it fit into the goals of mapping and exploration organizations? Why are most academic and industry geologists now using computer mapping technologies in their day-to-day work? In this chapter we cover these questions and mention spatial information technology - what are traditionally called Geographic Information Systems.

Background

There has been a fundamental change in field mapping in the past decade, as more and more mapping organizations, ranging from geological surveys through to prospectors, come to terms with three fundamental facts of life:

- decisions are being made in shorter and shorter timeframes
- decisions are being based on larger and larger datasets
- decisions are being influenced by ever wider ranges of datatypes.

Whereas field mapping and exploration decisions twenty years ago were often based on the personal knowledge of a single expert referring to one map and at most a few reports, many decisions now draw on diverse data from technologies such as digital geophysics, compiled geochemical atlases, just-in-time remote sensing data, and compiled geological maps available in digital form. These datasets, hosted on computers rather than in report & map format, are ever larger, and have already largely surpassed the ability to be used without information systems tools.

The transition was and continues to be sped on by the rapidly decreasing costs of both the software and compiled data sources; datasets are available at no cost across the Internet that a decade ago would have been impossibly expensive, and the rate of growth of available datasets is increasing.

Desktop decision support tools have the potential to help with the facts of life listed above, if all of the data is compatible with these tools. In many businesses, decision support tools based on relational databases are completely interwoven with corporate structure and function, supporting tasks ranging from inventory control to market prediction. These tools directly respond to the large-dataset, rapid decision making reality of recent times: in many ways, these tools have *created* the current situation.

GIS tools are specialized decision support tools that handle data where spatial location is a significant part of the decision making process. In fact, traditional decision support tools are rapidly merging with GIS tools since most business, scientific, and governmental decisions *do* involve questions of location and spatial relationships.

In a typical mapping office, desktop GIS tools ranging from specialized geophysical and geochemical processing packages through to Internet-hosted data browsing tools are being used to make decisions faster, with larger and more diverse datasets. In many ways GIS is a communications medium, since by hosting all of the critical information in an organization in one environment, they promote collaborative and cross-disciplinary decision making.

The down side of the use of GIS tools is that all data must be collected or reprocessed into a format compatible with the system. For many subdisciplines of mapping, such as geophysics and remote sensing, the data as collected is in fact digital, and so all that is required is reformatting into compatible, standard, data structures. Other data, however, is principally analogue, and considerable additional work must be expended to capture this data into a GIS.

Field geological mapping data is a prime example of traditionally analogue data that many organizations are now striving to capture, or in many cases, recapture, into GIS. If the field geological data is to be incorporated into the decision making process, the data must both be digital, and be of consistent detail and quality, to support the types of questions that facilitate mapping and exploration.

FieldLog addresses the issue of capturing field data directly. To understand what functionality it incorporates, we need to examine the field mapping process in more detail.

The Field Mapping Process

Geological mapping and research is fundamentally a problem of collecting *data* at various *places*, and then *manipulating* the information, directly or indirectly, either during the field season or after the season is finished, to produce a report which is almost always accompanied by a *map* and explanatory *graphics*.

Most field data that needs to be manipulated is located at a specific point in *space*, almost always on the surface of the earth, and most field data occurs as descriptive classifications, orientation data, and written notes. In a traditional mapping operation, the data is recorded in an analogue form in a notebook and when manipulation is necessary the geologist laboriously works through the notebook and produces a summary. The summary is often a thematic map keyed to illustrate some aspect of the data or a specialized diagram such as a stereonet

— a visual representation of voluminous data that allows general trends to be noted and conclusions to be drawn.

In fact, perhaps the last thing a field geologist really needs is to have a project's field data strewn through various notebooks, with each query concerning the data requiring extensive reading, notetaking, and manual summarizing on diagrams. All of these take time away from *mapping* and divert it to clerical duties. This is where a GIS can help.

The crucial balance that must be achieved is between the power of the GIS to aid in analysis and graphic production versus time wasted entering data in the first place. There have been two approaches to the problem of using GIS to date:

- collection of traditional analogue notes and then recapture into a GIS either in the evening or post-season.
- collection of digital notes on the outcrop, possibly using Global Positioning System navigation to simplify location finding.

FieldLog 3 supports both types of data capture. For recapture, it provides an interface whereby field notes can be added to project specific databases; it handles multiple projects simultaneously to simplify organization, and provides cartographic functionality through AutoCAD to draw a publication-quality map.

For digital capture, FieldLog supports importing field data from PDA handheld computers, such as the Apple Newton, and the direct import of tables captured in delimited format from GPS receivers. It also can be used directly in the field, running on a pen or mouse-based portable. The only limitation in this process is that the computer must be capable of running AutoCAD. To date this rules out using Windows CE-based palmtops.

The advantage of digital capture over recapture is clear: by providing capture on the outcrop, the GIS is bound to be more complete, more consistent, and also may aid in the mapping process by allowing limited analytical work on the outcrop. By being captured direct to digital, time spent recapturing the data in the evening can instead be directed towards map production, thinking about the data, and carrying out analysis.

About Classification

When geologists examine a sample, or geological structure, they are fitting what they *observe* into a *classification scheme* based on their knowledge of geological methods and theory. Scientific terminology is a rigorous system for classifying observations in a way that allows unambiguous communication, at least as an ideal.

When categorizing an observation, there are two issues that become central: the consistent *use* of terminology by members of a mapping team, and a consistent level of detail of classification.

Much of the query functionality and data entry tools in FieldLog are built around supporting consistent field observations so that the field mapping database will be as useful as possible. These tools, as a result, have explicit ways of dealing with terminology.

The Field Analysis and Cartography Process

Once consistent data is captured into a field system such as FieldLog, it is straightforward to carry out decision support analysis using the data. Typical questions asked of spatial data are:

- locating subsets of the data that have specific characteristics...

  where are the granite outcrops? where are the steep structural fabrics? where are the mafic rocks that were sampled? where are the sedimentary rocks with known bedding orientation that also had tops determined?

- locating subsets of the data based on location...

  isolate all of the stations that are in the northeast quadrant of the map for output to a more detailed map... find all structural measurements that were made within 1km of a specified fault zone... plot a stereonet of all structural measurements in an irregular area...

- locating subsets based on complex combinations of characteristics and location...

  make a stereonet of all planar fabrics recorded in mafic volcanics within an irregularly defined zone, where the mapping was done by a specified geologist...

Since a spatial decision support system can handle most possible geological questions *in principal*, the usual limiting factor on analysis is the availability and continuity of suitable data. Consistency of terminology and detail is crucial.

FieldLog supports these type of analysis by providing a rigorous data model for the storage of the field information, and providing powerful database and spatial search tools to act on the stored data. FieldLog is capable of performing composite searches, including any of the types used as examples above, and returning the solution to the question as a table. Once inspected, the results can be dynamically displayed on the current map view, plotted as a thematic diagram such as a stereonet or rose diagram, exported to another desktop GIS tool, or archived to disk. FieldLog further supports naming the question itself, so that a library of common questions can be built up to speed analysis.

In addition to the ability to search and display results, the system must also be capable of handling cartographic design as required by a geological map. Advanced GIS tools can produce publication quality maps with ease - in fact, most modern maps are produced using GIS. At the level of field geology, needs are more modest, and the ability to draw polygonal areas, lines with variable linetype, and add text labels is often sufficient to make field maps. FieldLog supports cartography via AutoCAD, using the traditional AutoCAD drawing tools to handle line, text and polygonal area drawing, and extending AutoCAD greatly to handle the dynamic display of text, structural symbology, and descriptive data interactively between the field database and the current map.

Why AutoCAD?

FieldLog is a module that runs within AutoCAD. Why isn’t it an independent program?

AutoCAD is a high end CAD program with hundreds of features and a thick set of manuals. It provides interactive drawing tools, support for digitizers and other specialized hardware, and handles the storage of spatial information internally. FieldLog adds only the specialized geological and GIS tools that are lacking in AutoCAD.

AutoCAD’s drawing tools, layer support, linetypes and hatching allow sophisticated maps to be produced quite easily. The combination of a color inkjet printer, a laptop running FieldLog, a digitizer, and a word processor turns a bush camp into a map production studio!

Summary

FieldLog is a GIS that stores geological information at points or associated with linework. It provides projection, transformation, and export support, and has an intuitive and very powerful geological query mechanism that can create various geological diagrams.

FieldLog runs on top of AutoCAD, which provides excellent drafting tools for the production of final output maps. Furthermore, AutoCAD is available on many hardware platforms, enabling you to use the combination of FieldLog and AutoCAD in situations ranging from a laptop in the field to a workstation in the lab.

CHAPTER 2

Starting FieldLog

Introduction

This is the beginning of the introductory tutorial to FieldLog. We assume here that FieldLog is installed and working, and that the sample data for the Snowlake tutorial project is installed. If this isn't the case, refer to Appendix A, *Installing FieldLog*, and then return here.

Because FieldLog is an extension to AutoCAD, you must operate it from within AutoCAD. In this chapter you learn how to:

- Log on to FieldLog
- Browse a sample database
- Log off FieldLog

Logging on to a FieldLog database

Starting AutoCAD

Before you can log on to a FieldLog database, you must start AutoCAD and open a drawing. Refer to your AutoCAD manual for instructions on starting AutoCAD and opening a drawing.

In this tutorial we will be using *snowlake.dwg*, a map of the Snow Lake area of northern Manitoba*****. This map has all of the common elements found in a geological field map - a topographic base, location information, geologic contacts, and a coordinate system.

*****Bailes, A.H., and Galley, A.G., 1993, Geology of the Anderson-Stall volcanic-hosted massive sulphide area, Snow Lake, Manitoba: Geological Survey of Canada, Open File 2776, 1 map, scale 1:10,000.

Opening SnowLake.dwg

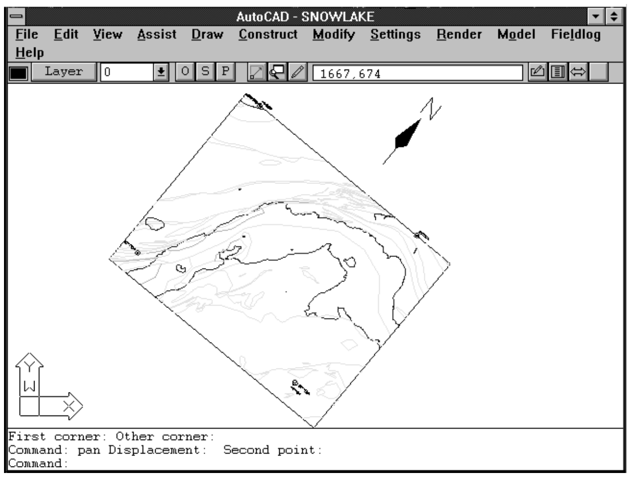
Snowlake.dwg contains the linework and cartographic annotation for the SnowLake FieldLog Database. Remember that FieldLog relies on AutoCAD to manage all the graphical elements of a map, while it adds the underlying database structure for storing geological field information associated with the map.

To open *snowlake.dwg*:

1. Choose **File**>**Open**.
2. Select *snowlake.dwg* from the *snowlake* directory (or where you installed the sample files).
3. Click **OK**.

   The SnowLake drawing appears.

The drawing is rotated relative to the screen by about 50 degrees clockwise. This is because the Snow Lake project is based on a user grid, and FieldLog understands and maintains the relationship between this grid and standard methods of projecting maps such as UTM. The user grid in this case is rotated relative to north, and note that the North arrow points off to the upper right on your screen. See Map Projections in Section 4 for more information.



Problems loading a database

If you get an error during loading (e.g. 'error 12') it is possible that required AutoCAD components such as ASE -- external database connections -- are not installed.

During the installation process FieldLog established which projects are available on your machine. If no names are present in the pop-up list, the list of available projects was not read. This process of identifying projects depends on your version of AutoCAD. Refer to Appendix A for further information.

Starting FieldLog

Now that you've opened a drawing, you can start FieldLog. You can do this manually or using the FieldLog menu. If you don't see a FieldLog menu at the top of your screen, refer to Appendix A for installation instructions.

Choose **FieldLog>Load FieldLog**.

A message in the AutoCAD command line indicates that FieldLog has loaded. Now you're ready to log on to a specific database.

Logging on to a database

Each time you open FieldLog you must indicate which database(s) you want to use. Several databases can be active at one time, enabling you to compartmentalize a project into several independent sub-projects or display adjoining project data on one map. See chapter 7 for more information about project setup.

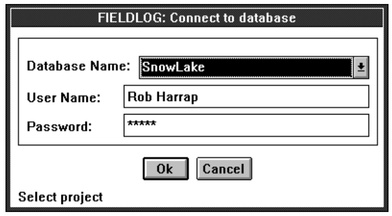
To log on:

1. Choose **FieldLog>fl-logon**

R13-R14 Note:

When logging on in AutoCAD R13 and R14, only projects not already logged-on will be available in the pop-up list.

The Connect to database dialog box appears.



Symbol Errors:

In some cases symbol libraries will fail to load properly. Simply hit OK to continue if this occurs.

If you were logging on to a corporate database, you would need a user name and password. Because the demo files are local and unprotected, you can leave the *User Name* and *Password* fields empty.

2. Select *SnowLake* from the Database Name pop-up, then click **OK**.

FieldLog will begin loading the project description, including the list of tables comprising the database, symbol specifications, coordinate systems, saved database queries, etc. When FieldLog finishes loading the SnowLake database, it returns you to the standard AutoCAD command prompt.

Now that you've loaded an AutoCAD drawing, FieldLog, and a sample database you are ready to browse the database.

Relational Databases:

Relational databases organize information in the form of tables. Each table can have multiple columns, or *fields*, and any reasonable number of rows, or *records*. Fields have a data *type*, meaning that a field might store a date, an integer, a logical (true/false) value, or a string of characters.

FieldLog can store information in many database formats through the use of external database drivers such as ODBC or those provided by AutoCAD. FieldLog also provides its own enhanced dBase III driver.

See Volume 2 for more information.

Browsing the SnowLake Database

A fundamental operation in FieldLog or any other GIS involves asking a question, then analyzing the answer. Normally GIS queries either return a list of valid data that satisfy the question, or else a map showing these data. In FieldLog, queries return their results in a query table, which can then be surveyed visually, edited, or plotted to a wide variety of formats, including to the displayed map. This section provides a brief overview of the query process using the SnowLake database.

To optimize storage and access of data, FieldLog stores all data in **relational databases**. Browsing data stored in relational databases is simply a matter of asking FieldLog to extract some of the information from the database into a table, which looks very similar to a spreadsheet display.

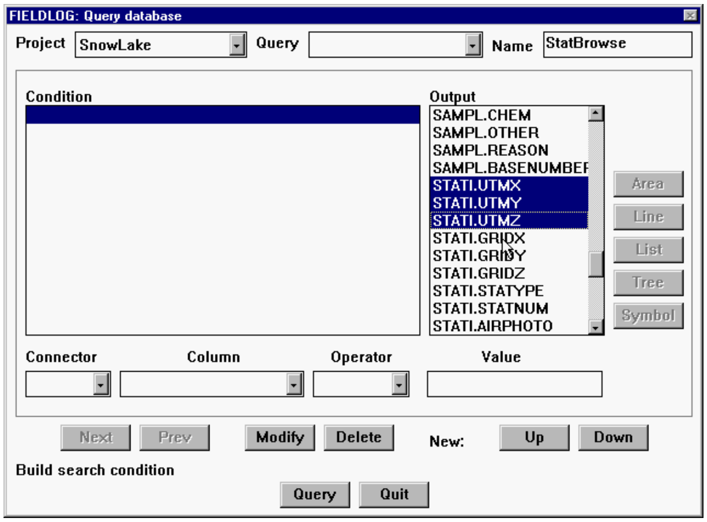
To start the query process:

1. Choose **fl-query** from the FieldLog menu.

   The Query Panel appears (see below). The query command lets you quickly review your database, as well as create complex, multipart queries and output the results in varying ways including to other programs.

2. Choose *SnowLake* from the *Project* pop-up. Remember that FieldLog allows you to have a number of separate projects running, attached to a single map.
3. Type `StatBrowse` in the *Name* box.

   Naming the query allows you to rerun it at a later time simply by picking its name from the Query pop-up. This can save considerable time when re-using complex queries.



Tables in the SnowLake database include *STATI*, the station table, *STRUC*, the structural table, *LITHO*, the lithology table, and so on, representing data typically recorded at a field site. Each table is independent, but can be *related* or *joined* to the others to build a complex query. Here all we want to do is look at an unfiltered portion of the database -- we don't want to look at the *entire* database, just few of the fields from two tables. This is achieved by selecting some of the database columns from the *Output* list. Because no further constraint is placed on the database, all the occurrences of data from those columns will be returned as rows in the result table. This amounts to building a quick summary of your field database and is analogous to asking the question 'show me all the data' stored in the specified fields.

Error Messages:

Three common situations result in error messages during the FieldLog Query process:

1. If there is no data corresponding in the database, FieldLog will return a no data error. This does not indicate a true problem.

2. If the query returns a name that is reserved by AutoCAD for a color name, FieldLog will return an error.

3. The number of records that FieldLog indicates were found during the query process will be incorrect in many cases, since the calculation indicates an interim total before the final query operations are complete. This is an unavoidable limitation of the AutoCAD database environment.

4. Choose the following from the *Output* list:

LITHO.ROCKNUM

LITHO.ROCKTYPE

STATI.UTMX

STATI.UTMY

STATI.UTMZ

These correspond to a numeric identifier for each lithology at a station, as well as a rock name, from the *LITHO* table, and a station location from the *STATI* table. You can select and deselect entries on the list with successive mouse clicks.

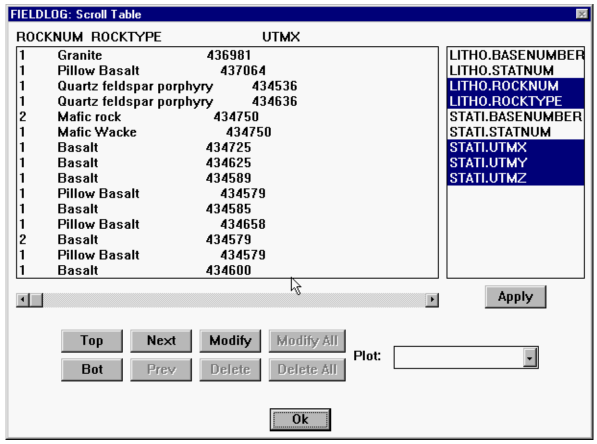
5. To run the query, click **Ok**.

A message box appears indicating that FieldLog is running the query. When the query is done click **Ok** to display the query results where you can use the Scroll Table dialog box to quickly view large amounts of data.

6. Click **Ok.**

The Scroll Table dialog box appears

Note that the columns in the table aren't aligned. This may happen if your Windows system font isn't set to a fixed width spacing. See Maintenance Procedures in Section 5, Volume 2 for more information.



Try navigating through the table:

- Use the *slider* to view data off of the right side of the table.
- Click **Next** or **Prev** to scroll up or down.
- Click **Top** or **Bot** to jump to the top or bottom of the scroll table.
- To close the Scroll table, click **Ok**.

About FieldLog Data Tables

R12 Note:

FieldLog sorts single-table queries according to basenumbers, and multiple table queries according to data values such as station numbers.

R13/14 Note:

All results are sorted according to a data value such as station number.

Although many of the entries in the data tables, such as station numbers, may at first seem redundant, these entries are the key to FieldLog's power.

Each table contains a column which stores a unique numeric identifier for each row in the table. In the SnowLake database this column is called *basenumber* and it unambiguously identifies individual records (rows). These unique values allow FieldLog to unambiguously separate what might otherwise be identical records.

Data is spread between many tables for flexibility and data integrity purposes -- in this the tables are related by common column values. For example, rather than repeating station level information, such as station location or field date, for each lithology in *LITHO*, FieldLog uses the *STATNUM* value found in both tables to relate station information indirectly. If you have four lithologies at one station, this means you only have to enter station information once!

The organization of database into small tables to reduce redundancy is called database normalization. We discuss this in detail in the relational database notes in Volume 2.

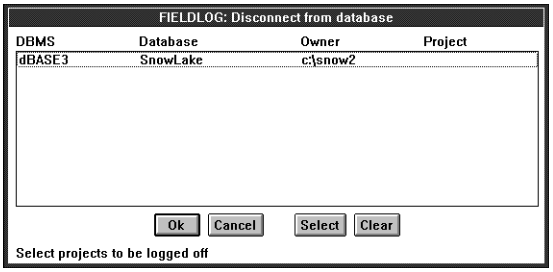
Logging Off

When you're finished using a FieldLog database, log off the database. This allows FieldLog to terminate any connections to external databases and close down internal connections clearly.

Performing *fl-unload* to deactivate FieldLog on exiting AutoCAD will cause each project to be logged-off automatically.

1. Type `fl-logoff` in the AutoCad command line or choose **fl-logoff** from the FieldLog menu.

   The Disconnect from database dialog box appears.



2. Select the *SnowLake* database by clicking on it, or by pressing *Select*.
3. Click **OK**.

Ending an AutoCAD session

To save your drawing and exit AutoCAD:

1. Choose **File>Save** from the File menu. Remember that FieldLog automatically saves your field observations in a database, but all associated map graphics is stored in an AutoCAD drawing *.dwg* file that must be manually saved. If you don't save the AutoCAD drawing, you will lose all graphics that have been added (or changed...) during your Fieldlog session.
2. Choose **File>Exit AutoCad**.

Database activity is not affected by the *File-Save* process, as all database manipulations are immediately saved upon execution.

Summary

In this chapter, you learned how to...

- Start AutoCAD
- Open a Drawing
- Start FieldLog
- Log on to a FieldLog database
- Browse a FieldLog database using the fl-query command
- Log off
- Save an AutoCAD drawing
- Exit AutoCAD

AutoCAD Novices

If you're new to AutoCAD, you might want to read Chapter 6, *Map Preparation with AutoCAD* before continuing the tutorial.

CHAPTER 3

Adding and Editing Data In FieldLog 3

Introduction

In Chapter 2, you learned how to start FieldLog, log on, and logoff a FieldLog database using fl-logon and fl-logoff. You also reviewed one section of the sample database using fl-query. The key points of Chapter 2 were that databases are external to the AutoCAD drawing, and so you need to connect to them explicitly, and that the database consists of tables that you can browse, edit, and perform sophisticated queries on.

Building a GIS database is about more than simply browsing records using queries. In this chapter you'll discover what's involved in adding data to an existing database. The process you'll learn in this chapter is very similar to the one you'll perform at the end of a day's field work, or during data recapture, if you choose to use FieldLog to capture notes from maps and field notebooks.

In this chapter, you'll learn how to:

- Add data to an existing FieldLog table
- Edit existing data
- Interactively move data on the graphics screen

Before you begin

If you aren't logged on to FieldLog and the *SnowLake* database, follow the steps from Chapter 2 to open *snowlake.dwg*, start FieldLog, and log on. Remember that you will need to start FieldLog before you can logon.

Adding data to a table

The FieldLog Data Model:

The manner in which FieldLog decmoposes field data into distinct tables is called the FieldLog *data model*, and is covered in detail in Volume 2.

In brief, the tables mirror *kinds* of information recorded during a fieldwork session. Traverses are about *the days work*. Stations are *places where observations happen.* Lithologies are *rock types seen at a station.* Structures are *structural features seen or measured at a station.* Samples are *specimens collected to match observations, and include such things as rocks and photographs.*

The overall structure thus reflects the field mapping process. By breaking things into tables, long-term clarity is enforced, and the ability to manage large data sets is enhanced.

Each time you add field data to an existing database, you'll be working with a number of different tables. For example, after each traverse you'll probably add:

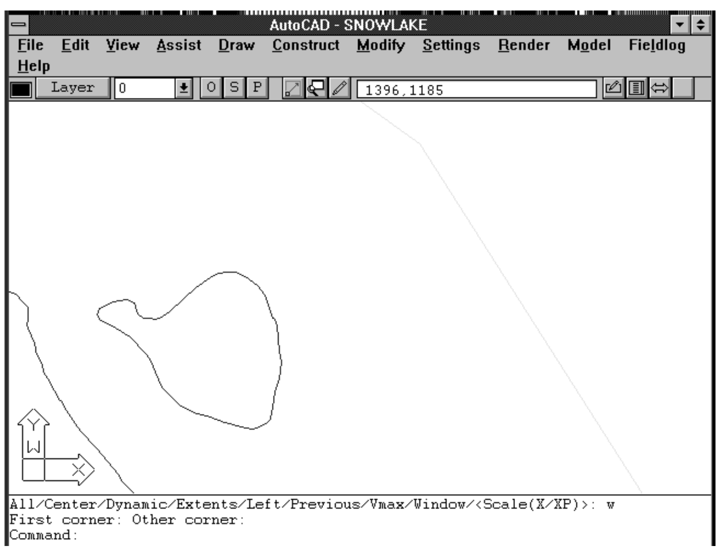
- A new traverse description to the *TRAV* table
- New stations to the *STATI* table
- One or more lithologies observed at each station to the *LITHO* table
- One or more structural measurements per station to the *STRUC* table
- A record of all photographs taken at each station to the *PHOTO* table
- One or more samples to the *SAMPL* table

As briefly noted in Chapter 2, FieldLog manages field data in a relational database. Each of the different tables in the database are *related* to build one coherent database - see the text box for a thematic overview. The subdivision of data you enter into the tables reflects the internal organization of the database, which reflects the overall structure of fieldwork. As you will see in Chapter 7, you can at any time completely customize and revise this organization to meet your needs.

Let's assume that you've done some mapping in the Snow Lake area and are ready to enter some new data to the *SnowLake* database.

Getting Ready

First, use AutoCAD's zoom command to zoom in on the island on the east side of the map. When you're done, the island should fill about a tenth of your screen.



Now you're ready to add the following field geological information to the *SnowLake* database:

- A new traverse
- Two stations on the island
- Lithologies for each station
- A sample at one station

- A photo at the other station
- Structural measurements at both stations

As you add the new data, note that you first enter the data into the database, then on the map. Fieldlog setup allows you to specify what database details appear on the map during this data entry process. As well, any query you run can output to the AutoCAD map, so you can always dynamically add more map symbols and text later.

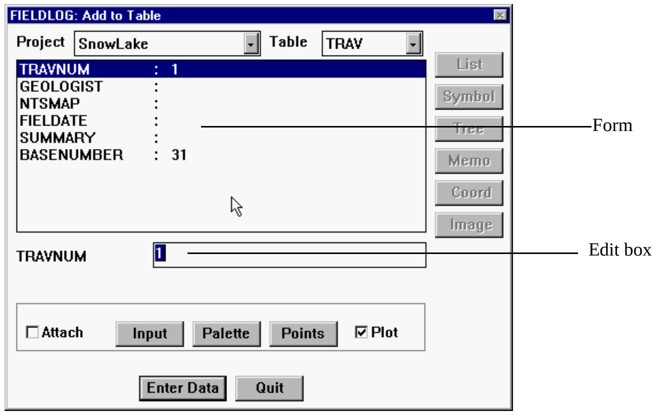
Adding a New Traverse

1. Type `fl-add` or choose **fl-add** from the FieldLog menu.

   The FieldLog Add to Table dialog box appears.

To shift between rows in the forms section, point using your mouse/digitizer or press the Return (Enter) key.

If you shift to a field that requires a value, you won't be able to move away from that field until you enter a value.



R13/14 Note:

In R13 and R14, the first project on the list will be automatically selected.

In R12, you must manually select the first project each time.

2. Select *SnowLake* from the *Project* pop-up.
3. Select *TRAV* from the *Table* pop-up.

   Now that you've chosen to add a new traverse to the database, FieldLog displays the possible data fields associated with the traverse in the Add to Table form. This is a data entry form for filling out FieldLog's tabular information. By providing a rigorous data entry form, FieldLog supports uniform detail in a database.

4. Select *TRAVNUM*. Type *29* in the edit box at the bottom of the screen, then press Enter.

   If the entry is valid, FieldLog selects the next item in the table. If the entry is invalid, a message appears at the bottom of the Add to Table dialog box.

5. For *GEOLOGIST* type `ME` in the Edit box, then press Enter.

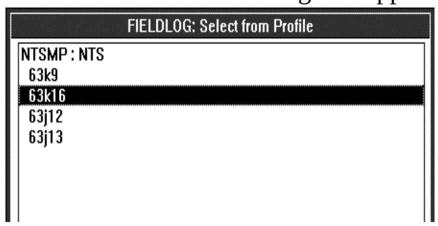
   Normally you'd type your initials here, but we don't know your initials, and will need them later for a query. Note that if you try to enter a long name here, FieldLog returns an error. In the setup of the SnowLake database, this field was deliberately kept short.

6. For *NTSMAP*, click **List** -- the top right most button.

Why have a traverse table?

During a typical data entry session you add data for one day of mapping or one traverse. Why bother explicitly keeping track of traverses? This simple once-a-day entry enables you to do sophisticated queries —such as displaying mapping done by one geologist or mapping done after a certain date.

The Select from Profile dialog box appears, listing possible values.



7. Choose *63k16*, then click **OK**.
8. Once you're back in the Add to Table dialog box, press Enter.
9. For *FieldDate,* type `19960621` (or today's date), then press Enter.
10. For *Summary,* type `Quick tour of island`, then press Enter.
11. To add the record to the traverse table, click **Enter Data** at the bottom.

    FieldLog assumes that you'll be adding more traverses to the database, so it increments the traverse number by one and returns you to the Add to Database dialog box.

    If you want to enter data to another table, you can easily change tables using the Table pop-up.

12. When you're finished adding data, click **Cancel**. This doesn't cancel the entries you've just made, it simply ends your current data entry session.

About Space

Location on the surface of the Earth is specified using a coordinate system. In Canada, the two common methods used are geographic coordinates (or latitude/longitude) and Universal Transverse Mercator (or UTM). UTM is a map projection or a method of transforming locations on a globe to a flat sheet with a minimum of distortion.

FieldLog can convert between most major projections and can simultaneously record locations into multiple projections, automatically converting between them as data is entered.

The SnowLake database is an example of where two coordinate systems are used — the map is stored n a user grid coordinate system and the positions are transcribed into UTM.

Adding new stations

When adding a new station to a FieldLog database, you must enter the station coordinates — after all, the key to a spatial database is that it records not only descriptive information (usually called attributes) but also spatial location. You can enter coordinates by:

- Typing in the actual numeric value (in the current projection system)
- Pointing with a digitizer or mouse to the station location on the screen
- Pointing with a digitizer or mouse to the station location on a map or air photo secured to a digitizing tablet (you must first calibrate the map or photo to the AutoCAD map — see *Tablet Calibration* in Chapter 6)

During actual field work you might be digitizing the location from a calibrated airphoto, grabbing the data from a hand held computer or GPS, digitizing from a sketch map, or visually comparing a sketch on the screen with a paper map. For simplicity, we'll use this final method here.

In this lesson you'll learn how to locate a station by interactively choosing a point on the screen. This is the least rigorous of the methods allowed because the location will be specified via approximate visual placement.

1. To open the Add to Table dialog box, type `fl-add` or choose **fl-add** from the FieldLog menu.
2. Select the *SnowLake* project and the *STATI* table.
3. Leave the *UTM* and *GRID, x, y, and z* values blank.

    If the *UTM* or *GRID, x, y, and z* contain values, you won't be able to interactively select a point. FieldLog assumes that since you have left them blank, you want to pick the location interactively.

4. Select *STATNUM*, type `me1`, then press Enter.
5. For *AIRPHOTO*, type `none`, then press Enter.
6. For *TRAVNUM*, type `29` (since this was the last traverse number you entered, it should by default already be in the table).
7. Click **Enter Data**.

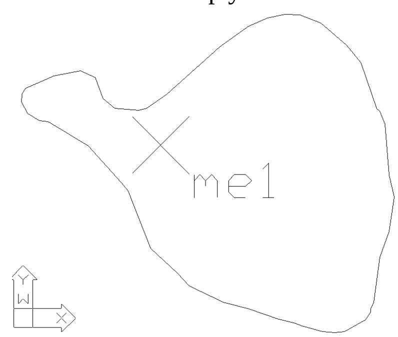
   The dialog box disappears and a crosshair with the station symbol and number appears on the map. If your digitizer was calibrated and you had a station on map or airphoto to enter, you would now align the digitizer cross-hair with the station or the digitizer and click. Here, though, you'll work in a relative mode, by visually estimating a location.

8. Move your mouse or digitizer until the crosshair is on a point at the left side of the island (southwest side), then click to place the data.

   Note that the station number is automatically positioned beside the symbol. (Remember, during setup you specify what database information appears on the map and what information is simply stored in the database.)

   FieldLog returns you to the Add to Table dialog and automatically increments *STATNUM* by one. Because FieldLog assumes you'll be quickly adding blocks of data, it defaults to the next station number.

   After the station has been entered, the map should look like the one shown below. To view the map you can close the fl-add panel by



   clicking *Quit*, or by dragging the panel to one side using your mouse.

Why a key number?

If FieldLog included rock descriptions as part of the STATION table, you would have to make assumptions about data collection during database setup. How many rocks, at most, would you leave room for in the STATI table ? Any unused fields would still occupy space in the tables, so your database would be highly inefficient.

By keeping rock descriptions in a separate table, the LITHO table, any number of rock descriptions can be entered. Each description represents one row in the table. Each is uniquely identified by the combination of a station number and lithology code. The lithology code could be a sequence number, representing the 1st, 2nd, 3rd, etc., lithology at the station, or it could be a code from a geological legend (e.g. 2a).

.

Adding Lithology Data

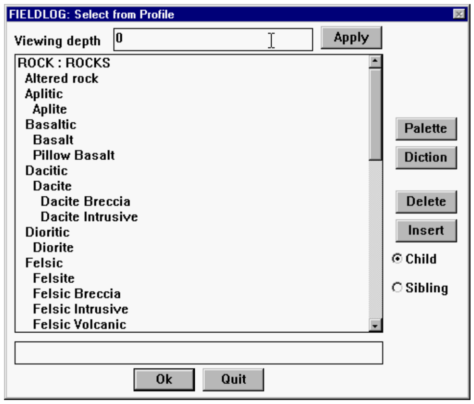
Now we will add lithological information for the newly created station. We will do this using fl-add once again:

1. If the fl-add panel is not displayed, open it using the menu or the command line.
2. Select the *SnowLake* database and the *LITHO* table.

   Notice that the station number is already correctly filled in and we can begin by adding the Lithology. Note that there is a key number for the rock number. Accept the entry of *1* here and move to the *Rocktype* field:

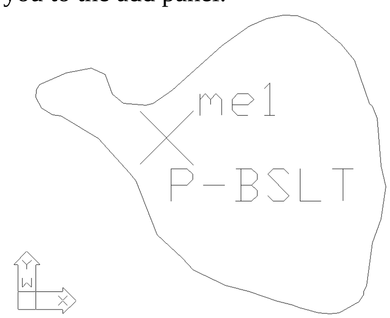
3. With *Rocktype* highlighted, click on the **List** button on the right.

The Select from Profile list browser appears.



4. Click *Pillow Basalt*, then **OK**.
5. Interactively place the lithology code on your map by pressing **Enter Data** and positioning the lithology code on the map.

   FieldLog returns you to the add panel.



6. You're finished adding lithology information. Click **Quit** to exit.

About Depth

The Profile Browser contains a viewing depth field and an Apply button. What are these for?

Geological classification schemes are, mostly, hierarchical. For instance, we subdivide rocks into igneous, metamorphic, and sedimentary classes. We subdivide igneous rocks into felsic intermediate, mafic, and ultramafic. The exact level and type of subdivision reflects the specific interests and goals of the mapping geologist. Most geologists can agree on the division and subdivision terms for rocks, but sub-subdivisions and so on quickly become highly personal terms.

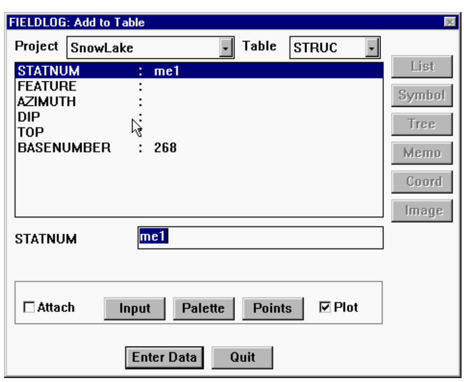
FieldLog is unique because it allows geologists to express queries in geologic terms. To a great degree this comes from FieldLog's use of profiles. The FieldLog profile allows a query to specify, for example, all igneous rocks without naming them all — the subdivisions *know* their division.

The Viewing Depth box allows you to specify how deep into the profile hierarchy you see. A 0 shows the entire hierarchy, a 1 only the divisions, a 2 the division and subdivisions, and so on. VIewing depth can be useful when you want to scan the entire profile without getting overwhelmed by details.

Adding Structural Data

Next you'll add some structural data.

1. Open fl-add, then select the *STRUC* table.



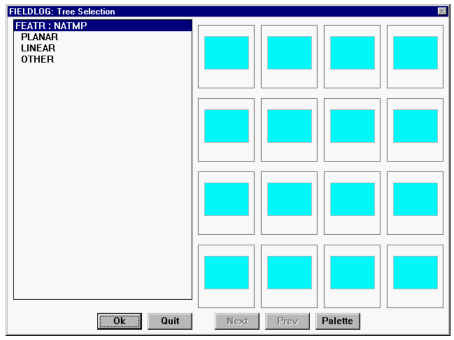
Notice that the *Statnum* is already filled in. Because the *STATI* table ties station *me1* to traverse *29*, future queries could search for structures observed on a specific traverse.

Just as the profile for rock types keeps track of rock types hierarchically, FieldLog can be setup to store structural symbols hierarchically — planar versus. linear, bedding versus. foliations, and so on.

Now we'll use the structural browser to pick a first-phase foliation from the selection offered.

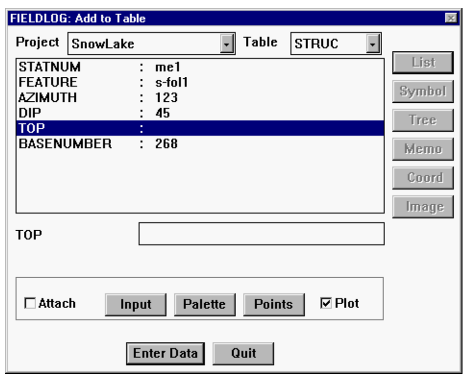
2. Click the *Feature* field, then the **Tree** button.

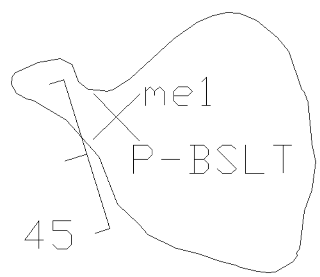
   The Symbol Tree browser appears.



3. Click *Planar,* then *Foliation*, then *s-fol1*, and click **OK**.
4. Press Return to add the chosen symbol to the table.
5. Enter `123` as the azimuth, and `45` as the dip.

   Your browser should look like the one shown below.





6. Click **Enter Data**, then place the symbol on the map.
7. Your map should look similar to the one shown at the right.
8. To exit the Add to Table dialog box, click **Quit**.

Congratulations, you've successfully added a station, a lithology, and a structural measurement to the FieldLog database.

Adding a sample to station *me1*

For practice, and to illustrate a few other features of FieldLog, we'll now guide you through entering some more data to the map.

1. In the Add to Table dialog box, select the *SnowLake* database and the *SAMPL* table.

To plot or not to plot

Remember that when you add data to FieldLog you're primarily building a database, not drawing a map. A few well-structured queries can plot anything from the a database to the map at any time. Don't get preoccupied with what you do or do not initially plot to the map! When in doubt, reduce clutter by keeping data in the database only.

2. Enter the data in the Add to Table dialog box according to the values listed below:

TABLE 1.

STATNUM	`me1`	
ROCKNUM	`1`	
SAMPLENUM	`1`	(for this station)
THIN	`N`	(no thin section)
STAIN	`N`	(not stained)
CHEM	`N`	(not chemically analyzed)
OTHER	(leave blank)	
REASON	`to assay`	

3. Before finishing, click the *Plot* box to empty it. This allows data to be placed only into the database and not on the map.
4. Click **Enter Data**.

You've added a sample to the *SAMPL* table. Note that you didn't have to enter a location — the database assumes the sample coincides exactly with its station.

Adding a photograph caption to the photo catalog

R13/14 Note:

In AutoCAD 13 and 14 it is possible to use the Image option (under *fl-add* etc.) to inspect digital photographs linked into a FieldLog database. Simply specify the digital file name.

If no path is specified, FieldLog will attempt to find the file in the project directory. If a relative path is specified, it will be realtive to the project directory. If an absolute pathname is specified, it will be used as is.

In the Add to Table dialog, select the *SnowLake* database and the *PHOTO* table.

1. Enter data into the Add to Table dialog box according to the values listed below:

STATNUM	`me1`
ROLL1	`1`
FRAME3	`12`
CAPTION	`Interesting feature in outcrop`

2. Again, make sure the *Plot* box is clear.
3. To add the station, click **Enter Data**.
4. When FieldLog returns you to the Add to Table dialog box, click **Cancel** to return to AutoCAD.

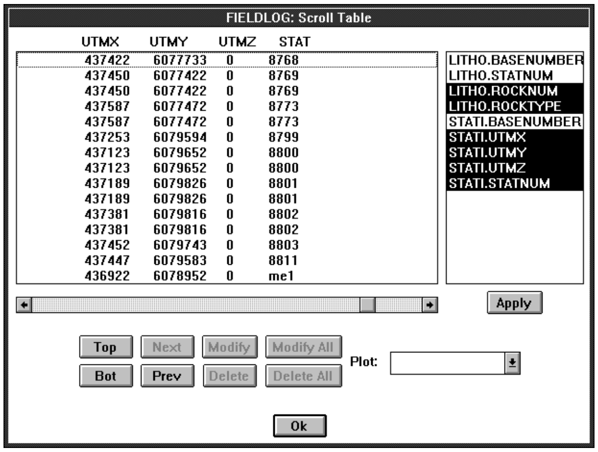
Using fl-query to check a station's values

We'll now check to see if you're adding the data correctly by using FieldLog's fl-query command.

Notice how easy it is to run a saved query! As you continue to use FieldLog, get in the habit of naming any queries that might be useful later. Give them descriptive names so you'll remember what they do.

1. Type `fl-query` or choose **fl-query** from the FieldLog menu.
2. Rerun your StatBrowse query by picking it from the list, then click **Query**.
3. Click the **Bot** button to move to the bottom of the list.

Note that *me1* is now in the list along with *UTMX*, *UTMY*, and other attributes you added earlier.



Adding information to existing stations

You can go back at any time and add or modify information to existing stations. In this section we'll add another structure measurement — a lineation — to *me1* and force it to remain hidden. Hiding information is useful when you want a complete database, yet don't want your map to be too crowded.

1. Start fl-add using the menu or AutoCad command line.
2. Choose the *STRUC* table. To change the current station to *me1*, select *STATNUM*, type `me1`, then press Enter.
3. For *Feature*, click **Tree**. The Tree Selection dialog box appears.
4. Click *Linear*, then *L-Fabric*, then the *lu* symbol.

   FieldLog returns you to the Add to Table dialog box.

5. Press Enter.
6. For *Azimuth*, type `45`, then press Enter.
7. For *Dip* (plunge in this case), type `30`, then press Enter.
8. Clear the *Plot* checkbox, located at the bottom right of the dialog box.

☐ Plot

9. Click **Enter Data**.

FieldLog adds the value to the database, but not to the map. You can now use the fl-query command to check whether the information was entered correctly into the database. Try it!

R13-R14 Note:

In AutoCAD R13 and R14, it is possible to preview raster images stored in TIFF, Targa, and CompuServe GIF (R13 only), and Windows Bitmap (R14 only) formats. To do this, a column is designated as an image column using *Input Setup* and FieldLog then interprets the text as a filename. The image will be dispayed when the user clicks on the Image button during editing, and will be hid when Enter is pressed.

This permits references to digital photography, sketches, and other raster images to be stored in the database and displayed by FieldLog

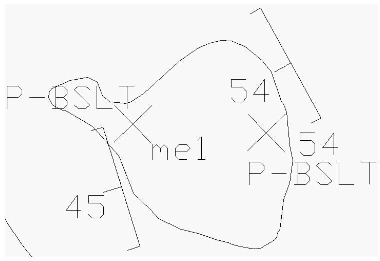
Exercises

Before going on to more advanced topics, take a moment and do the following exercises.

- add a station, *me2*, at the other end of the island (use the same date, map, etc. as for me1)
- add a lithology, *pillow basalt*

- add a foliation (*s-fol1*) with strike *111* and dip *54*
- add a sample, *for assay*

Make sure you toggle *plot* back on so that the data ends up on the map. When you are finished the map around the island should look similar to the one shown below.



Editing Data

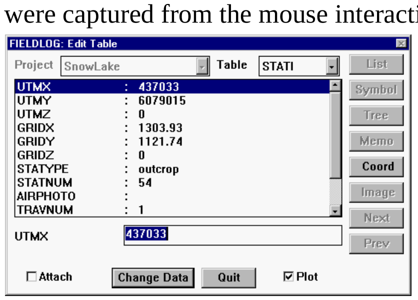
You can edit any data in a FieldLog database whether to correct mistakes or to refine interpretations. In this section you'll edit some of the data you just entered into the *SnowLake* database.

There are two principal ways to access FieldLog data for editing. If the value you want to edit is tied to a visible object (a structural symbol, a station marker,...), you can edit the value using **fl-move** or **fl-edit**, simply by invoking the command from the menu or command line and clicking on the object on the screen. If the value isn't visible, first find the data using the **fl-query** command, highlight the row you want to change or add to, then click **Modify** to change its value. We'll start by moving an existing station.

If FieldLog isn't running and you aren't connected to the SnowLake database, follow the steps from Chapter 2 to open *snowlake.dwg* and log on to the database.

Editing a station's location

Try using *fl-edit* to inspect a station. Note that the station has coordinates that were captured from the mouse interactively.



If you get this message, try selecting the entity again. You may not have selected the entity correctly or you may have selected an entity that doesn't contain any FieldLog information.

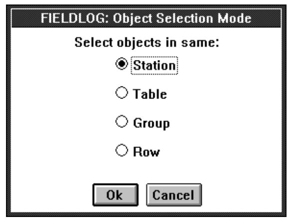
Moving a station

After entering station *me2*, you realized that you placed it in the wrong location. You want to move it a few meters up the right side of the island. If this were simply an AutoCAD entity, you could use the *move* command or drag the object dynamically. However, since it is a FieldLog station, we must move not only the graphic representation of the object on screen, but also the coordinates stored in the FieldLog database.

1. Type `fl-move` at the AutoCAD command line.
2. Select the station symbol (the X) for station *me2*, then press Enter.

   The Object Selection Mode list box appears. You can use this list to select all items in the same station, table, group, or row.

3. To move all data associated with the station, select the Station radio button.



4. Click **Ok**.
5. Drag the station and all associated data to a new location on the right side of the island.
6. Click to place the station in its new location.

   That's it! Note that all the lithology and structural data followed along.

About Object Selection

When you decide to move an object on the map, there's some ambiguity about what you're trying to accomplish. You might want to:

- move all data associated with a station (STATION)
- shift all data associated with a table by an offset from the station location — this is useful for placing structural data beside stations rather than on top of them (TABLE)
- move only a selected database entry from a single table (ROW)

To accommodate all of these possibilities, FieldLog displays the Object Selection Mode dialog box whenever you use fl-move.

Moving a row

Occasionally, when you move a station some of the station information, such as structural symbols, may obscure other objects in your view. To move the structural symbol for *me2*:

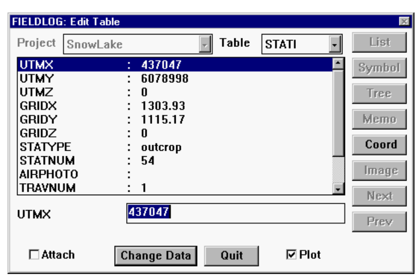
1. Type `fl-move` in the AutoCAD command line.
2. Select the structural symbol for *me2*, then press Enter.

   The Object Selection Mode list box appears, where you can select items in the same station, table, group, or row.

3. To move all data associated with the structural symbol (a row in the *STRUC* table), select the Row radio button.

   This limits the changes you make to the selected structural symbol and its associated text representing the dip or plunge.

4. Drag the symbol and dip to a new location, then click it into place.



5. Use fl-edit on the moved station to verify that the position has indeed been updated in the databas, as shown above.

Navigating Tables:

Notice that once you have selected *me2* the *Table* pop-up list remains available. In FieldLog you can navigate to any table related to the currently selected fl-edit item. Once you have finished editing in the second talbe, using *Change Data* will save your edits and return you to the previous table. *Quit* will cancel any edits and return you to the previous table.

R13-R14 Note:

In AutoCAD R13 and R14 you may navigate and display up to four tables from the original fl-edit table. In r12 you can only navigate and display only one additional table. Note that changes made to the navigated tables will not be applied to the map, as only the database is modified.

Limits on Modifying Tables in R12/R13/R14:

If you use *fl-query* in r12 you will notice that, often, the modify buttons are grayed out when you arrive in the Scroll Table display. In other words, you cannot modify any of the data on the display.

This is due to a limitation in AutoCAD's support for the Structured Query Language, around which FieldLog is built. AutoCAD only allows edits when all displayed data comes from a single table. Notice in the photo editing exercise we only select items from the photo table -— all of the entries are prefixed by *PHOTO*. If we had selected any entries from any other tables — for example, *STATI.STATNUM*, we wouldn't be able to modify the data in the table because the scroll table would contain items from more than one table.

In r13 and r14, on the other hand, all scroll tables are modifiable.

Editing a structural symbol using fl-edit

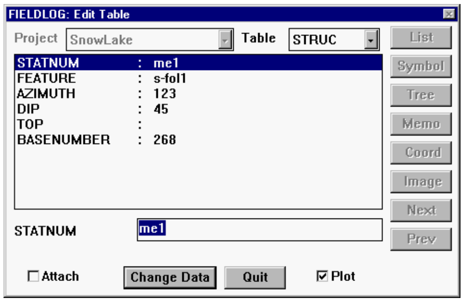
Now let's change the dip of the structural symbol at *me2*.

1. Type `fl-edit`.
2. Select the structural symbol at *me2*.

   The Edit table dialog box appears, listing the structural data for the selected symbol.

3. Select *DIP*, then replace its current value (`54`) with `55`.

   Your edit panel should look similar to the one shown below.



4. Click **Ok**.

Your map should now show the changed value of 55. Note that using fl-edit you can interactively edit all aspects of a structural measurement or any other database content associated with any map entity created by FieldLog.

Editing a photo caption with fl-query

Next let's edit the photo caption at *me2*. Because the photo isn't shown on the map, use the fl-query command to access and then edit the caption.

1. Use fl-query to select all stations with *PHOTO.STATNUM > 0.*

From the selection list choose the following:

PHOTO.STATNUM

PHOTO.ROLL

PHOTO.FRAME

PHOTO.CAPTION

PHOTO.BASENUMBER

2. Run the query.
3. When the Scroll Table appears, click **Bot** to move to the bottom of the table.
4. Select the *me2* entry, then click **Modify**.
5. Select the caption, then replace the current text with `Fascinating structures at me2`.
6. Click *Ok* to exit. Note that the entry has changed.

That's it for adding and editing! Save your drawing and log out of the SnowLake database.

Summary

R13/14 Note:

Digital photographs may be viewed if the column in the *PHOTO* table contains the filenamd and if the *image-import* option is set.

This will activate the '*Image*' button which will display the photo when pressed. Press *Enter* or *ESC* to clear the photo.

In this chapter you learned how to:

- Add new data to an existing FieldLog database
- Move data interactively on the map by item, station, and table
- Edit values in the FieldLog database by selecting them on the display
- Edit values in the FieldLog database by selecting them with a query

The ability to add data to a database by interactively working on a (screen) map is an effective way to capture data from analogue field notebooks or to recapture historic data. Many field geologists are finding, however, that it is more effective to capture the data digitally in the field, and then simply import the captured digital data directly into a database in the base camp. This is later covered in chapter ?.

Editing is an essential part of day to day usage of any field data capture system. Editing inevitably percipitates organizational difficulties when working on larger projects - who has the right to change data? Furthermore, databases that are hosted on multiple machines can quickly become internally inconsistent if great care isn't exercised.

Exactly what is entered and the organization of the database itself is an essential part of FieldLog usage. The combination of the profiles and forms in FieldLog enforce a level of data collection, and furthermore a degree of terminology control, that is essential to guarantee that large databases are internally consistent. The structure shown for the SnowLake dataset is fairly typical of a geological survey's normal focus during mapping, but of course all users will want to customize FieldLog to some degree. Refer to Chapter 7 for details of customization.

CHAPTER 4

Querying a Database

Introduction

Although FieldLog would be useful if all it did was allow you to plot data to a map and build database files containing field data, FieldLog actually does much more — it leverages the power of relational databases and CAD programs to enable geologists to change the way geological map analysis is done. While serving as a cartographic tool, it also incorporates queries similar to those found in geographic information systems, and further adds a new class of queries based on a model of how geological nomenclature works.

Although most of the work you'll do in FieldLog is data entry and editing, the payoff comes when you mine the database for information. You can mine your database by:

- querying the database for tabular information
- querying the database and drawing the results to the map
- deriving stereonets of structural information via a query
- plotting geochemical diagrams from database tables
- exporting the existing database to advanced GIS software for further analysis

So far you've used fl-query to generate browsable scroll tables from the database. In this chapter you'll learn how to perform complex queries — displaying results on a map, generating diagrams, and exporting. You'll also explore the full power of FieldLog's hierarchical approach to geological data manipulation, the core of nomenclature based searches.

The fl-query command is a powerful aspect of FieldLog. It's extremely simple to use for basic searches, yet provides sophisticated power for advanced users. Many of the abilities of fl-query are not provided by even the most advanced GIS tools on the market because they were never intended for geological work - they are general purpose, whereas FieldLog is a specialized GIS tailored for geoscientists.

Before you begin

If you aren't logged on to FieldLog and the *SnowLake* database, follow the steps from Chapter 2 to open *snowlake.dwg* and log on:

- Start AutoCAD, then open *SnowLake.dwg*.
- Load FieldLog using the menu.
- Logon to the *SnowLake* database using fl-logon from the AutoCad command line or the FieldLog menu.

At this point you should have a map of the SnowLake area displayed. Zoom out to view the entire map before you start the tutorial.

What goes where?

FieldLog has a very complex set of choices to make when plotting to a map, such as what layer to plot on, what color to use, what symbols to use, and so on.

A definition of how to plot a particular item in FieldLog is called a Palette. The palette is available as a button item on many of the dialogue boxes. Palettes are covered briefly in Chapter7, and extensively in Volume 2.

Benefits of using layers

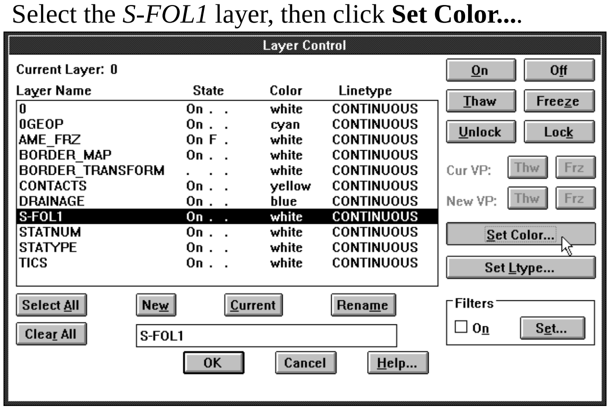
In Chapter 6, we'll discuss the importance of AutoCAD layers for separating different data types during map preparation. In this section, we briefly introduce you to the use of AutoCad layers in FieldLog. The following assumes you are at least basically familiar with AutoCAD functionality.

The foliations we added to the *SnowLake* database in Chapter 3 are on a layer named *S-FOL1*.

1. To open AutoCAD's layer control panel, type `ddlmodes` in the AutoCAD command line, or select the analogous icon from one of AutoCAD's toolbars.

   AutoCAD's Layer Control dialog box appears.

2. Select the *S-FOL1* layer, then click **Set Color...**.



   The Select Color dialog box appears.

3. Choose red from the Standard Colors list, then click **OK**.
4. To exit the Layer Control dialog box and return to your map, click **OK**.

   Note that the foliation symbols and their dip measurements are now red. It's a good idea to set AutoCAD's colors up so that different data types have different colors. This allows you to keep track of what is going where, and where data is in cluttered areas of the map.

5. Zoom out to see the whole map.

Not only can layers be assigned a colour, but they may also be used to control the visibility of objects on the map. If map objects have been thematically grouped into layers then it is possible to make visible/invisible any combination of map layers. The ability to highlight or hide certain data allows you to easily build a variety of thematic maps from one basemap. Another way to do this is to physically remove data from the map but not from the database. Both methods have their place - layers are useful for thematic control, while removing data is useful for making one particular layer simpler to understand, and less crowded when plotted.

Performing a simple query — details...

Thinking in Queries

First of all, remember that for a query to be useful, it must make geologic sense. Before running a query, think through what you are doing. In this case, we are going to isolate all of the first phase foliations observed in the SnowLake area by the workers who built the SnowLake FieldLog database. Thinking through the logic carefully can prevent major mistakes in the long run.

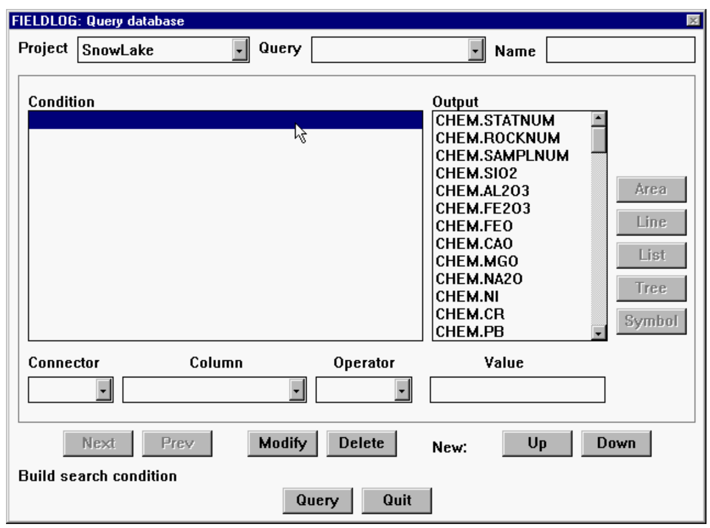
Prior to executing a query that will plot to the map, save the drawing just before you run the query. You can then revert to the saved drawing if the result is inappropriate or if an error occurs.

Now let's do a simple query — find all *S-FOL1's* in the *SnowLake* database and add them to your map. This time we'll go through the process in detail so you can see what each section of the query box is actually contributing to the process.

To start the query process:

1. Type `fl-query` in the AutoCAD command line or select it from the FieldLog menu.

   The Query database dialog box appears.



R13/14 Note:

In R13/14, the first project is automatically selected in the *query database* dialogue. In R12, the user must manually select the project each time.

TABLE 1. Fl-Query Dialogue Items

Project	Allows you to choose which database to query, if you have more than one open. Normally you will have one database open, but in large or complex projects you may elect to spread the project between several sub-projects, each with its own name and database.
Query	Enables you to select from previously created searches, providing you named them when they were initially used. Most queries are used frequently, so get into the habit of using the *Name* box and giving queries common-sense names.

Note:

If you inadvertantly click on a column that you don't intend to use, FieldLog will include it in the output list. Make sure you check your output list before issuing a query, as the selected columns will affect the search results.

Query Nesting:

FieldLog does not permit nesting of conditions. Conditions must follow one of the following patterns:

(1) (condition OR condition OR...) AND

(condition OR condition OR...) AND...

(2) (condition AND condition AND...) OR (condition AND condition AND...) OR...

Conditions using the special operations IS, HAS, INSIDE, OUTSIDE, NEAR must be connected with:

(condition AND condition AND...)

TABLE 1. Fl-Query Dialogue Items

Name	The place where you type in a name for the current query. The named query will be available the next time you return to fl-query.
Condition	The viewing area where query conditions that filter the database are built. You don't interact directly with this box except to edit existing query conditions.
Output	The area where you select which fields will be displayed in the scroll table that results from running the query. Fields used in a query condition are automatically selected in this window.
Area	Allows a search of a geographic area on the map, selected using the mouse or digitizer. To use this feature you must select *Inside* or *Outside* in the Operator pop-up, indicating you want to search inside/outside a polygonal area.
Line	Allows a search based on proximity to a line on the map, usually known as a buffer search. To use this feature, you must select *Near* in the Operator pop-up. Enter the width of the buffer as a number in the Value field. The width must be in the current drawing units.
List	Allows you to specify a Value from a hierarchical profile associated with the column selected in Column. For example, structural data is tied to a structural profile, so you can choose the desired structure name to search on by selection from a list if the Column pop-up contains the field STRUC.FEATURE. You must, of course, select the Column before you use this button.
Tree	As with List, this button allows a search based on a profile, but in this case via a hierarchical browser.
Symbol	As with List, this button allows a search based on a profile, but in this case from a browser showing all the symbols associated with the profile.
Connector	Defines the logical relationship between entries in the Condition list. The two possible entries are: • *AND* — When conditions are related by *AND,* both conditions must be true for the specific entry in the *Column* table to be returned into the Scroll Table view. • *OR* — *W*hen conditions are related by *OR,* either condition must be true for the specific entry in the *Column* table to be returned into the Scroll Table view.
Column	This is the heart of the query table. The query built in the Connector-Column-Operator-Value boxes acts on the field in the database indicated by the Column entry. So, for example, to search for station numbers above a certain threshold, the column pop-up would be set to STATI.STATNUM. Much of the work involved in setting up a query involves deciding which column to run the query on.

TABLE 1. Fl-Query Dialogue Items

Operator

Contains all of the acceptable logical operators that FieldLog can use. A search condition is satisfied if the Value of the specified Column in the database meets the search conditions:

- > field must be greater than *Value.*
- < field must be less than *Value.*
- <= field must be less than or equal to *Value.*
- >= field must be greater than or equal to *Value.*
- = field must be equal to *Value.*
- **NOT=** field must be not equal to *Value.*
- **LIKE** allows searches based on **wild cards.** Valid wild-cards in SQL (the foundation of FieldLog) are:

  _ (the underscore character): This wild-card substitutes for any single character in the position indicated. For example, the search *STRUC.FEATURE LIKE SFOL_* would return all structural features SFOL1, SFOL2, and so on.

  % (the percent character): This wild-card substitutes for any number of characters in the position indicated. For example, the search *STRUC.FEATURE LIKE%1* would return all structural features ending with 1.
- **NOT LIKE** is similar to *Like* except that it returns those entries that fail to match the criterion.
- **IS** acts on hierarchies in profiles within FieldLog. It returns elements that are of the indicated type as well as its subtypes. For example, the search *STRUC.FEATURE IS BEDDING* would return the *BEDDING, SUBED, S-BED* and *SOBED* features from the *SnowLake* database.
- **HAS** is the logical complement to the *Is* operator. It returns elements that are of the indicated type or its super types. For example, the search *STRUC.FEATURE HAS BEDDING* would return the *BEDDING,* and *PLANAR* features from the *SnowLake* database.
- **INSIDE** — if you choose a location field in the Column pop-up (e.g. UTMX or UTMY in the SnowLake database), you can then search for stations inside a specified area. The Area button allows you to interactively specify the target area by specifying the bounding polygon.
- **OUTSIDE** — as with INSIDE, but the query returns features that are outside the area specified using the AREA button.
- **NEAR** allows a buffer search — it finds all features within a specified distance of a line specified with the Line button. Specify the buffer distance in drawing units in the Value field.

Note:

IS, HAS, INSIDE, and NEAR are non-SQL operators especially provided by FieldLog. They must be connected to any other condition using ‘AND’:

(condition AND condition...)

Value

This field accepts logical, alphabetic, and numeric entries that must be satisfied by the search condition. For example, if you were querying to find all station numbers greater than 100, you would place 100 in this field.

Next

Selects the Condition directly below the currently selected one. Use next when editing existing conditions. Conditions can also be simply selected by clicking on them with the mouse.

Note:

To create a new blank condition UP or DOWN must be pressed. Then simply create the condition and click on MODIFY.

Prev

Selects the Condition above the currently selected one.

Modify

Overwrites or enters the selected entry from the Connector-Column-Operator-Value fields into the Condition list. ***This button must be pressed to modify an existing condition or to insert a new condition into the list.***

Delete

Deletes the selected entry in the Condition list.

Up

Inserts an empty search condition into the Condition list, above the currently selected entry.

Down

Inserts an empty search condition into the Condition list, below the currently selected entry.

TABLE 1. **Fl-Query Dialogue Items**

Query	Runs the query as it is presently entered, as long as the query is valid.
Cancel	Closes the query box, cancelling the query.

For more information on these operators, see the *FL-QUERY* detail chapter in Volume 2.

2. Select *SnowLake* from the Project pop-up.

   The only choice in the Query pop-up is the *StatBrowse* query from chapter 3. We'll make a new query here, so leave the pop-up blank.

3. In the *Name* box type `SfolSearch`.

   Remember that by naming a search, we can reuse it easily, and furthermore if there is an error, avoid reentering the entire query.

Choosing the input for a query

First you must choose the table you want to query and then you must select the columns from the table that you want included in your query. Remember that the tables are organized to roughly mimic the organization of fieldwork - traverses, stations, and structure, lithological, sample, and photo observations. Here we want to look for structural information.

About Complex Queries

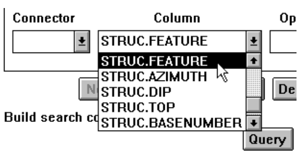
It is easy to get misleading results from any complex query, especially those that involve multiple conditions. When in doubt, work through the query slowly and make sure the query does what you want! Most people run into problems when using the AND connector. For example the following condition is impossible:

Feature=s-fol1 AND Feature=s-fol2

The Feature column can contain only one value, s-fol1 or s-fol2, but not both! In this case OR is required to indicate that both s-fol1 and s-fol2 occurrences are to be returned from the query.

The = and IS operators are also often misused. Use the = operator when you want the condition to return a single value (e.g. = s-fol1 -- all s-fol1 measurements). Use the IS condition when you want the condition to return a family of values (e.g. IS Planar -- all planar measurements).

1. Select *STRUC.FEATURE* from the Column pop-up.



   The current line in the Condition box will now query the feature name in the Structure table. Since this is the field that names the individual structural entities, this is where we can search to eliminate structures that don't meet our chosen criterion.

2. Select = from the Operator pop-up.
3. Click inside the Value edit box, then click **Tree**.

   The Tree Selection dialog box appears. Tree selection is based on a hierarchical organization of nomenclature.

4. Select *s-fol1* from the *PLANAR>FOLIATION* section of the tree.

   S-fol1 appears inside the Value edit box. (If you know the name of the value you want to query, you can type its name directly into the Value edit box.)

   The query we've entered, *STRUC.FEATURE = s-fol1*, will find any entries in the structure table that are *s-fol1's*.

   To insert the condition into the Condition table, click **Modify**.

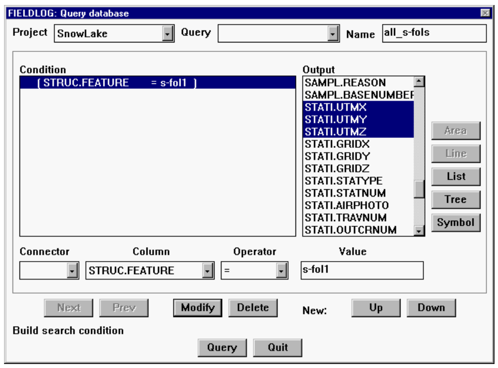
   There should now be an item in the main body of the dialogue. If a row in the main body is highlighted, you can edit it by changing the characteristics in the pop-ups and then hitting **Modify** once again.

Choosing the output for your query

Now that you've set up your condition and entered it into the Condition list, you must choose the type of output you want. Let's output the results onto *snowlake.dwg*. In other words, we'll direct the features that meet the query condition — all *s-foll's* — to be plotted to the map. To output the symbols on the map, FieldLog needs to know:

- *STRUC.FEATURE* — the feature to be drawn
- *STRUC.AZIMUTH* — the strike direction of the symbol
- *STRUC.DIP* — the dip value for the symbol
- *STATI.UTMX* — the X location
- *STATI.UTMY* — the Y location

1. In the Output list, select *STRUC.FEATURE*, *STRUC.AZIMUTH*, *STRUC.DIP*, *STATI.UTMX*, and *STATI.UTMY.*



Running the query

Now that you've created conditions and output options, you're ready to run your query. FieldLog will take the query you have expressed, translate it into an SQL statement, pass it to the AutoCAD database engine which will attempt to execute it.

1. Click **Query**.

   A message box appears indicating that FieldLog found records that matched your query. Depending on how large your database is, you may have to wait for a few seconds.

2. Click **Ok** in the FieldLog message box.
3. The Scroll Table dialog box appears, displaying a list of values that match your query. If you move to the bottom of the list you should see the two measurements — *me1* and *me2* — that you entered into the database.
4. To plot the symbols, select *MAP* from the Plot pop-up.

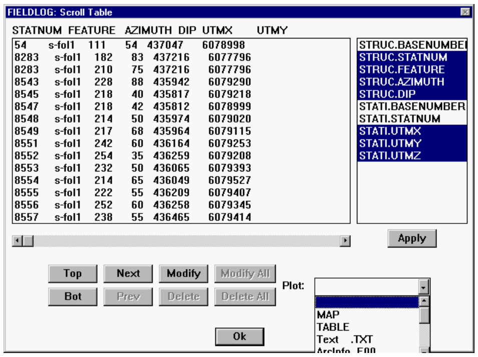
   Remember that AutoCAD is acting as a drafting engine, and FieldLog is acting as a notes storage and query engine. If you plot to a map, FieldLog will tell AutoCAD to actually draw new symbols to the map.

R13/14 Note:

In AutoCAD R13 and R14, the Scroll Table Dialogue has an iddional output item, called *Image or Sketch.* This allows the user to review all raster images that were returned by the query, for example to review field photographs.

The images are shown sequentially in the AutoCAD window. For each picture, the user has the option to show it or not, in effect acting as a pause between images. After the last image is displayed, click the Enter key to finish. the *Esc* key aborts image viewing.

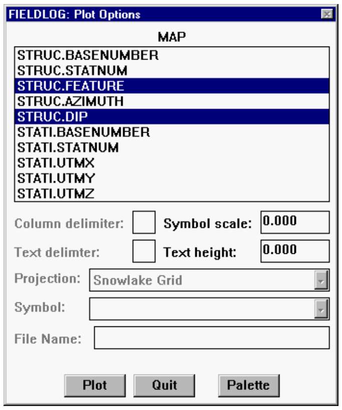
In AutoCAD R13 and R14, two radio buttons now appear with the plot options to specify whether all query items are to be plotted, or only rows selected by the user. The *Clear* button deselects all currently selected rows.



Unlike the results in many desktop GIS programs, these entities are permanent, and will have to be erased manually to clear them.

The Plot Options dialog box appears, asking which items to plot. Depending on what you're plotting, you may be able to specify parameters.

5. Select *STRUC.FEATURE* and *STRUC.DIP*, then click **Plot**.



This is equivalent to plotting just the structural symbols with adjacent dips. FieldLog's palette setup for the *Struc.feature* column knows which symbol to use, and knows to access *Struc.azimuth* to get rotation information. Note that the Palette is accessible from the Plot dialogue box.

FieldLog plots the output. When it's finished, FieldLog displays a message indicating the number of records it plotted and warns of any values it couldn't plot.

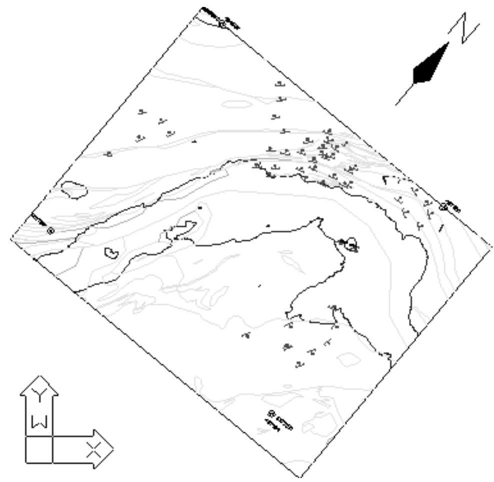
6. Click **Ok** to exit the scroll table.

Your map should now contain a large number of foliation measurements (they'll show up in red if had the layer *s-fol1* is set to red).

With a plotter hooked up, you could print a quick plot of first phase foliations — a custom map in less than 10 minutes! And if you named the query, it would take less than a minute to reuse the query.

We've covered a lot in this section. The possible Operator choices in FieldLog are a bit intimidating at first, but remember that these options are the key to FieldLog's power and flexibility. Take some time to try each one out.

Now let's try another query, retrieving geological features from an area on the map using the Inside operator.



Performing a spatial query

Now that you know how to perform a simple query, you're ready to perform a more sophisticated query — a spatial query on a selected area of your drawing.

Spatial queries are key features of GIS software — any database can do queries such as finding all *s-fol1's*. But few databases can find all *s-fol's* within a highly irregular area. The advantages of FieldLog are the geological nature of the database (including the fact that you can build hierarchical lists of terms) and the ability to do spatial searches just as an advanced GIS package would. If fact, because you can express your spatial queries using hierarchical relationships, FieldLog surpasses most GIS packages in terms of expressing complex geological queries.

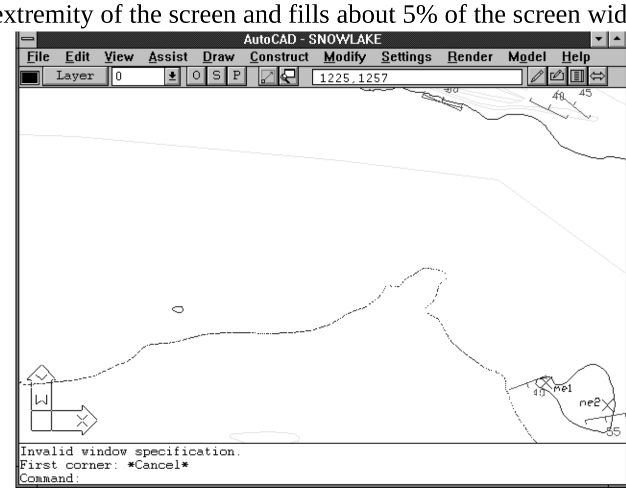
Navigation in AutoCad

To move around in your AutoCAD drawing, use the following commands:

- **zoom** to zoom in or out — the **W** option in zoom allows you to pick a window to zoom in to
- **pan** to move around on the view by shifting the current view in small increments

See Chapter 6, AutoCAD review, for more information on these and other AutoCAD commands.

Before you begin the query, use AutoCAD's zoom command to set your view so that the island containing stations *me1* and *me2* is on the right extremity of the screen and fills about 5% of the screen width.



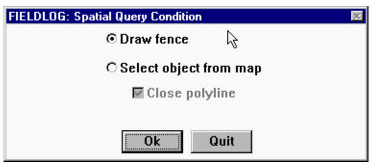
Selecting a query area on a map

In this query, you'll pick an area on your drawing and ask FieldLog to list all of the existing structural measurements for that area. Make sure you've zoomed to approximately the area shown in the following figure.

1. Type `fl-query` in the AutoCAD command line or select it from the FieldLog menu.
2. In the Query database dialog box, select *SnowLake* from the Project pop-up.
3. In the *Name* field type `StrucArea`
4. To choose an area, select *STATI.UTMX* from the Column pop-up. The Area operator in FieldLog must operate on a field that contains location information of some sort.
5. Select *Inside* from the Operator pop-up.
6. Click **Area**.

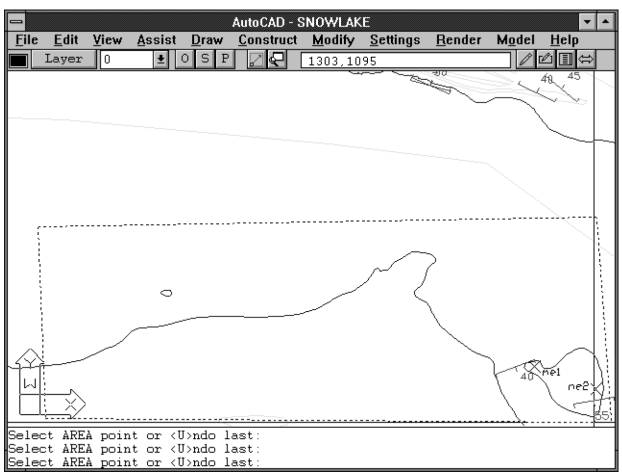
   FieldLog replaces the Query dialog box.

7. The Spatial Condition dialogue will appear. Leave it set to select by fence.



   The *Select Object From Map* option allows you to use an existing item on the map, such as a geological unit boundary, as a query window.

   Click three or more points to define a polygon-bounding fence enclosing your area of interest. Make sure you choose a fairly large area so that your query finds some stations. Do not close the polygon.



8. To finish, press Enter.

   This closes the polygon and returns you to the Query panel.

   The Value box should say *AREA*. This indicates that FieldLog has stored a list of points from the map to define the area. If it hasn't, try again.

Using Objects to Select Areas

If you use an existing object to define an area, FieldLog allows you to close the object to complete the polygon automatically. The object must, however, be a continues, uninterrupted polyline.

If the *Close Polyline* is toggled off, then FieldLog will not accept open polylines to indicate areas.

9. To add the query to the Condition table, click **Modify**.

The Query should now appear in the list box.

Selecting data

1. Select the following in the Output list:

STATI.UTMX

STATI.UTMY

STATI.STATYPE

STATI.STATNUM

STRUC.FEATURE

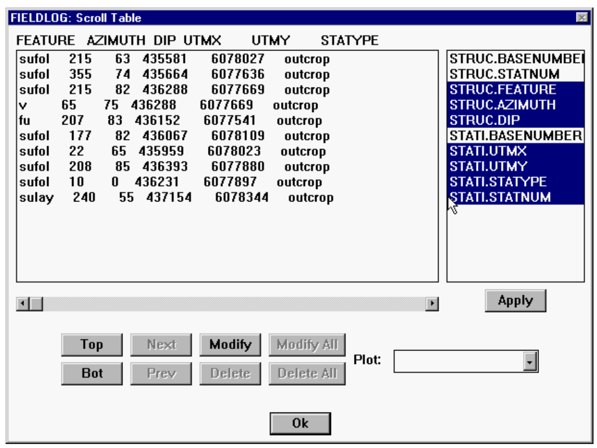
STRUC.AZIMUTH

STRUC.DIP

Note that as usual, we select the *STATI.UTMX* and *STATI.UTMY* columns so that our output options will include those requiring location information.

2. Click **Query** and then **Ok** when the message box appears.

The Scroll Table dialog box appears, listing the data.



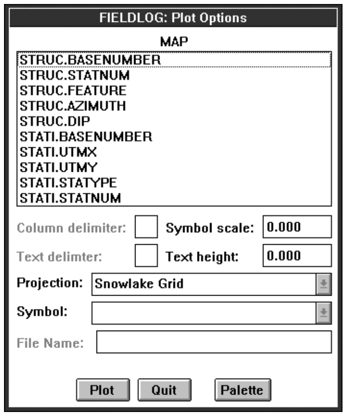
Your specific display may differ from the one shown above, because it’s likely you’ll have chosen a different area of the map. If no data appears, you chose an area with no measurements. Return to fl-query and rerun *StrucArea* on a larger section of the SnowLake map. Remember to click ‘Modify’ to update the condition after you have selected a new area.

Plotting data

Next, you’ll add all measurements found by the query to the map view. Remember that FieldLog maintains the geological database independent of the map, so that you’ll routinely add and remove symbols from the map as you do cartographic work and analysis.

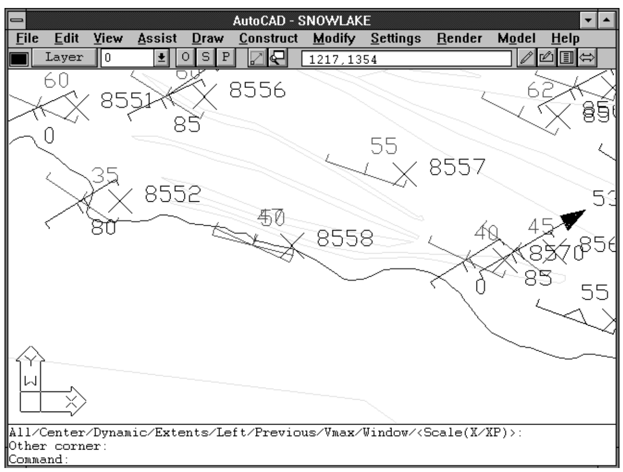
1. To plot the data, select *MAP* from the Plot pop-up.

The Plot Options dialog box appears.



Notice that, depending on the type of plot option, Plot Options allows you to override some of the projection, palette, delimiter and size parameters. When plotting to a map, only the size parameters are available. *Symbol scale* denotes a scale factor to be applied to symbols, whereas *Text height* refers to an absolute size, in drawing units, for plotting the text.

2. Select *STRUC.FEATURE*, *STRUC.DIP*, *STATI.STATNUM*, and *STATI.STATTYPE*, then click **Plot**.
3. Zoom in on the new data.



Note that FieldLog has placed a variety of different data types on the map — station numbers, structural symbols, and dip values. If you examine the layer definitions within AutoCAD you’ll see that the symbols are layered by data type. The layering is defined in fl-setup, but can be overridden within the Plot Options dialog box via the Palette button, as discussed earlier.

Performing a compound query

Finally, let's do a compound query. A compound query finds data that fulfills the conditions contained in two or more separate condition rules. Here is our query, in geological terms:

TABLE 2.

Query in geological terms	Translated to FieldLog query
Find all pillow basalt samples that have a planar structural measurement occurring at the same station.	Condition 1: *LITHO.ROCKTYPE = Pillow Basalt* Join: *and* Condition 2: STRUC.FEATURE IS Planar

Before you begin, use AutoCAD's zoom command to zoom to the extents of your map. If FieldLog is not loaded and/or you are not logged on to the *SnowLake* database, do so now.

Beginning your query

1. Type `fl-query` in the AutoCAD command line.
2. In the Query database dialog box, select *SnowLake* from the Project pop-up.
3. Name the query `PBStruc`

About Bayesian Operators

And and *or* are examples of Bayesian operators. These can be a bit confusing.

- *And* returns only records that satisfy both listed conditions perfectly.
- *Or* returns records that satisfy either condition.

Remember that a field in the database with only a single value per field cannot have different values, and so the *and* operator will always return an empty set if you do a compound *and* query on it. Think about this.... X = a AND X = b is impossible!

Setting up conditions

To set up a condition requiring all selected stations to contain Pillow Basalts:

1. Select *LITHO.ROCKTYPE* from the Column pop-up.
2. Select = from the Operator pop-up.
3. Click **List**, then choose *Pillow Basalt*.
4. *Pillow Basalt* should now be displayed in the Value edit box.

   This selects all stations where a pillow basalt was observed.

5. To add this to the Condition list, click **Modify**.
6. To insert the next condition below this one, click **Down**.

You must establish a relationship between the second rule and the first. To get results that fulfill both rules:

7. Select *AND* from the Connector pop-up.
8. To choose only planar structures, select *STRUC.FEATURE* from the Column pop-up.
9. Select *IS* from the Operator pop-up.
10. To get a list of available structures, click **Tree**.
11. Select *Planar*, then click **Ok**.
12. Click **Modify**.
13. Select the following output values:

    LITHO.ROCKNUM

    LITHO.ROCKTYPE

LITHO.CLRWEATH

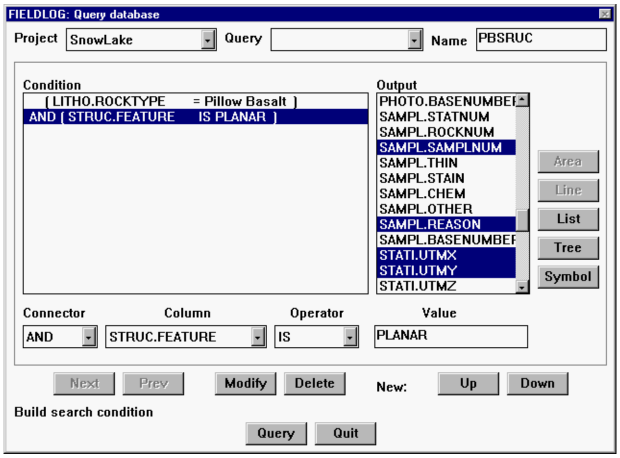
LITHO.CLRFRESH

SAMPL.SAMPLNUM

STATI.UTMX

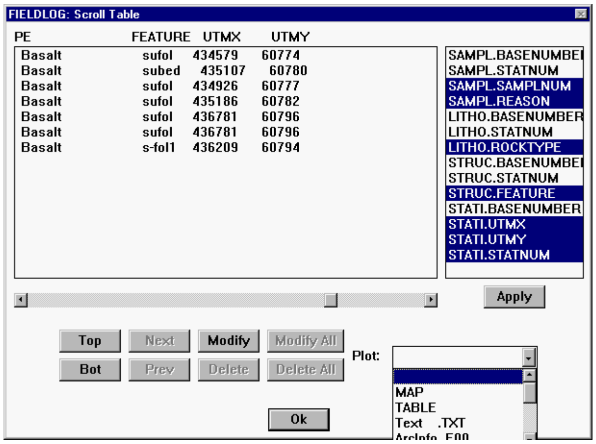
STATI.UTMY

STATI.STATNUM



14. To submit your query, click **Query**.

The resulting scroll table should look similar to the one shown below.



Exporting query results

Before exiting the query it might be useful to also export the resulting records to a text file, for preparing a report, exporting data into another program, or archiving subsets of a database.

To export the query results to a text file:

1. Select *Text.txt* from the Plot pop-up.

2. For output, select all items except for those ending in *BASENUMBER*. These are internal FieldLog record numbers and aren't generally useful outside of the program.
3. Select *UTM ZONE 14 NAD27* from the Projection pop-up.

Notice that FieldLog allows you to re-project the station locations. This can be crucial for:

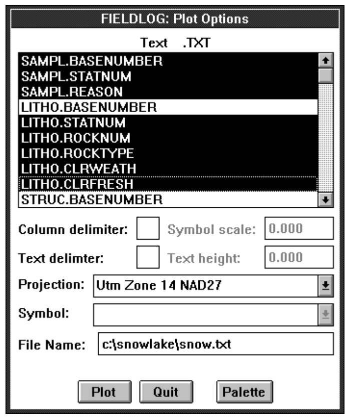
Other Plot Output Options

You've learned how to plot the results of a query to a text file. Other options include:

- Arc/Info E00 — E00 files are the standard interchange file for ArcView, ArcView2, Arc/Info, and ArcCAD. If you need Geological Survey regional data, chances are it's available in E00 format. ArcView is available free of charge across the Internet.
- Map/Info MIF — Map Info is a desktop and laptop GIS common in the mining and business community.
- Spans — Spans is a raster GIS well suited to raster analysis and geoscience modeling.
- Stereonet — FieldLog will generate equal area and equal angle point stereonets and plot them to the current map view.
- Rose Diagrams — FieldLog generates rose diagrams and plots them to the current map view.
- Geochemistry — FieldLog generates x-y plots and x-y-z plots given a user-specified formula relating FieldLog database fields to an x-y or x-y-z grid. These are plotted to the map.
-

- exporting data into other programs
- matching specific data format requirements
- standardizing data archives

4. Type `c:\snowlake\snow.txt` in the File Name edit box (assuming you've put your sample data in the `c:\snowlake\` directory.



5. To output the data to the text file, click **Plot**.

   A message box appears, indicating that the records are plotted.

6. Using a text editor or word processor, open up the text file you just created (in this case `c:\snowlake\snow.txt`).

   The text file should contain the same information as the scroll table.

That's it! You've done simple, spatial, and compound queries — outputting the results to a table, a map, and a text file. The fl-query command is powerful yet relatively simple. As you get more familiar with FieldLog you'll begin to naturally think in terms of how to express queries.

Conclusions

In this chapter you learned how to:

- Manipulate the colors of entities by AutoCAD layer
- Perform a simple query
- Perform a spatial query.
- Perform a compound query
- Export data to a text file
- Plot database data to the map view

The FieldLog query dialogue can be intimidating, and the options available from the data browser are quite diverse. However, the geological questions that can be addressed using the combination of operators in the query dialogue allow you to address real world problems with your data. And the data mobility and thematic map flexibility of the data browser will allow you to migrate your field notes into stereonets, thematic diagrams, and to other systems.

A few of the operators found in the query dialogue are fairly strange at first examination, but turn out to be the most useful when it comes to dealing with real, often ambiguous geological data. At an organizational level, the divergence in naming between different mappers has for years been a severe limitation on doing queries in a GIS environment. The hierarchy operators in FieldLog, based on artificial intelligence techniques, directly reflect the core of the mapping problem - where are rocks *similar*, rather than only *named identically.*

CHAPTER 5

Attaching Data to Lines

Introduction

All of the data you've worked with so far in this quick tour is associated with points on a map. Structural geology measurements, samples, and photos are all keyed to a station location, just as they would be when you recorded them in your notes. Associating database entries with point entities on the map is the normal mode for FieldLog data, though not the only possible one.

While most field measurements are well suited to being treated as points, there are cases where it's useful to label other entities — usually linework — with FieldLog database records. While the information stored by FieldLog wouldn't change, this labeling would allow a direct association between features such as faults and contacts and the FieldLog database. The data could then be accessed by clicking on the drawing using Fl-edit.

In fact, in a full GIS for an area, there would likely be point data such as station-based observations, line data such as contacts and lake shores, and polygonal data such as geological unit extents. FieldLog directly supports the generation of line and point datasets, concentrating of course on the point data. AutoCAD, especially versions before 14, is extremely limited in handling polygonal data.

>> **Sidebar**: FieldLog does permit polygons to be attributed. A text label positioned inside the polygon is usually linked to a database table that contains the polygon attributes. The text label is positioned using the standard fl-add functionary. It is very useful to label polygons in this way and to store associated descriptive information, including the label location, in a database table as most GIS systems require the label and its location before they recognize the polygon. See the *UNITS* table in the SnowLake database for an example.

In this chapter, the final chapter of the quick tour, you'll learn how to associate FieldLog data with linework.

Line attachments

If you aren't logged on to FieldLog and the *SnowLake* database, follow the steps from Chapter 2 to open *snowlake.dwg* and log on.

Adding an outcrop to your drawing

1. Zoom in on the island on the left side of *snowlake.dwg*.

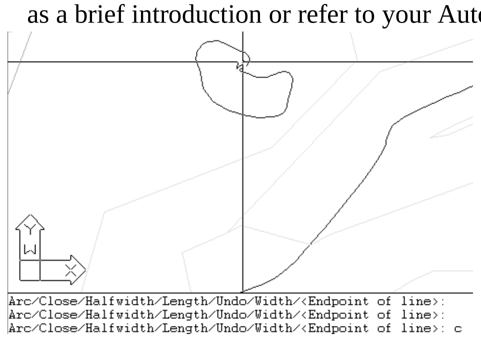
   Once you've zoomed in, the island should fill the center half of your screen

2. Use the **layer** or **ddlmodes** command to make a new layer named *outcrop* and make it the current layer.

   Its name should appear in the layer display in the upper left part of the AutoCAD display. Now all new drawing entities are placed on this new layer. While FieldLog automatically places new AutoCAD entities on proper layers as it creates them, you have to do this manually for linework you add using AutoCAD commands such as **pline**.

3. Use AutoCAD's **pline** command to sketch a quick outcrop on the island, near the bay. Use pline's **close** option to finish the outcrop's outline with a perfect closure.

   If you're unfamiliar with pline and other drawing commands, read Chapter 6 as a brief introduction or refer to your AutoCAD manual.



   Be sure to close the pline properly. If data will be migrated to a desktop or workstation GIS environment eventually, it is essential that all linework that defines polygonal areas be closed properly. See Chapter 6 for notes on proper digitizing.

Associating data with the outcrop

Creating a new entry

First, create a new Traverse entry for your whirlwind island visit.

1. Type `fl-add` in the AutoCAD command line.
2. Select *SnowLake* from the Project pop-up.
3. Select *TRAV* from the Table pop-up.
4. Enter the following values:

   TRAVNUM `30`

   GEOLOGIST `me`

   NTSMAP `63k16`

   FIELDDATE `19960405`

   SUMMARY `Detail on Island Outcrop`

5. To add the traverse to the database, click **OK**.

Adding an outcrop description

Outcrops are, conceptually (to FieldLog), areas of geological interest that may contain more than one station. Since you drew an outcrop outline it's only natural that you now associate an outcrop table entry with that linework. There will then be a logical link between the two, and this link will be passed on if you export the data to another GIS program.

To add an outcrop description:

1. Type `fl-add` in the AutoCAD command line, or pick it from the menu.
2. Select *OUTCR* from the Table pop-up.
3. Enter the following values:

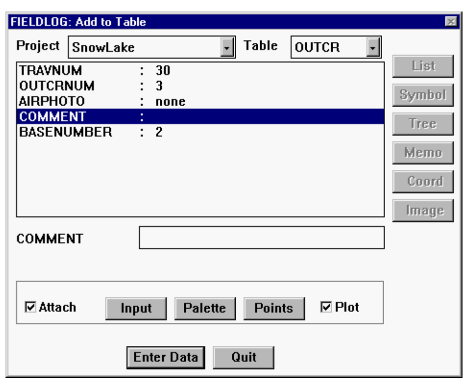
   TRAVNUM `30`

   OUTCRNUM `3`

   AIRPHOTO `none`

   BASENUMBER (use provided value)

4. Make sure that the Attach checkbox is selected (you want to link the outcrop table entry to the outcrop's outline).



5. Click **OK**.

Linking Logic:

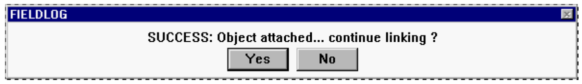
When linking database information to entities on the map, there are a few things to keep in mind:

- You are trying to build links where the items are conceptually linked. Use links sparingly to avoid chaos.
- Be aware of the size of the entity you are linking to. If it is a pline, it may very well extend onto other areas of the map, where the observations linked would be out of context.
- A single record can be linked to multiple AutoCAD entities, but a single AutoCAD entity can only be linked to one record. Adding later links will sever earlier ones.

Overwriting Links:

If you link a table to an AutoCA entity, and later link another to the same entity, the first link wi be overwritten. The link will be gone, although this won't affec the contents of the table. The limit of one link per entity is a major limitation on the FieldLog link process.

6. Select the outcrop's outline, then click to attach.



7. When prompted for more links, click **No**.

Verifying that an attachment worked

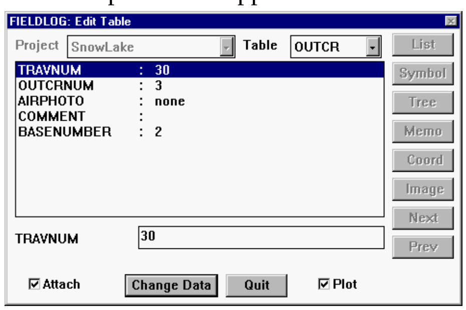
The point of attachments is that you'll be able to access tabular data by clicking on a drawing entity - the entity and the table become conceptually linked, and this link will persist if the data is exported.

You can check whether an attachment worked by clicking on a drawing entity that should contain attachments.

Now verify that the outcrop is attached to the database.

1. Type `fl-edit`, then click the outcrop's outline.

   If you attached the station correctly to the outcrop, the Edit Table dialog box for outcrop 3 should appear:



Conclusions

In this chapter you learned how to:

- Attach data to screen entities
- Verify that the attachment took place

Summary

This quick tour of FieldLog introduced the main concepts and methods needed to use FieldLog. At this point you should be able to carry out work as a FieldLog user.

If you want to learn more about using FieldLog, here's what you'll find later in this manual:

- Volume 2 reviews all FieldLog commands, with short recipes for carrying out each of the common tasks.It covers all of the buttons referred to in this section.
- Volume 2 also covers data exchange and conversion issues and provides exhaustive information on map projections.
- Chapter 7 of this volume introduces setup and customization procedures. These issues are covered in much more detail in Volume 2.
- Volume 2 also covers maintenance procedure — things you'll need to do as your FieldLog project grows.

CHAPTER 6

Map Preparation with AutoCAD

Introduction

AutoCAD is a powerful computer aided drafting (CAD) program. It enables you to draw and display maps and FieldLog builds on this infrastructure to construct a field data system. Unfortunately, AutoCAD also contains many functions that are of little or no use for geological map production, data archiving, and query-based data access, so that navigating in the regular AutoCAD documentation can be frustrating and intimidating. This chapter provides a quick overview of AutoCAD and briefly describes the AutoCAD commands you must know to use FieldLog effectively.

Since there are currently 4 versions of AutoCAD that are directly supported by FieldLog, there exist differences in the AutoCAD interfaces. This chapter assumes that you are running AutoCAD 12 for Windows. Command-line data entry has not changed significantly between the supported versions, and so we assume here that you are typing in commands rather than using menus.

For more information on using AutoCAD, and on enhancements available in newer versions of the software, please refer to your AutoCAD manual.

Drawing a map

As discussed in Chapter 1, Fieldlog is a specialized GIS that primarily stores point data. This means that while it is well suited to storing, querying, and outputting field data from defined positions, it doesn’t itself allow the construction of a proper geological map, since geological maps typically:

- show contact types
- have shaded, colored or symbolic patterns to indicate lithology
- make extensive use of secondary text and drawing for legends and location insets — also known as cartographic annotation.

To overcome these shortcomings various AutoCAD functions must be invoked.

When you need to produce a map using FieldLog and AutoCAD, FieldLog uses the data you enter to provide the geological constraints for linework showing contact and other geological relations. Some lines may have FieldLog data attached, however, most of the linework starts and ends as AutoCAD, not FieldLog, entities.

Typically map production is aided by reference to historical maps. A new map is plotted onto a base that is either digitized from an existing paper map or onto an existing digital map that represents the topographic and cultural features of the map area. If you are digitizing the base yourself, chances are that you'll be doing this in AutoCAD, using the commands reviewed below. If you purchase a base map from a governmental or third-party source, you can normally purchase it in DXF, the AutoCAD transfer format. Regardless, you need to know a minimum amount about AutoCAD to be effective with FieldLog. This chapter provides the core of that required knowledge.

AutoCAD is a relatively straightforward program, but like any program it's useful to have both a conceptual background — how it works, and a procedural background — how to get it to perform. We'll start with a conceptual background.

What is AutoCAD?

AutoCAD is a **C**omputer **A**ided **D**rawing or Design (CAD) program. AutoCAD is a very sophisticated set of tools for putting various graphic entities such as linework and text into a file that can then be viewed and printed. Like FieldLog, AutoCAD has at its core a database. The difference is that AutoCAD's database is oriented around rapid drawing, not geological research. While AutoCAD can quite efficiently represent a line or a point in two or three dimensions, it doesn't try to track what that linework means to the user. Think of AutoCAD as a highly paid draftsperson who carries out your instructions for making a drawing — it doesn't really care about the topic of the drawing, but it draws very well nonetheless.

About themes

If you use other GIS software, especially Arc/Info, you'll see the word theme a lot, but rarely the word layer. This reflects the conceptual foundations of each type of software — CAD software doesn't focus on what data is, just on drawing it. GIS software, on the other hand, is totally concerned with what data is and often doesn't even have a permanently visible display area.

You should get in the habit of thinking of each AutoCAD layer as a distinct conceptual theme, as this will lead to a more flexible layer structure in the long term.

From a geological point of view, the structure of AutoCAD is based around storing linework, text and symbols, and layering these entities for the convenience of the user. AutoCAD has a large number of tools for:

- controlling what view of the drawing you can see
- adding and removing map entities
- for hiding information associated with map entities.

It also has simple tools for layering data.

Grouping data

As different *thematic* data accumulates in one drawing, confusion can result due to clutter, interference between map entities, and the difficulty of tracking original source characteristics for diverse data. Ideally each *theme*, or related bunch of drawing entities, should be stored independently, so that they can be viewed individually or in any combination. We would like, for example, to be able to view all of the roads in a map area, but sometimes we'd like to hide them so that they don't obscure geological relationships. We would also like to be able to control colors and linework styles (dots, dashes, and so on) by theme, so that modifying a drawing to be printed on monochrome or color printers and at different scales is painless.

AutoCAD achieves this type of control by assigning similar data to *layers*. Each layer can be shown or hidden, have color globally changed, and have linework properties changed without affecting other drawing layers. Combining select layers can deliver *thematic maps* that neatly sidestep the clutter problem. In addition, secondary information such as legends and annotation can be stored on separate layers and displayed only when plotting final output. This speeds display times and further reduces clutter during routine data entry and manipulation.

If you take the time before you start a project to set up layers that are well suited to your needs, you will be rewarded by flexibility and elegant control throughout the use of the drawing. Whenever possible, separate data according to theme and different source onto individual layers — it's trivial to combine layers layer on, but laborious to split a layer once the drawing is under way. Keep careful track of what sources were used and what limitations or assumptions are associated with the data. This can save you endless trouble later on. In GIS this 'data about the data' is called *metadata*. It's your vital quality control information.

What this means

AutoCAD's was originally designed to draw architectural and machine-shop designs. In order to use AutoCAD to make maps we need to learn how to recognize the areas where AutoCAD doesn't handle real world map making problems very well, and also recognize its strengths.

Potential problems include:

- accuracy of linework and closure of polygons
- the curvature of the earth (introducing distortion in maps of large areas)
- problems with scale

To address these issues, you need to know something about how a GIS works so that you can see how to solve these problems in AutoCAD.

Data types in GIS

Given that we want to have limited GIS capabilities within AutoCAD and might eventually want to export FieldLog data to a full GIS, it makes sense to consider how a GIS stores data and how that affects our use of AutoCAD.

GIS software uses two general data models, the Raster and Vector Models.

- The Raster Model models the world as a regular array of cells much like the surface of a television set. Attributes are associated with individual cells, and the array covers the area of interest. This model is well suited to geophysical datasets such as gravity and magnetics, to remotely sensed data, and to geological data when flexible modeling is paramount (Bonham-Carter, 1994). However, it's poorly suited to map production because the cell size places fundamental limits on the quality of output data and because entities such as road that are contiguous in the real world are modeled as discrete, disconnected cells.

- The Vector Model, on the other hand, breaks objects down into points, lines, polygons, and possibly other entities such as faces, surfaces or volumes — associating attributes with any or all of these. FieldLog is a limited GIS in that it handles points well, has limited capacity to attach attributes to lines, does very little with polygons or other geometric data types, and uses AutoCAD for drawing vectors rapidly. A robust GIS would contain a database of points, lines, polygons, and possibly other geometric data types, and it would permit information to be associated with any of these. It could then also draw a map based on a particular subset of its database. From this perspective, FieldLog stores a database of points, some tags on lines, and associates these with an AutoCAD drawing. AutoCAD internally maintains a database of drawn entities and separates these onto layers.

Projection systems

Projection systems are mathematical ways to transform geographical coordinates (on a sphere) onto flat coordinates.

See Chapter 14 for more information on projection systems.

Data types in geology (and basemaps)

data type	sample geologic features
raster	geophysical data, continuous field data such as hydro geochemical and geophysical field data
point	field stations, structural measurements, sample locations, photograph centers, and so on (height of land, monuments, benchmarks)
line	faults, contacts (roads, rivers, pipelines, powerlines, and so on)
polygon	geologic units, equal-value polygons for geochemical data (lakes, islands, town outlines, and so on)

The curvature problem

When a GIS draws a map from its database, it takes careful account of the geographic factors like shape of the earth and desired map projection. AutoCAD, however, is a drafting program and it considers the world to be flat. FieldLog keeps track of a map's projection system (typically Universal Transverse Mercator in Canada) so that it can back-calculate what the geographical coordinates are and take the earth's curvature into account. In effect, when you digitize or add data points to a FieldLog database, you need to explicitly specify to FieldLog the projection system of the current data. FieldLog can then correctly store the data in AutoCAD in a way that keeps track of curvature and other projection problems. Fieldlog is flexible in this, because in addition to standard systems and projections such as UTM, Lambert, and Geographic Coordinates (lat.-long.) FieldLog also allows you to define a user projection system.

It's extremely important that when you digitize a piece of a map you tell Fieldlog the correct projection system, otherwise FieldLog and AutoCAD can't handle the data correctly!

Closure

The fundamental requirements of a vector GIS are that:

- points are accurately positioned
- polygons close exactly

Accurate positioning includes not only proper placement on the curved surface of the earth, but also correct absolute placement — if you digitize a map sloppily, you will end up with a sloppy database.

Not only must the drawing entities be accurately placed, but it's important that they close.This means that you must ensure that any polygon you use to represent a geological unit is completely and perfectly closed-in by linework. Linework that appears closed at one scale may in fact be open. You can check this by zooming in. Truly closed linework will remain closed despite unlimited zooms on any given vertex. AutoCAD has tools for ensuring a polygonal area is closed when you digitize it. We'll discuss these later in this chapter.

About Basemaps

If you're about to embark on a major field project and FieldLog implementation, you are facing not only the task of FieldLog setup, but also the task of base map preparation.

To properly digitize a typographic basemap is a daunting task.

You may want to consider purchasing digital basemaps from the federal, provincial, or state government or a third party source.

In Canada, 1:20,000 scale basemaps are available for some areas of provinces from the provincial government. 1:250,000 scale basemaps are available from the federal government. All are available as DXF files, which FieldLog can easily load and, if necessary, re-project to suit your specific needs.

Scale

Finally, any map has a nominal scale. If we digitize a basemap at 1:25000 for use in a 1:250 000 soil survey, the basemap will be unnecessarily detailed, meaning wasted hours of digitizing, and will often be cluttered as well. If we digitize a basemap at 1:25000 for use in a 1:5000 detailed mapping project the basemap will likely be too crude to use. This means that you should carefully choose sources at an appropriate scale and choose appropriate data *types* when you make a map. At 1:25000 an outcrop might be a small polygon. At 1:250 000 it will be a point. At 1:5000 it might actually contain several smaller polygonal areas. Choosing the right *representation* for features is often just as important as accurately digitizing them in the first place. One useful trick is to make a sketch map at the final scale of your project (say, the scale of a map you have to deliver in the near future). Do points best represent outcrops at this scale? What scale basemap do you need? A little intuition and thought goes a long way here, and will save you a lot of time in the end.

AutoCAD Commands

The remaining part of this chapter details key AutoCAD commands and provides some insight on how they are used with FieldLog. This section is not intended to be a replacement for the AutoCAD Reference Manual, but it will focus on commands from the point of view of drawing a map. The commands are organized as follows: Organizational Commands, Navigation and Display, Drawing, File Management, and Program Extensions. The chapter concludes with a brief discussion of more advanced AutoCAD features and a discussion of AutoCAD and AutoLISP issues for users interested in more sophisticated interaction with their maps.

Organizational commands

New **maps**

To start a new map,

Choose **File**>**New**.

AutoCAD prompts you for a new drawing name. Use a unique name that's easy to remember, then press Return. Don't set yourself up for a disaster —

use a name that you haven't used before. You can use the date and month for the last few digits of a name to force it to be unique — for example, *SNOW9512* would be a map in Snow Lake started in December 1995.

***Tablet* calibration**

AutoCAD directly supports graphics tablets. In AutoCAD a user can lock a digitizer to a drawing mathematically, so that regardless of the current drawing scale or view, data entered on the digitizer is transformed and correctly entered into the drawing.

To calibrate a tablet:

1. Type `tablet` at the command prompt.

   If you have a digitizer properly configured, AutoCad gives you the option of calibrating it.

2. Type `cal`.

   AutoCAD then asks you to pick a point. Pick a point on your map that you can accurately find on your screen, or that has known coordinates in the coordinate system of your AutoCAD drawing.

3. Click a point, placing the crosshair as carefully as possible.

   AutoCAD then prompts you for the coordinates.

4. Either type in the coordinates separated by a comma or else click the point on the screen that corresponds to the map point digitized.
5. Repeat this procedure for a second point diagonal from the first, then a third point, and so on (for most maps four points is adequate for digitizing).
6. Press Return.

   AutoCAD offers some statistics and asks you to choose between an orthographic, affine, or projective transformation.

7. Choose the affine or projective transformation, or whichever reports the lowest error.
8. Return to the drawing view (press F2 in Windows).

Now check your projection by placing the crosshair on a point you can identify on your screen, but not one that you used for the digitizing process. The cursor on the screen should be on the correct location and the coordinates displayed in the text box on the toolbar should be correct for the chosen point on the map. If not, repeat the tablet calibration with different points. Once you have a good fit, you're ready to begin working with AutoCAD and FieldLog.

***Layer* command**

Use the Layer command to:

- create new layers
- change the current drawing layer
- change global characteristics of layers, such as color and linetype

AutoCAD always draws onto the *current* layer. The name of the current layer is always displayed on the border of the drawing you are working on. Before doing any work in AutoCAD, always make sure that the layer you wish to work on is current.

In general, you should use more layers rather than less. It's easy to merge two layers onto one if the need arises, but very tedious to separate one layer onto two. Of course, map items that are associated with FieldLog avoid this problem because the database information can be used to direct the output to a specific layer as needed.

Options with Layer are:

?/Make/Set/New/ON/OFF/Color/Ltype/Freeze/THaw/LOck/Unlock

Most of options require that you know the layer name you want to act on, and the spelling must be exactly correct. The DDLMODES command does the same thing as the Layer command, but works graphically. We encourage you to use it instead. The various Windows AutoCAD versions also present toolbar icons for layer control. Regardless of how layers are presented, only a few of the settings are important for routine use of AutoCAD.

?	lists existing layers
OFF	makes a layer invisible to the user, but still accessible from the database
ON	makes a layer visible
Freeze	makes a layer invisible and inaccessible to editing commands
Thaw	makes a layer visible and accessible to editing commands
Color and Ltype	set default color and linetypes for the entities on the layer, respectively
Make	creates a new layer and makes it the current layer (the layer any new entities will go on by default)
New	creates a new layer but doesn't make it current
Set	makes an existing layer current

DDLMODES command

This command is a graphical equivalent of the Layer command. It lists all layers in the drawing, enabling you to easily keep track of the layers you've created and their characteristics.

To change the properties of a layer, click a layer name, then an option box.

End and ***Quit*** commands

End saves the current drawing and exits AutoCAD. Quit exits without saving, but before quitting AutoCAD gives you the option of saving any unsaved changes.

Undo command

Undo reverses the last action performed in AutoCAD.

Undo is useful if you've just erased something important, modified a feature you shouldn't have modified, and so on. Don't use it to undo a mistake in FieldLog. If you do something in FieldLog itself, FieldLog changes the database tables it maintains in the background.Undo does not undo changes

Important Note:

If you accidentally hit the Enter key when specifying the origin or target location during Move, AutoCAD may move the entity into a remote location far from your map area. Perfor an Undo to recover the lost entity.

Note:

Occasionally the Zoom -> E causes your map to appear as a small dot on the screen. This occurs becuase some entities have been placed at an extreme position far from the map (see note above). You will need to delete these outliers before zooming using the extents option again.

to database tables, so if you undo something on the AutoCAD map that actually involves FieldLog manipulations of the database, you will create inconsistencies between your map and the FieldLog database.

Before using undo, check to make sure the last operation was an AutoCAD operation (like pline, dtext, etc.) and then proceed.

Navigation and Display Commands

Move command

Move allows you to move objects around on the screen. For example, you can move text labels from place to place. You can also move geographically referenced data such as outcrops, but their corresponding database values won't be changed. To move FieldLog data, use Fl-edit.

Pan command

Pan allows you to shift your view of the drawing. AutoCAD distinguishes between the drawing, which is all of the entities you've entered and that have been loaded through FieldLog, and the view, which is your current screen view of that drawing. Because AutoCAD treats all graphic entities mathematically, you can zoom in or out infinitely, although your data will quickly fall below or above the scale of the view. Pan allows you to shift the view side to side or up and down without changing the scale. Simply type `pan`, then choose a point. Choose a second point to show AutoCAD where to shift the first point. Try it a couple of times to get the idea.

Zoom command

Zoom allows you to change the size of the screen display size of your drawing. Together with pan, zoom is the command you'll most often use to get different views of your data. Useful options are:

zoom > **e**	zooms to the entire extent of your current database
zoom > **w**	allows you to pick a new view window with the cursor
zoom > **p**	returns to the previous zoomed view of a drawing, this is useful for returning to a smaller scale view after you zoom in for a close look at something

Redraw command

AutoCAD frequently clutters up the drawing area with small ticks and lines that represent temporary markers used during editing. To clean up a view, type `redraw`. Although this command is very fast, it doesn't recalculate the view from the database. Setting the AutoCAD environment variable *blipmode* to *off* will prevent these ticks from being placed.

Regen command

To force AutoCAD to recalculate a view from the drawing database, type `regen`. AutoCAD frequently does a regen when you change the view of the drawing. Regens can be quite slow, especially on computers without much RAM.

Be prepared to wait a few minutes for a regen. Also, in R14 a regen must be performed before raster images, such as geophysical maps, are properly displayed in the background.

List command

List allows you to select and display the characteristics of drawing entities. It's useful for quickly determining what layer an entity is on.

Drawing commands

Line command

Do not use this command with FieldLog.

Pline command

Pline is the command you'll use the most when drawing your map. Pline is short for PolyLine. Use pline to draw lines where each line segment connects from the previous line segment's vertex. You can use pline to draw geometric shapes like boxes that have only a few vertices or, by using many vertices, almost smooth shapes like shorelines or rivers. With pline, every time you click with the mouse or digitizer you leave a vertex. To end the command, press Return.

To add a pline:

1. Type `pline`.

   Pline returns *From Point.*

2. Move your pointer to the first location you want a vertex, then click.

   After the first vertex the options change to

   Arc/Close/Halfwidth/Length/Undo/Width/<Endpoint of line>

3. To add more vertices, just click.

Close draws a line segment from the last vertex to the first vertex of this polyline, closing a perfect polygon. Undo removes the previous segment.

A useful option that isn't listed is End. If you type `End` then press the spacebar, AutoCAD asks you to pick a vertex. You can pick any vertex on the screen and AutoCAD will draw a segment from the previous position to the exact position of the chosen vertex. This is a useful way to ensure that polylines close onto each other — since Close only allows a polyline to close on itself. You can set up AutoCAD to always try to find a vertex to jump to whenever you click the cursor, a useful feature for making maps — see OSNAP below.

Pedit command

Pedit allows you to modify an existing polyline. Things you can do with pedit include:

- assign a color or width to the line
- move a vertex
- join lines

You’ll primarily use pedit to rearrange polyline vertices using a pedit submenu called Edit vertex. Options under Edit vertex are:

Next/Previous/Break/Insert/Move/Regen/Straighten/Tangent/Width/eXit <N>:

N	shifts the currently selected vertex (shown on your screen as an X on a vertex) to the next vertex
P	shifts the currently selected vertex (shown on your screen as an X on a vertex) to the next vertex
Move	allows you to move the current vertex
Break	splits the polyline at the current vertex

The other options are less often used. Remember that you can use Move and End to move a vertex exactly onto another vertex (to close a polygon, for example).

Other things you might want to do with pedit are override the color of a line or change a linetype or width. Normally we use 0 with lines in AutoCAD so that lines appear sharp at any zoom. However, you may want to assign lines a definite thickness. This can be useful for emphasizing faults and other features. However it’s usually better to put all similar features on one layer and make a special linetype for that layer. Read about linetypes in the AutoCAD Reference Manual.

Osnap command

Osnap modes, or Object Snap modes, are modifications to the way AutoCAD runs other commands rather than independent commands. Object Snap forces AutoCAD to modify the placement of features such as vertices by referring to the drawing area surrounding the click point and then doing a quick operation. Available operations are *Endpoint, Midpoint, Center, Node, Quadrant, Intersection, Insertion, Perpendicular, Tangent, Nearest,* and *Quick*. The most useful one is Endpoint.

To set the object snap:

1. Choose **Object Snap** from the Settings menu.
2. Select the Endpoint checkbox.
3. Adjust the size of the search area using the Aperture Size slider.

Until you clear the checkbox in the Object Snap dialog box, any click that’s close enough to an existing vertex that the existing vertex falls inside the Aperture box size (there will be a small box around the cursor to show you the size) will be shifted to the existing vertex instead of appearing at the click location. This is useful in map production. If the aperture is set relatively small, you can quickly draw polygons and always close them exactly — try to pick an existing vertex and Osnap will automatically shift the click point for an exact match. Try it!

To use Osnap from the command line, type `Osnap`, then type `Endpoint` for the mode. To adjust the aperture size (in pixels on your screen) type `Aperture`. A value of about `12` is a good starting point.

Text command

Text allows you to place a single line of text on a drawing. It requests a start point, a height, a rotation angle, then the text string. To change the font or style of the text, type `Style` at the first prompt rather than picking a start point.

When placing text on a map it's a good idea to place it on a separate layer from the map information. That way annotations can be turned on or off depending on the use. Multiple text layers (say *placenames*, *samplenotes*, *etc.*) are even more flexible. Use layer or ddlmodes to make a layer for text.

Dtext command

Dtext allows you to place lines of text anywhere on a drawing. It's identical to the Text command except that it doesn't exit until you press Return twice. Multiple lines of text can be entered.

Rotate command

Rotate allows you to rotate any drawing entity on the screen using your mouse or digitizer, or by specifying the actual rotation angle. Rotating a structural symbol or other FieldLog entity doesn't change the value stored in the database, only the currently drawn symbol. Use Fl-edit to change values in the database. Rotate is useful for rotating text to coincide with the alignment of features like roads and rivers.

Erase command

Erase allows you to select and erase drawing entities on the current display. Any number of entities can be selected before erasing, but it's best to select only a few, since you'll have to prematurely exit the command (Ctrl+C on most systems) if you inadvertently select an entity you want to keep! If you erase something you want to keep, use undo.

File management commands

Save command

Save saves your file to disk quickly. It doesn't prompt you for a filename unless this is the first time you've saved the file. Save your work often! Note that save does not backup your FieldLog database. FieldLog data is automatically saved when entered.

Save As command

Save As allows you to save a drawing under a new name. This is useful if you want to generate multiple independent backups of a drawing. Save As does NOT backup the FieldLog database — it only saves the drawing part of the file. If you use Save after Save As you'll be replace the second version of your file, not the original file. When a Save As is performed, AutoCAD changes the name of the currently open drawing and leaves the original drawing untouched on disk.

DXFOUT Command

DXFOUT allows you to export a DXF file. DXF is the standard CAD (and low-end GIS) way of exchanging spatial data — you can import a DXF into CorelDRAW or Illustrator, for example, to make slides for a presentation. DXFOUT opens a dialog box and asks for a filename and directory. It then asks for decimal places of accuracy (6 is often sufficient, unless you are importing into a GIS where maximum accuracy -- usually 16 -- is desirable) and proceeds to write the file to disk.

DXFIN Command

DXFIN allows you to import a DXF file. DXFIN opens a dialog box and asks for a file name and directory. It then brings in the entities from the file and places them on the view at appropriate places. Note that when making maps you can get bizarre results if you DXFIN a file from one map projection into another map projection — AutoCAD doesn't directly support map projections. To get around this, import the DXF into an empty drawing,project it using `fl-project` into the desired projection and insert the drawing into the original using *INSERT*.

WBLOCK Command

The *WBLOCK* command writes a block or the entire drawing out to a disk file, creating a new DWG file. Use this command to get blocks used for symbology out of one DWG file and into another. If an entire drawing is exported, it can be inserted as a block into another drawing - this is an easy way to create composite maps where one map is at a different level of detail than another.

INSERT Command

Inserts a named block onto the map, allowing the user to specify rotation and scale as desired. If a drawing is named, the entire drawing will be converted into a block and written into the file on-the-fly.

Program Extensions

Appload

Appload is the function that loads program extensions (see ADS below) and that you'll use to load FieldLog when you use AutoCAD to work on your map.

1. Choose **Applications** from the File menu.

   The Load AutoLISP and ADS Files dialog box appears, listing known AutoLISP and ADS files.

2. If FieldLog isn't visible (FIELDLG3.EXE, FLG13.EXE or FLG14.ARX in most cases) click **File...**, then navigate to the directory containing FieldLog, which is usually the support directory under AutoCAD's main directory.
3. Select the *FieldLog* program, then click **OK**.
4. Select the application you want to load, then click **Load**.

FieldLog should load quickly and you'll be ready to log on to your database.

AutoLISP

AutoLISP is the programming language embedded within AutoCAD. Lisp excels at handling lists, and AutoCAD stores drawing entities as lists in its database. You can write relatively simple programs in AutoLISP to access the database, make changes, and so on. For more information, refer to the AutoLISP Programmer's Reference Manual that comes with AutoCAD.

ADS

ADS is the programmers extension to AutoCAD for writing modules in the C language. FieldLog is written in primarily in C using ADS. For more information, refer to the AutoCAD Development System Programmers Reference Manual that comes with AutoCAD.

Advanced Issues

Blocks and Attributes

Blocks are structures in AutoCAD that are built up out of smaller drawing entities. An example might be a north arrow (with an N and an arrow) or a template for a drawing name, date, and author. Any number of entities may be included with a block, up to and including an entire drawing!

To make a block:

1. Make sure all of the related entities are visible, then type `block`.
2. Type in a unique block name.
3. Enter a base insertion point, which is the point on the block that the aggregate will be inserted around. Try this out, it isn't exactly intuitive.
4. Select the objects you want included in the block.

   The entities disappear. Don't worry. They went into the block database. To replace them, insert the block.

To insert a block:

1. Type `Insert`, then the block name.
2. Enter the insertion point, followed by a scale factor (1 for X, 1 for Y unless you want the block size to change), and a rotation angle (0 to leave the block unrotated).

   AutoCAD inserts the block.

Attributes are user defined data that are embedded within a block. You can put text or numeric fields with prompt names inside any block. When it inserts a block, AutoCAD prompts you for values for the attributes. This is a simple way to build up a database map combination. We don't recommend it within FieldLog, as FieldLog provides more sophisticated ways to build a database than simple attributes. See the Attributes section of the AutoCAD Reference Manual for more information.

Before you make a block and attribute set, consider carefully: FieldLog is designed to provide symbol-database combinations exactly like blocks and attributes, but much more powerfully and simply. If the needed changes can be made via a FieldLog table, consider going through the Setup process and including the new item in your FieldLog database rather than maintaining two separate database systems. A general rule is: if the data is geological, it should be in FieldLog.

FieldLog maintains symbols as either blocks or shapes in AutoCAD drawings. However, prior to being used with FieldLog all symbols must reside in shape format libraries that are loaded by FieldLog before any symbols are plotted to a drawing. Refer to the Appendix X for instructions on how to create shape libraries.

XREFs

There are times when it would be useful to include material for other drawings into a FieldLog map temporarily. The XREF command allows the contents of any AutoCAD drawing to be attached as background to a drawing in use. The attached reference drawing cannot be edited in any way, but can be temporarily modified in display color and behavior by the DDLMODES command. All layers in the attachment appear with their drawing name as a prefix.

As long as the projection parameters of the attachment and the drawing are matched exactly, XREF can be useful; if the two drawings are projected differently they will not superimpose properly and XREF will be useless.

Explode

If you need to disassemble a symbol or user block in AutoCAD, use the Explode command to select and break up the block. If a FieldLog database record is attached to a block, then that linkage would be lost upon exploding. However, for blocks such as steronets, FL creates links to the entities inside the block where exploding the block will expose the database links and permit the database contents associated with them to be browsed with `fl-edit`.

CHAPTER 7

Customizing FieldLog

Introduction

FieldLog provides support for field data capture through a *data model* well suited to the needs of most field geologists. The *data model* provides building blocks for the construction of personal database structures in which the field data resides. For example, the database used in this tutorial (*SnowLake*) exemplifies a data structure well suited for the needs of survey geologists interested in capturing a wide variety of field observations and dependent laboratory results into a single data management system. This example data structure is also populated with real field data*****.

Your needs may be substantially different from those of the workers in the SnowLake area. This might include differences in symbolization, differences in terminology and classification schemes, and differences in depth of detail.

The customization of FieldLog is covered in detail in Volume 2. This chapter assumes that you want to make minor changes to an existing FieldLog project, and briefly introduces customization of the palettes, profiles, and table structure within a project.

Warning:

Changes to the fundamental structure of FieldLog can lead to unanticipated adverse side effects. Before customizing FieldLog, back up your database completely. Once a change has been made, take the time to do a wide variety of queries, data entry and editing examples, and map editing before attempting major work with the modified system.

*****Bailes, A.H., and Galley, A.G., 1993, Geology of the Anderson-Stall volcanic-hosted massive sulphide area, Snow Lake, Manitoba: Geological Survey of Canada, Open File 2776, 1 map, scale 1:10,000.

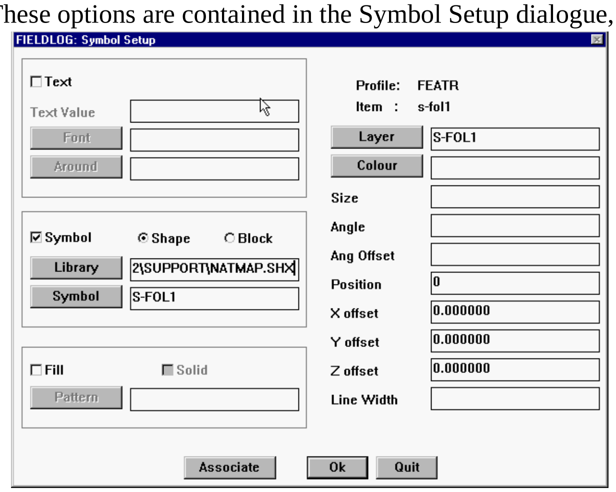
Customizing FieldLog Palettes

At some point when working with FieldLog you may want to modify the way in which FieldLog symbolizes data to the map. The Palette controls the display characteristics of items as they are plotted to the map.

For example, the possible variables in a palette specification are:

- text value and font, if text is to be printed.
- symbol library and symbol name, if a symbol is to be printed.
- layer the new entity should be placed on
- color of the new entity
- size of the new entity
- orientation angle of the new entity
- angular offset
- position of a text item around a symbol
- X,Y,Z offsets relative to station location
- line width, for entities with controllable line width.
- solid or pattern fill type for the wedges of a pie diagram

These options are contained in the Symbol Setup dialogue, as shown here:

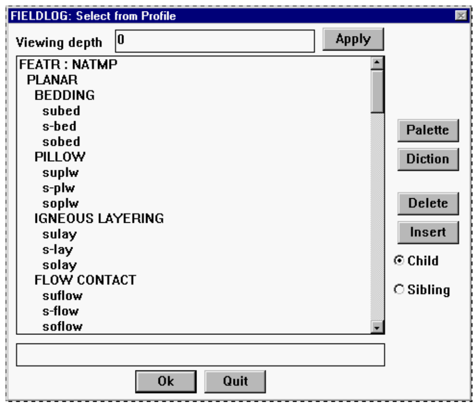


Palette controls can be associated with various parts of a database setup, permitting groups of database items to share a Palette control. If every possible combination of layer, color, symbol, orientation and so on had to be set for every possible entry in an entry field, database setup would be incredibly tedious. This is alleviated by permitting symbology to specified at different levels of database setup.

FieldLog allows symbol palettes to be assigned at two levels: first, any column in a table may have a palette attached to it. Second, any item in a profile may have a palette specification.

FieldLog's data entry and data query processes are column-based: data is added to tabular rows, which consist of columns, and queries return a table of columns. Even FieldLog's dictionaries and profiles are attached to columns. More significantly, it is columns that are selected for plotting in both the data entry and query procedures. Thus, when a symbol is to be plotted, FieldLog first inspects the column's (e.g. *Rocktype* in *LITHO*) Palette parameters and utilizes those that are specified. For those parameters without a value at the column level, FieldLog reads the data item in column (e.g. *monzogranite*) and checks in the profile to see if a Palette value has been defined for the data item. If so, then it tries to find the missing symbol parameters here. If some parameters are still not found FieldLog will traverse up the hierarchical profile searching for them in the Palette definitions of any parent profile items (e.g. in *Granite* and *Igneous*). If no symbol or text parameter is specified in this process (though other parameters could be defined), FieldLog simply prints the data item as text onto the map.

For example, as shown in the figure above, *s-fol1* is present in the palette, has a specified symbol from a specified library, and will be placed on the layer *sfol1*.



About Symbols:

Symbols in AutoCAD are named features built out of individual line segments or other graphic entities. They are named with a postfix*.shx* and stored as separate files on your hard drive.

The FieldLog distribution comes with three Canadian structural symbol libraries, *OGS.shx, GSC.shx, and NATMAP.shx.* These will in all likelihood cover more structural types than you will ever see.

If you need to define your own shape libraries, refer to the notes in Volume 2, and experiment with the programs for manipulating symbols: *SHX2DXF.EXE and DXF2SHX.EXE*

If there is no value in the palette attached to the profile entry, FieldLog will examine the palette for the entry that is the *parent* in the profile hierarchy (i.e. *Foliation*) to the original data value. It will continue to move up the hierarchy (i.e. to *Planar*) until the top is reached, or until a value is found.

This structure is quite complex on first examination, but consider this: instead of specifying *for each structural symbol in the profile* how to rotate to the correct azimuth, this is simply set in the column's palette. Instead of explicitly designating for the position of text, such as the dip or plunge, *for each structural symbol in the profile*, these can be assigned to the *Planar* and *Linear* items and thus inherited by the remainder of the structural items in the profile. This resulting system is both flexible and powerful.

Using Palettes

When modifying or setting up palettes, remember that the purpose of the hierarchy of symbol palettes is to avoid you having to make a new entry in multiple places. If you are symbolizing a group of symbols, anything common to the group belongs either in the column's palette, or perhaps in the profile parent's symbolization.

One of the most powerful features of palettes is that they allow *dynamic symbolization*, where the symbols on a map convey multiple meanings through the use of the available cartographic variables (typically: color, size, orientation, symbol type, and lineweight). In a traditional map, a structural symbol conveys orientation through orientation, type of structure through symbol type, and dip through associated text. A dynamic symbolization might color structural symbols to reflect steep and shallow dips, and avoid using the dip text totally.

There is no limit to the number of possible dynamic symbolizations of a fieldlog dataset. However, bear in mind that a map that others must use must have either recognizable, standard symbols or else a very clear legend.

Example Of Modifying Palettes:

To look at both the symbolization process and dynamic symbolization, we will make some basic modifications to the symbol palette for the structure table in *SnowLake* and examine the results.

Before you begin

If you aren't logged on to FieldLog and the *SnowLake* database, follow the steps from Chapter 2 to open *snowlake.dwg* and log on:

- Start AutoCAD, then open *SnowLake.dwg*.
- Load FieldLog using the menu.
- Logon to the *SnowLake* database using fl-logon from the AutoCad command line or the FieldLog menu.

At this point you should have a map of the SnowLake area displayed. Zoom out to view the entire map before you start the palette tutorial.

Simple Palette Changes

The exercise we will do is to change the palette for structural symbols so that all planar structures plot in red and all linear structures plot in green.

1. First, zoom in to an area where you can see an existing structure. Type *fl-add* at the command prompt or select it from the menu, and select the *STRUC* table.
2. Notice that the panel near the bottom of the dialogue has a palette button. This is how we will access the palette.
3. Select the *Feature* column in the table, then click on the *palette* button. The dialogue should come up:

   Notice that there is a section for color. What will happen if we pick a color here? That color will be used for all plotted structures subsequently.

   Since we want to set two different colors, not one global color, leave the dialogue box by pressing *Quit*. We need to control palette symbolization through the profile for structural data, since that is where different types of structures can be symbolized independently. Exit this dialog using *Quit*.
4. After returning to *fl-add*, with the Feature column still selected, click the *List* button. The hierarchy browser for the structural palette should come up.

About Structural Measurements:

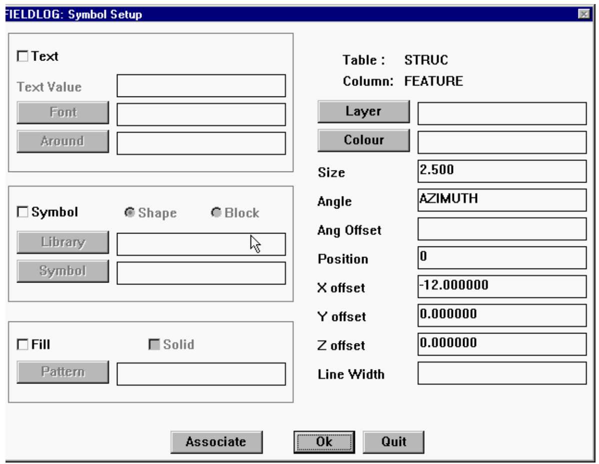
Structural observations are representations of the three-dimensional orientation of observed features. Since a simple observation of strike and dip by itself is ambiguous (does a strike of 80 degrees mean that the object dips off to the right or left?) a common method for recording structures is to record planar structures such that when looking in the direction of the strike, the object dips off to the right. This is informally known as the right-hand-rule. Using this system, strikes will range from 0 to 360 degrees, and dips from 0 to 90 degrees.

For linear objects, record the trend as the facing direction when the object plunges away and down, and the plunge as the angle at cwhich it drops below the horizontal.

Alternatively, FieldLog supports the dip-direction method of recording planar structures, where the trend and plunge of the steepest line int he plane is measured as a lineation.

AutoCAD symbol positions:

AutoCAD places text around predefined symbols using a simple 8-position system. In this notation, a 1 indicates that the text is placed to the right, a 3 to the top, a 5 to the left, and a 7 to the bottom. The even numbers represent the diagonal quarters.



Since we want to use color to distinguish between *Planar* and *Linear* features, only these items need to be symbolized in the hierarchy: there is no need to set the color for any of the *child* items of *Planar* and *Linear* as FieldLog will move up the hierarchy and finally reach the *Planar*/*Linear* items, and their colors. Also notice that the position of text around a *Planar* feature has been set to 1 -- this indicates that associated text (such as dips or plunges) will plot immediately beside any *Planar* symbol.

5. Click on Planar, then the *Palette* button.
6. Click on the color button, and choose red from the choices offered.
7. Return to the hierarchy browser, and similarly set the color of linear structures to green. Notice that the position of text around a *Linear* feature has been set to 3-- this indicates that associated text (such as dips or plunges) will plot immediately above any *Linear* symbol.
8. Return to the browser, and exit to *fl-add.* Quit *fl-add.*
9. Run a query using *fl-query* to display all structures (you should be able to do that by now! If not, see chapter 4) Note that they plot in red and green dependent on type.

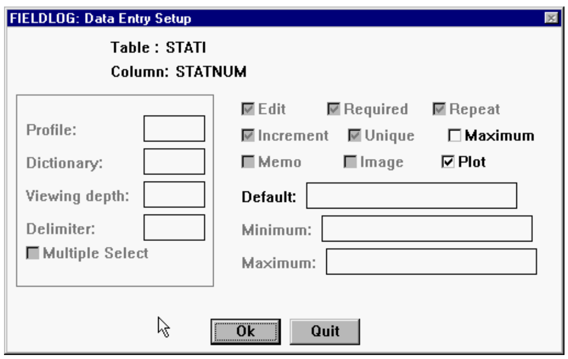
We've just seen that the symbolization controls in FieldLog allow customization that supports dynamic symbolization for making thematic maps. For more complete coverage of all of the options in symbolization, refer to Volume 2, the FieldLog Reference Manual.

Controlling Data Entry with *Input*

One of the key problems facing geological database builders is quality control. Misspellings, informal terminology, and missing data can cripple a GIS database. FieldLog has two methods for dealing with this problem: first, profiles and dictionaries act as on-line references for spelling and meaning, and allow typing to be replaced by selection from lists to avoid spelling errors.

Second, FieldLog supports controls on all columns in all tables that restrict data access types, force columns to be completed, and do simple checking on entered data.

The input controls are accessible from *fl-edit*, *fl-add,* and *fl-setup*. For the *statnum* field of the *STATI* table, the data entry setup dialogue contains:



Making New Profiles and Dictionaries:

Once you have created a new profile and dictionary, you will need to fill it with valid entries. After exiting Data Entry Setup you should see that the *list* item is available in *fl-add* and *fl-edit* for this column. You can now use the interactive dictionary creation buttons under *Profile* and *Dictionary* to populate your profile. See the notes on Profiles, below.

The Table and Column referred to are indicated at the top of the dialogue. The main features of the dialogue are:

- Profile Name: if a profile is attached to the column, it will be named here.

  To attach a new profile, simply name it here and a table will be created automatically once the *OK* button is pressed. If the option is grayed out, adding a profile is unavailable except through setup, or is inappropriate for this column type. To attach a new profile, you must also define a new dictionary. Profile names are maximally 5 characters long.

- Dictionary Name: if a dictionary is attached to the column, it will be named here.

  To attach a new dictionary, name it and a table will be created automatically once the *OK* button is pressed. If the option is grayed out, dictionaries are unavailable for the column highlighted. Dictionary names are maximally 5 characters long.

- Viewing Depth: specifies the number of levels visible in the profile browser.
- Delimiter: specifies the character used to separate multiple choices from a profile.
- Multiple Select Checkbox: indicates that the current column may contain multiple entries separated by a delimiter.
- Edit Checkbox: indicates whether the current column is editable.

Uniqueness:

In a GIS like FIeldLog, there are two fundamental types of information stored in tables: field data and information about the database and project setup.

FieldLog requires a numeric column in each table, called the *Unique Number*, to contain unique values. This provides the system with an unambiguous way of referring to a record ina table.

There might be a hundred places ina large database where a specific lithology is observed - a granite, for example - but each is uniquely identified via the unique numbers FieldLog places in the table.

Some user defined numbers, such as the station number column in the STATI table, are also unique.

For more details on relational databases and FieldLog, see Volume 2.

R13/14 Note: Images

AutoCAD R13 and R14 support the direct incorporation of images into a FieldLog database. Supported file formats are:

R13: TIFF, GIF, TARGA (TGA)

R14: TIFF, TGA, BMP

Certain fields are used internally by FieldLog, and should not be modified by users. The unique number is an example of this.

- Required Checkbox: specifies whether the column must be filled in.

  Required fields are a crucial tool for ensuring that a minimum level of data is collected and recorded.

- Repeat Checkbox: forces FieldLog to repeat the last value entered into this column when a new record is created.
- Increment Checkbox: forces FieldLog to repeat the last value entered, incremented by one, when a new record is created. Used to automatically increment unique numbers.
- Unique Checkbox: forces FieldLog to check that an entry is unique, in order to prevent duplicates occurring.
- Minimum and Maximum Checkboxes: forces FieldLog to enforce minimum and maximum values for numeric fields. The actual limits are indicated in the fields.
- Memo Checkbox: indicates that the column is a memo, where a multiple-line message can be typed.

  Memo fields are very useful for recording descriptive text. Though they can be exported to text files, they cannot be searched. Unlike many GIS and database systems FieldLog’s memo fields are completely compatible with all SQL compliant databases.

- Image Checkbox: indicates that the column contains a reference to an image file which can be viewed using the *Image* button. This is inactive with AutoCAD R12, but works in R13-14.
- Plot: indicates that the selected column is to be plotted to the map during data entry. This box may be overridden by the Plot button in the *fl-add* panel. The Input>Plot option does not affect which columns are to be plotted from a query, as those are selected at query time.
- Default: stores the default entry for the column. This value will be automatically placed in the column during data entry
- Minimum: stores the minimum value allowed for a numeric field.
- Maximum: stores the maximum value allowed for a numeric field.

There are obviously a lot of controls here that can affect how data entry progresses. The most crucial for day to day work are the *required* and *unique* checkboxes. These can be used to enforce a minimum level of detail, and to prevent index numbers such as lab sample numbers, from being entered incorrectly.

FieldLog Dictionaries and Profiles

Perhaps the most revolutionary feature of FieldLog is the incorporation of terminology dictionaries and profiles into the basic operation of the program. Dictionaries and profiles allow organizations and users to control the use of terminology during the creation and upkeep of a database, and can thus ensure some level of uniformity across large projects. Since the dictionary/ profile combination is a set of standard database tables, they can be distributed between projects to enforce standards organization-wide. One

Short Name Abbreviations:

Short names can be used during data entry. The user can type the short name and FieldLog will automatically replace it with the long name. in fact, only the unique part of the short name need be entered for FieldLog to determine which long name is being referenced. This greatly speeds data entry.

common implementation of this involves the creation of corporate dictionaries and profiles, where the corporate profile is a core subset of terms, from the a corporate dictionary, arranged in a hierarchical manner. Geologists are encouraged to retain this core during daily operation, but they may evolve the lower levels of the hierarchy to meet individual and project needs. Thus a degree of corporate uniformity is maintained without sacrificing flexibility of usage.

The dictionary is in fact a form of *metadata* that store definitions, abbreviations, and long forms of common geological terms. Dictionaries enforce not only a common spelling of a term, but also provide an easy way to check on definitions, and so support a uniformity of *usage* of terms, a much more difficult task and problem in large GIS projects.

The profile is essentially a hierarchical view of the terminology within a dictionary. It also links to palettes to provide controls on symbology, and links to the dictionary to provide access to the meaning of the terms. Arranging geological terms hierarchically is crucial in recording, and especially analyzing, geological observations, since the inexact nature of geological fieldwork virtually guarantees that descriptions will be more specific in well exposed and geologically clear-cut areas, and more general in poorly exposed or highly ambiguous areas.

As FieldLog has the ability to search within hierarchies, using the *fl-query* tool, it is possible to analyze data despite differences in the level of classification. For example, a hierarchical query looking for granitoids would find not only rocks labelled as granitoids, but also rocks that were more specifically *types* of granitoids.

Examples of Using Dictionaries and Profiles

Although Dictionaries and Profiles can be created, modified, and deleted using advanced tools in *fl-setup>Dictionary Setup*, basic changes to existing Profiles can also be made via the Profile browser accessed via the *List* button located on the *fl-add* panel; as well, new Profiles can also be created using the *Input* button. This allows Profiles to be modified during data entry to reflect new terminology, and it also allows new Profiles to be created when a column in a table could benefit from a classification system.

Before you begin

If you aren't logged on to FieldLog and the *SnowLake* database, follow the steps from Chapter 2 to open *snowlake.dwg* and log on:

- Start AutoCAD, then open *SnowLake.dwg*.
- Load FieldLog using the menu.
- Logon to the *SnowLake* database using fl-logon from the AutoCad command line or the FieldLog menu.

At this point you should have a map of the SnowLake area displayed. Zoom out to view the entire map before you start the dictionary/profile tutorial.

Dictionary Access

1. Use fl-add to add a new station on the map, using the following data values:

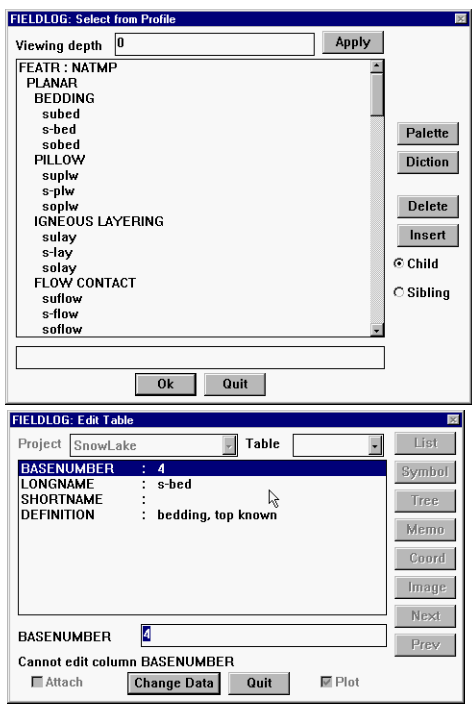
UTMX, UTMY, UTMZ	leave blank
Station Type	Outcrop
Station Number	me4
airphoto	none
Traverse Number	30
Outcrop Number	none

2. Add a structural observation for this station, using the following values. Do ***NOT*** press *Enter Data* when done.

Station	me4
Feature	s-bed
Azimuth	123
Dip	54

3. Let us assume that in this case we want to check on the exact meaning of s-bed in the dictionary. Select the *Feature* column, and click on the *List* button.

4. In the *Select from Profile* browser choose s-bed once again, and click on the *Diction* button. The *Edit Table* dialogue will come up, with the dictionary definition for *s-bed* listed:



Note that no short form is defined. Also, since this is a simple table just like all other FieldLog tables, it is viewed in the standard *fl-edit* dialogue.

Misspelled Profile Items:

To correct a misspelled profile item, you must delete it and insert a correctly spelled item.

The dictionary items could be modified at this point, but we will leave them intact.

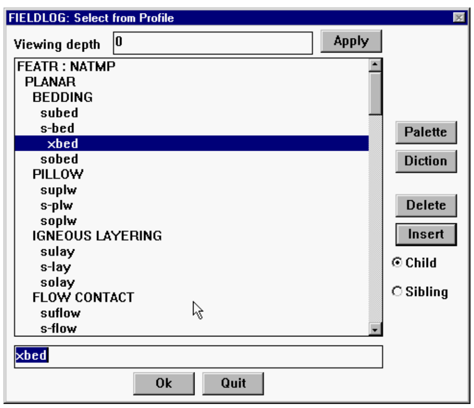
5. Click on the *Quit* button.

Profile Modification

We will now modify the structural profile to include a specialized type of bedding - an observed crossbed, *xbed.* This will require defining the relationship of *xbed* to other items in the profile, and filling in a new dictionary entry for the new term.

1. Access the structure entered in the last exercise using *fl-edit.*
2. Select the *feature* entry. Click on *List* to bring up the Profile browser.
3. Select the item *s-bed*. We will introduce a special case of the *s-bed* symbol, *xbed,* which will be a *child* of *s-bed*.
4. Click on the *child* radio button to force FieldLog to enter the new Profile entry as a child of the currently selected item.
5. Enter *x-bed* in the data entry field at the dialogue's base.
6. Click on the *Insert* button to place the new item, *xbed*, into the profile.Fill in the dictionary item with a definition for the new term (e.g. Longname = *x-bed*, Shortname =*xb*, Definition = *cross bedding*), and click on *Change Data*.

   You should now see a new subtype of *s-bed:*



Saving the Setup

Once you have changed a profile or dictionary, you should force FieldLog to save the changes in case there is a crash.

From the *fl-setup* button menu, choose *Save FieldLog Setup.*

7. Click ok to force the change into the *fl-edit* dialogue, and *Enter Data* to commit the change to the database.

Prior to plotting an x-bed to the map, a Palette definition must be specified for it. Use the Palette button as described above to accomplish this.

A properly constructed set of profiles and dictionaries can make a big difference in the internal consistency, and thus utility, of a field geological database. Field terminology is itself inherently hierarchical, and so by treating this hierarchical organization explicitly, FieldLog provides unique tools for geological analysis.

Modifying FieldLog’s Table Structure

Palettes, profiles, dictionaries and input controls determine how data is entered into a series of tables to produce a self-consistent, geologically useful database, and how items from this database are plotted to the map. But the actual data content is also controlled by the table structure of the database, which is built from logical building blocks (the FieldLog data model) that reflect the mapping process. From these building blocks, geologists can construct databases are tailored to individual and specific project needs.

For example, in the SnowLake database, the following tables are central:

- TRAVerse table

  This table provides a place to record information that describes and documents a traverse, which often comprises a days work, but at the very least is a thematic series of stations.

- OUTCRop table

  The Outcrop table records groups of stations that are geographically linked to a single outcrop. A single outcrop may have any number of associated stations

- STATIon table

  The station table stores location and identification information describing a station, the site of a series of geological observation. Multiple stations can be associated with a single traverse or outcrop.

- LITHOlogy table

  The Lithology table hosts information about a rock type observed at a station. It includes all of the data related to the rock itself that could be observed in the field. Multiple lithologies can be associated with a single station.

- STRUCture table

  The Structure table records structural data, including type and orientation details. Multiple structures can be associated with a single station. Alternatively, structures can be associated directly with a specific lithology, allowing analysis showing the relationship between lithology and structures present.

- SAMPle table

  The Sample table derives from the lithology table, and records the details of sampled lithologies. Multiple samples can be associated with a single lithology.

- LEGND table

  The Legend table stores map legend information, including age relations, and stratigraphic nomenclature. It is used in assigning regional nomenclature to a set of map data.

- MINERal table

The Mineral stable records specific instances of minerals observed in lithologies. Multiple mineral observations may be associated with a single lithology.

- CHEMistry table

  The Chemistry table is an example of a data source that is from outside the field environment, in this case from a geochemical survey associated with specific samples. Although this data originated as a spreadsheet from a lab, it has been imported and incorporated into the *SnowLake* project seamlessly.

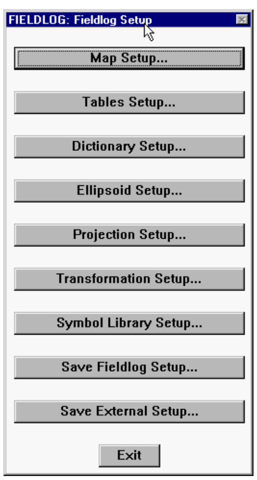
- UNITS table

  The Units table records positions at which labels may be placed to uniquely define polygons for the construction of a polygonal geological map. When exported to a desktop GIS, the Units table is used to attribute polygons constructed from AutoCAD linework.

- PHOTO table

  The Photo table catalogs photographs taken in the course of field mapping. FieldLog operating within AutoCAD r13 and r14 will permit digital versions of the photographs to be displayed from the database if the digital filename is stored within a column and if that column has been designated as an *Image* using the *Input* button.

These tables divide the normal data collected in a field mapping project into pieces that are *related* by identification numbers (e.g. station number, sample number, lab number, etc.) to generate a single flexible structure. The exact fields, or columns, present in each table will vary depending on the needs of the organization: the *SnowLake* database is for government geological survey style mapping.



In constructing a new FieldLog project, you may want to change which tables are present, or add new columns to existing tables. This reflects the varying needs of different mapping organizations. Changing the table structure is a straightforward process in FieldLog, and is managed by *Fl-Setup>Table Setup.*

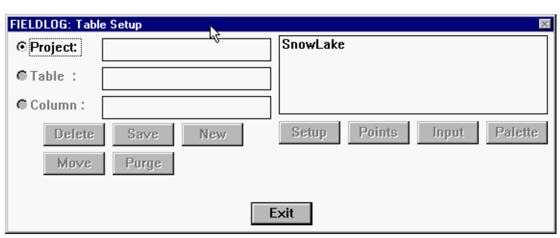
Example Using Table Setup

As an example we will examine the table structure underlying the *Sample* table.

1. Click on *Fl-Setup* on the FieldLog menu.

   The details of other aspects of the setup process are covered in Volume 2, the FieldLog Reference Volume. Note that Map setup is covered below.

2. Choose *Table Setup* from the *Setup* menu. The table setup dialogue will come up.



R13-R14 Note

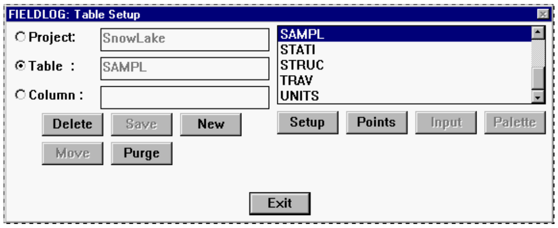
In AutoCAD R13 and R14 there is an additional button in the Fl-Setup menu bar. *Project Setup* is used to establish links between AutoCAD and FieldLog projects. See Appendix A for details.

The Delete and Purge Options:

Delete will make FieldLog unaware of the table, and it will also permit you to permanently erase the table and its data. Use *Delete* with great care. *Purge* is a house-keeping operation that will eliminate deleted rows, that are invisible to you, from the table. This compresses the table and improves database performance. It is worthwhile to occasionally perform this operation on

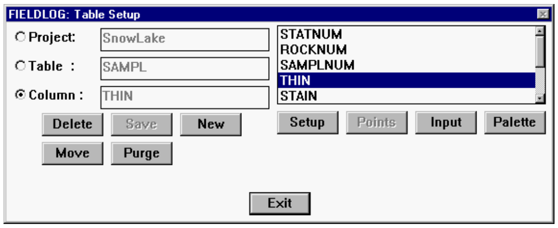
The radio buttons on the left of the dialogue select the project, table, and table column to modify. To select a table, a project must be first selected.

3. Select the *SnowLake* project from the choice list on the right. Choose the *Table* button. A list of available tables to modify will appear.



Note that at this point the *New* button is available, allowing us to create an entire new table. Select the *Sample* table by clicking on *Sampl* in the list of tables in the right panel. Notice that the *Delete* and *Purge* buttons become available. Also available are the *Setup* and *Points* buttons; these are discussed below in the Table Registration and Points Registration sections.

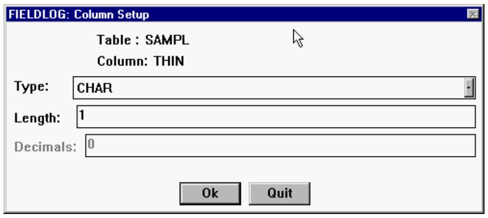
4. From the option list choose the *Column* radio button. The list at the right now shows the columns in the table, available for editing.



Here we have selected the column *Thin*, which records whether or not a particular sample is intended for thin sectioning.

Note that at the left of the dialogue, the *Delete*, *New*, and *Move* buttons are now active. These act on the selected column, performing the indicated action: *Delete* removes a column from the table, *New* creates a new column (by typing in a new column name and pressing Enter), and *Move* shifts a column from its current sequential position to another position in the column list.

On the right, we now have access to the *Setup*, *Input*, and *Palette* buttons. Input and Palette are for setting default input controls and palette settings, respectively, as discussed earlier in this chapter. Setup controls the data type parameters for the indicated column. For example, the *Thin* column has the characteristics:



Type *Char* indicates that this is an alphanumeric field. Length *1* indicates that only a single character is recorded. *Decimals* is in this case irrelevant.

The alternative choices for *Type* are variations on numeric types, including floating point, real, and integer values in various precisions. Press *Quit* to exit column setup.

At this point we could easily add a new column to the Sample table by pressing *New*, typing a new column name, and pressing *Enter.* The new column name will appear at the bottom of the column list, in the right panel. FieldLog will have assigned it a data type of *Char* and a *Length* of 6. To modify this select the new column by clicking it, and then use the *Setup* parameters to alter the default data type specification. Finally, *Save* must pressed to save the new table structure.

Table Setup and Registration

Although many of the characteristics you will set when creating a new table are at the level of columns - data input controls and profiles, for example - the most complex setup process is to actually determine the logical place of a new table in the FieldLog data model. This is done using the *Setup* button once a table has been selected from the table list, and the *Table* radio button is active.

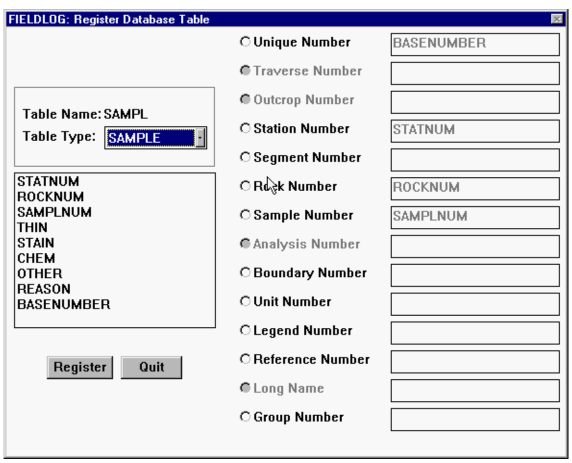
As an example, we will examine the overall setup of the Sample table and examine its place in the FieldLog data model.

1. Return to the *Table Setup* dialogue, and select Project *SnowLake* and Table *Sampl.*

   At this point the *Delete, Purge,* and *New* buttons on the left, and the *Setup* and *Points* buttons will be accessible.

   Points is a special button that allows us to tell FieldLog that a specific set of columns in a FieldLog table contains coordinate information, and to define the projection system for that information. We will return to this shortly.

2. Select the *Setup* button. The *Register Database Table* dialogue will appear. This is a complex dialogue, and we will only examine it superficially here. Refer to the FieldLog Reference Volume for detailed notes.



This dialogue is roughly divided into three sections. The lower left displays the available columns in the selected table, in this case *Sampl*. The upper left chooses the table *type,* in this case a Sample Table. The right section permits the assignment of columns from the table to the required logical components in the data model. This ultimately allows FieldLog to link tables within a database.

For example, each FieldLog table must contain a numeric column which in turn will contain unique numbers for each row in the table. The Unique Number edit box in the right panel represents this logical entity. For FieldLog to be able to use a table it must know which actual column in the table represents this unique number concept. In the *Sample* table the column containing unique numbers is called *Basenumber* and thus *Basenumber* appears within the Unique Number edit box.

For the FieldLog data model to be practical, it requires one or more other links to be specified between tables, depending on the type of table. These links are represented by the Traverse Number, Outcrop Number, Station Number, etc., concepts listed in the right panel. When a table type is chosen some of these links will become activated indicating the possible links available. Of the activated links, some are mandatory and others are optional. FieldLog will not permit the table to be registered until all mandatory links are specified. The actual column in the table that corresponds to an activated link may be specified by selecting the link, typing the name of column into the edit box beside the link, or alternatively, clicking on the column name in the bottom left panel and thus causing the column name to be automatically placed in the edit box of the selected link.

As a general rule, the closer the table is to the 'top' of the list, the more required links will exist. The *Sampl* table, shown here, has relatively few requirements. It must have:

- a unique number for record identification, usually called *Basenumber.*
- a placeholder for FieldLog to store Station Numbers, to keep samples associated with their source stations.
- a sample number, to store the data recorded on the sample for human identification purposes.
- it may optionally also contain a Rock Number to associate the sample with a specific lithology observed at the station.

Most tables require not only a *unique number,* but also one other key column to uniquely identify the table. For example, the *statnum* field uniquely identifies the *STATION* table, though *STATION* also contains a *basenumber* field as its unique number.

Required key fields for the table types include:

- ANALYSIS: unique, analysis and station numbers.
- SAMPLE: unique, sample and station numbers.
- COMPOSITION: unique and station numbers; optionally rock number.
- GENESIS: unique and station numbers; optionally rock number.
- ROCK: unique and station numbers.
- SEGMENT: unique, station and segment numbers.
- STATION: station number; optionally traverse and outcrop numbers.
- OUTCROP: outcrop number; optionally traverse number.
- TRAVERSE: traverse number.
- BOUNDARY: unique and boundary number.
- UNIT: unique and unit number.

- LEGEND: unique and legend number.
- REFERENCE: unique and reference number.
- DICTIONARY: unique and item name.
- OTHER: unique.

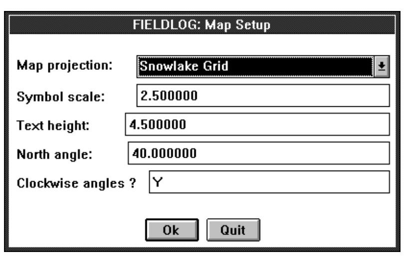
Of course, you may want to include other links to create a more highly interrelated database setup. For example, linking in a *Unit Number* would allow a direct association between the geological unit and the sample. The degree to which you interrelate information in the database is a matter of the needs of the project. This issue is covered in more detail in Volume 2.

FieldLog provides a powerful environment for storing data, at the cost of a data model that requires care and handling. When working on the table setup for a project, be sure to do a backup, and test the changes thoroughly before returning to normal use.

Map Setup

Map Setup assigns a projection to the AutoCAD map, permitting FieldLog to associated the map with an actual location on the earth's surface. Map Setup also controls the default display preferences for the plotting of symbols and text onto the AutoCAD map. It doesn't affect the actual data in the database — it simply controls defaults on the current projection system and symbol display. Whenever you start using a new map with an existing FieldLog database project you **MUST** perform map setup. The map setup preferences are actually embedded in the map and saved with the map when you perform an AutoCAD save (e.g. **File>Save**). Thus map setup need only be performed a single time for each map, and once the map is saved, those preferences will be activated each time the map is used with FieldLog. Of course, changing Map Setup preferences will require the map to be saved in order for the changes to take effect in future sessions.

To access map setup, click the **Map Setup** button in the FieldLog Setup button box. The Map Setup dialog appears.



Note that although these values pertain only to the current map associated with a FieldLog database, they are all required in order for FieldLog to function.

Projection — before using a map with FieldLog you must assign a working projection to the map. This projection relates points on the map to actual locations on the earth's surface. It also permits seamless conversion between points in the database and the map, when the database and map coordinate systems differ. FieldLog will not be able to perform any operations on the map until a projection is specified in Map Setup.

Often in field mapping some of the data being added to a database is purely graphical in nature, such as road locations, grid lines, and lakes. The **Map Projection** pop-up allows you to specify the projection for this graphical data, so that any field data in the associated FieldLog database can be correctly located and plotted to the map during Fl-Add, Fl-Query, and so on. The actual FieldLog database may store coordinates in a coordinate system other than the map's, and as long both are clearly specified the FieldLog engine will convert between them whenever required. Database coordinate systems are specified using the *Points* button in *fl-setup>Table Setup*, as described above. For a complete discussion of map projections, refer to Volume 2.

Symbol Scale Note:

Even though FieldLog plots symbols as either blocks or shapes, every symbol must originate from an AutoCAD shape library. FieldLog provides tools to ease the construction of these libraries. See Volume 2.

Symbol scale — This is the default size scale factor for map symbols. AutoCAD draws symbols using *blocks or shapes*, which are objects composed of a group of lines and curves amalgamated into a complex shape. The size of these *blocks* or *shapes* is specified at the time of creation, in drawing units. Since drawing units differ dramatically in size depending on map projection, and since map scales vary dramatically in scale depending on geological purpose, you usually have to scale symbols up or down to suit the map currently in use.

For example, the symbol libraries that come with FieldLog (*OGS.SHX*, *GSC.SHC*, and *NATMAP.SHX*) contain symbols drawn at 10 units in length. Specifying a *Symbol Scale* of 2 would double all subsequently drawn symbols to 20 map units in length.

Note that this default *Symbol Scale* can be overridden for individual columns or elements of a symbol dictionary using the *Palette* button in *fl-setup>Table Setup, fl-add* or *fl-query.*

Text height — Default height for text in current drawing units. Unlike *Symbol Scale*, which magnifies or diminishes symbols, *Text Height* sets the actual size of text drawn to the map.

As with *Symbol Scale*, map projection differences mean that the needed height for text must be established visually, based on a combination of map scale and projection. In practical terms, annotation text should be about 5-10 mm high on the final, printed map. Since map scales for output often vary dramatically, the default text height value can be overridden with the *Palette* button, available in *fl-setup>Table Setup, fl-add* or *fl-query.*

North angle — The angle from 'right' on the map, measured counter-clockwise, which represents North or 0 degrees. This value is used to correct the rotation of structural symbols to take into account rotated map projections and user grids. Valid responses are 0 - 360. For a 'normal' map, where north is to the top of the page, the value would be 90. Because a user grid was superimposed on the SnowLake map, its North angle is actually about 50 degrees from the 'right'.

Clockwise angles — Enter 'Y' for azimuthal angle measurements, or 'N' for standard Cartesian counter-clockwise method. In order to plot oriented data measured using standard azimuthal techniques (i.e. strike, dip direction) this parameter must be set to 'Y'.

You can experiment with the symbol size and text height parameters as you use a map. For example, the size of symbols and text already present on a map may be modified using the fl-scale command, discussed in Volume 2. Experimenting with north angles is more problematic (and shouldn't be necessary): if the angle values are wrong, any plotted symbols will be incorrectly rotated, and you must either carefully erase these and replot after correcting the north angle value; or preferably, apply the fl-update command to the plotted symbols and their angles will be corrected after correcting the north angle value. Fl-update is discussed in Volume 2.

Conclusions

FieldLog customization is essential when adapting an existing project setup to suit the needs of a new field mapping area. It is almost always easier to modify an existing project than to create a new one from scratch. The empty version of the *SnowLake* database, *SnowEmp*, is included with the FieldLog distribution as a template for building new projects. It contains the SnowLake data structure, all dictionaries and profiles, as well as all input and display preferences from the SnowLake sample project. Only the actual data has been removed.

The issues discussed in this chapter are covered in much more detail in Volume 2, the FieldLog Reference manual. The Reference manual also provides background information on relational databases, projections, and a detailed discussion on the FieldLog data model.

APPENDIX A

Installing FieldLog and updating from older versions

Introduction

FieldLog is a complex program, building database links into a CAD package, and possibly maintaining these links between different programs as a live process. Furthermore, FieldLog version 3 supports a data model that is both tuned to the field mapping process in its structure, and also supports geological reasoning in the form of profiles and dictionaries built into the data you collect.

This appendix covers AutoCAD installation under AutoCAD R12, R13, and R14, and provides summary notes on upgrading existing FieldLog version 2 projects to FieldLog version 3. It also summarizes a selection of advanced issues such as live links between AutoCAD/FieldLog and ODBC-compliant databases. For more exhaustive treatment of all of these topics, refer to the FieldLog Reference Manual.

Installing FieldLog under AutoCAD R12

To use FieldLog you must install the full version of AutoCAD for DOS or Windows. Specifically, the AutoCAD database environment (ASE) must be installed correctly. If you are not sure that these are installed, reinstall AutoCAD on your machine with all options set: a ‘full’ installation will guarantee that all necessary components are installed.

Ensure that you have installed the latest release of your AutoCAD version. For R12 this means r12_c4 for Windows and r12_c3 for DOS.

Assuming that you will want to install the sample database in order to do the tutorial, the installation procedure includes one process to install FieldLog, and another to install the sample database.

The FieldLog Distribution:

The FieldLog software distribution contains 8 files:

- FLG12WIN.EXE, the AutoCAD12 for Windows executable
- FL12DOS.EXE, the AutoCAD 12 for DOS executable
- FLG13.EXE, the AutoCAD 13 executable
- FLG14.EXE, the AutoCAD 14 executable
- SNOWLAKE.EXE, the Sample data.
- SNOWEMP.EXE, an empty database
- SNOWARC.ZIP, Sample Geophysical data.
- README.TXT, a text file containing the latest information

The first 6 are self-extracting pkzip archives and unpack into many small files when they are clicked on from Windows. The *snowarc.zip* file must be extracted using the command:

```
pkunzip -d snowarc
```

The *readme.txt* file is a text file containing the latest development notes and it can be directly opened by any word processor.

FieldLog installation:

To install the FieldLog executable under Windows 3.1, Windows 95 or NT:

1. Go to the AutoCad Support directory (e.g. *\acadwin\support* for r12, *\r13\win\support* for r13, and *\Program Files\ AutoCAD r14\support* for r14).
2. For r12/r13: if you have a custom AutoCAD menu file stored in this directory and you have named it *ACAD.MNU*, copy it under a new filename (... *ACAD-old.MNU ...)* since FieldLog writes a new *ACAD.MNU* file into this directory as it unpacks.

3. Copy one of the FieldLog distribution executables (*flg12win.exe, flg12dos.exe, flg13.exe, flg14.exe*) into the AutoCAD support directory using DOS, File Manager, or Windows Explorer.
4. Execute the FieldLog distribution file you copied by typing its name at the DOS prompt, or double clicking on the Icon in Windows Explorer/File Manager. This will unpack several files into the AutoCAD support directory.
5. For r12: reboot your system.

There will now be several new files in the *support* directory, including one called FIELDLOG.DCL.

Sample Data Installation

The files associated with a FieldLog project are located in one directory, known as the project directory. Installing a project or creating a new project first involves creating a directory to contain the project and then, for existing projects, copying the project files into the directory, and finally, notifying FieldLog about the project's name and location. To install the tutorial data provided:

1. Make a project directory for the sample data using your file management software. We recommend naming this directory *snowlake* (*e.g. c:\snowlake*).
2. Go to the sample data directory you just created.
3. Copy the file *SnowLake.exe* to the sample data directory
4. Extract the data by typing the filename (*Snowlake)* or double clicking on the file icon.
5. Get a directory listing for the sample directory. There should be many small files in the directory.

This installs the sample project data. To inform FieldLog about this sample data follow the instructions below.

Setting Up a FieldLog Project under AutoCAD r12

In order to use a project with AutoCAD r12 and FieldLog, a registration file called *FieldLog.prj* located in AutoCAD's *support* directory, and the PC's *AutoExec.bat* startup file, must be modified. A line for each project to be used with FieldLog is added to these files. These changes allow Fieldlog to find the data on the PC, to determine the database type, and to assign a project name to the files found.

1. Using a word processor (such as NotePad), edit the ascii text file called *fieldlog.prj* in your AutoCAD support directory (typically this is *\acad\support* for DOS and *\acadwin\support* for Windows). It should include the following line:

   ```
   SnowLake=c:\snowlake,dBase3
   ```

   assuming c:\snowlake is the directory containing the sample data files. There should be **no spaces** in this file. Make sure you save it as an ascii text file, not as a word processor file.

2. Add the following line to the **top** of your *autoexec.bat* file, typically found in the root directory of your PC (e.g. *c:\autoexec.bat*):

   ```
   set SnowLake=c:\snowlake
   ```

   again assuming c:\snowlake is the directory containing the sample data files. The only space should be after `set`.

3. Reboot the machine.

If you proceed through the *logon* process described in Chapter 2 of this tutorial, the *SnowLake* project should now be accessible. Successive projects would be added the same way, though each project would require a unique name and distinct project directory to contain its files.

Setting Up a FieldLog Project under AutoCAD r13 and r14

Under AutoCAD 12, the location of projects and their host database type is stored in the *FieldLog.prj* file. This file is not used under FieldLog for AutoCAD 13 and 14. In AutoCAD 13, the necessary information to locate and identify a database is stored in the *ASI.INI* file in the AutoCAD directory, and under AutoCAD 14, it is stored in the Windows Registry. These files are not modified by hand, but instead handled by a new command under the *fl-setup* menu bar of FieldLog. You must first ensure that FieldLog is installed, then start AutoCAD, and *Load FieldLog* from its menu in AutoCAD. Press the **fl-setup>Project Setup** button.

The setup dialogue presents the user with four columns:

- Project Name

  This is the name by which FieldLog will refer to the project. It is unrelated to actual filenames in the target directory.

- Project Directory

This indicates the location of the project, either on the local PC's hard drive or on some remotely connected hard drive.

- Database Type

  This indicates the type of database that is hosting the FieldLog project. The default is dBaseIII.

- Database Links?

  This indicates whether AutoCAD should maintain AutoCAD database links in addition to the normal FieldLog links. These additional links are required if the project is to be accessed from AutoCAD MAP or via the AutoCAD SQL extension.

Project Catalogues

AutoCAD requires that project databases be arranged in accordance with the SQL '92 specification. This means that all projects hosted by a specific database type, such as dbaseIII, must be stored as sub-directories of a common location on the hard drive

If a specified project is stored in a directory named c:\data\field then all other projects must be subdirectories of c:\data as well.

For further notes see the FieldLog Reference volume.

There are four corresponding input fields: two text fields for the name and path to a new project, a pop-up menu for choosing the database type, and a toggle to turn links on and off. The *New* button will blank all of the input fields in preparation for placing a new project on the list. The *Insert* button adds a project definition using the variables in the four fields. When a new project is inserted, FieldLog will attempt to verify that the Project Catalogue restriction is met (see box at left), but does not verify that the directory exists or contains a valid FieldLog project.

Once a directory has been specified, you will be able to log on to the database, and create tables, add data and so on.

The *Delete* button removes a project from the list, but only if it is currently not logged on. If the project removed was the last of its type (e.g., dBaseIII) the catalogue restriction will be lifted for the subsequent added database. Note that deleting a project specification does **NOT** delete any of the project files, it merely makes the project unknown to FieldLog.

The *Modify* button allows the database directory and link setting to be changed. If the name or type of database is to be modified, you must delete the current database reference and reinsert it with a new name/type.

Note for ODBC Database Users

For ODBC projects registered to FieldLog, the *Directory* field must not only specify the location of the directory but also the name of the database file in which the FieldLog data resides. This database file will posses an *.MDB* extension (e.g. *c:\snowlake\snowlake.mdb*). The catalogue restriction applies to the location of ODBC files.

Projects must also be registered with the Windows ODBC driver. To register a project with ODBC, go to the Control Panel in Windows, and choose the *Windows ODBC Drivers* icon. The *ODBC Data Source Administrator* dialogue will come up. If there is not currently a data source called *ODBC,* click on *Add* to create one. Select the appropriate driver type from the list, and click on *Finish.* Enter *ODBC* as the new data source's name, and select your database as the default data source. Click *Ok* to save the data source configuration. The database should now be accessible, and as well, any other database of similar driver type will also be accessible. The name (here, ODBC) of the data source must be identical to the name of the ODBC environment which you are using in the ASI/Registry.

These steps are required for AutoCAD to function correctly with ODBC.

The Projections Project

Under FieldLog 3, the name *Projections* is reserved for a special purpose project used to maintain a library of ellipsoids, projections, and transformations. This allows users to centralize this information even if many individual FieldLog projects are being used. It also allows users to share projections with other users without risking sharing actual data. The Projections project does not normally have any tables other than those used for ellipsoids, projections, and transformations (i.e. *fldatum.dbf, flproj.dbf, flxform.dbf, flxpoint.dbf*).

Whenever FieldLog loads, it checks to see if a project called *Projections* has been defined. If so, it automatically loads this project, and makes all of the projection information available to all subsequent FieldLog projects. FieldLog ensures that all changes and additions to the projections environment are kept in this central location. Projection information from individual projects are then added to this projection catalog when the projects are logged on. Any changes to projection information will cause all the projection information to be saved to the common location, as well as to any loaded projects. Therefore it is critical that projection information is well managed.

To create a projections project, create a new project using *fl-setup* or a text editor, depending on your version of AutoCAD. Name this new project *Projections.* You may further wish to copy the projection example files from *SnowLake* (i.e. *fldatum.dbf, flproj.dbf, flxform.dbf, flxpoint.dbf*) into the directory for this new project, to gain access to the wide variety of defined projections therein.

Upgrading from FieldLog v2.83 to v3.0

To update FieldLog systems from version 2.83 to version 3.0, you must upgrade your v2.83 database and any AutoCAD maps containing data linked to that database:

1. Back up your entire project onto a safe, reliable backup medium. Consider backing it up twice!
2. You must inform FieldLog where the v2.83 project can be found.

In AutoCAD r12:

- Add a project definition line to your Autoexec.bat as explained above for the sample data. For example:

```
set MyProjectName=c:\mydatadirectory
```

If you have multiple projects on this machine, use one `set` statement for each project in your autoexec.bat file.

- Add a project definition file to your AutoCAD *support* directory as explained above for the sample data. For example:

```
MyProject=c:\mydatadirectory,dBase3
```

If you have multiple projects on this machine, each project will be described by a separate line in your *FIELDLOG.PRJ* file.

- Reboot your system.

In AutoCAD r13 and r14:

- Start AutoCAD, *Load FieldLog* and in **fl-setup>Project Setup** insert a new project definition specifying the project name (e.g. `MyProject`), its location (`c:\mydatadirectory`), and database type (e.g. `dBaseIII`). This project definition should be listed in the main panel after being *Insert*ed.

3. You may want to copy the projection definitions from the SnowLake sample dataset into your project directory. This involves copying the *fldatum.dbf, flproj.dbf, flxform.dbf, and flxpoint.dbf* files from the SnowLake project directory (i.e. `c:\snowlake`) into the v2.83 project directory (i.e. `c:\mydatadirectory`).

4. Upgrade your project database (do **all** of the following steps, carefully, in order):
   a. Start AutoCAD and *Load FieldLog*, if this is not already done.
   b. Logon with **fl-logon**.
   c. Select **fl-upgrade** from the menu or type `fl-upgrade` at the command line.
   d. Select the project you want to upgrade by clicking on it.
   e. To start the upgrade procedure, click **Ok**. FieldLog proceeds to upgrade each table in your database.
   f. FieldLog will interrupt the upgrade process and ask you load any symbol libraries you wish to use with the project. If FieldLog has been able to locate the OGS, NATMAP and GSC symbol libraries they will have been automatically loaded and should appear in the main panel. Any additional libraries can be specified at this point. Use the *File* button to locate the libraries, and the *Load* button to load them. When finished press *Exit*. FieldLog will then continue the upgrade process.
   g. FieldLog will inform you when the v2.83 database has been upgraded to v3.0. To save the new setup, click **Ok**.
   h. FieldLog will then ask to upgrade the map. You can upgrade your map(s) now or later. Before a map can be used with v3.0 it must be upgraded by following steps a-g, and then selecting all FieldLog created entities on the map. FieldLog will then upgrade the map entities so that they are linked to the v3.0 database. Map entities created with v2.83 will not communicate with a v3.0 database until they are upgraded. *Fl-upgrade* must be performed once on the database, and once for each map associated with the database.
   i. When the upgrade process is completed FieldLog will notify you that your database tables may need to be registered more accurately. This is an optional, advanced procedure: To complete the upgrade process you can register your tables more accurately by:
      - Select **fl-setup** from the menu or type `fl-setup` at the command line, then enter *Tables Setup*.
      - Select your project from the list on the right.
      - Click the **Table** option, then select the first table on the right.
      - Click **Setup**.

- Select appropriate table types and identify key fields. Each table already has:

a unique number field and station number field; other options:
STATION: unique#, station#, outcrop#, traverse#
SECTION: unique#, station#, section# (e.g. drill hole segments)
ROCK: unique#, station#, section#, rock# (e.g. each rock at a station is numbered)
SAMPLE: unique#, station#, section#, rock#, sample# (e.g. rock samples, photos)
PROCESS: unique#, station#, section#, rock#, sample# (e.g. structure)
COMPOSE: unique#, station#, section#, rock#, sample# (e.g. minerals, alteration)
ANALYSIS: unique#, station#, section#, rock#, sample#, analysis# (e.g. thin sections, geochemistry etc.)

- To save your new setup, open the Fl-Setup button box, then click **Save FieldLog Setup**.

Upgrading a v3.0 project from AutoCAD r12 to r13/r14

To upgrade from AutoCAD r12 to AutoCAD r13/r14 no special upgrade procedure is required. Simply follow the instructions above (**Setting Up a FieldLog Project under AutoCAD r13 and r14**) to inform FieldLog about your v3.0 project. However, because AutoCAD r13/r14 is SQL'92 compliant it reserves many more words than r12. If a database table name or any column name utilizes any of these reserved words, the table will not be accessible to FieldLog's commands (e.g. *fl-add*, *fl-edit*, *fl-query*, etc.). To correct this the improper name must be changed, and this name change must be performed outside FieldLog using another database system such as dBase, FoxPro, MS-Access, etc. The list of reserved words is:

ABSOLUTE, ACTION, ADD, ALL, ALLOCATE, ALTER,

AND,ANY, ARE, AS, ASC, ASSERTION, AT, AUTHORIZATION,

AVG, BEGIN, BETWEEN, BIT, BIT_LENGTH, BOTH, BY,

CASCADE, CASE, CAST, CATALOG, CHAR, CHARACTER,

CHAR_LENGTH, CHARACTER_LENGTH, CHECK, CLOSE, COALESCE,

COLLATE, COLLATION, COLUMN, COMMIT, CONNECT, CONNECTION,

CONSTRAINT, CONSTRAINTS, CONTINUE, CONVERT, CORRESPONDING, COUNT, CREATE, CROSS, CURRENT_DATE, CURRENT_TIME, CURRENT_TIMESTAMP, CURRENT_USER, CURSOR, DATE, DAY, DEALLOCATE, DEC, DECIMAL, DECLARE, DEFAULT, DEFERABLE, DEFERRED, DELETE, DESC, DESCRIBE, DESCRIPTOR, DIAGNOSTICS, DISCONNECT, DISTINCT, DOMAIN, DOUBLE, DROP, ELSE, END, END-EXEC, ESCAPE, EXCEPT, EXCEPTION, EXEC, EXECUTE, EXISTS, EXTERNAL, EXTRACT, FALSE, FETCH, FIRST, FLOAT, FOR, FOREIGN, FOUND, FROM, FULL, GET, GLOBAL, GO, GOTO, GRANT, GROUP, HAVING, HOUR, IDENTITY, IMMEDIATE, IN, INDICATOR, INITIALLY, INNER, INPUT, INSENSITIVE, INSERT, INT, INTEGER, INTERSECT, INTERVAL, INTO, IS, ISOLATION, JOIN, KEY, LANGUAGE, LAST, LEADING, LEFT, LEVEL, LIKE, LOCAL, LOWER, MATCH, MAX, MIN, MINUTE, MODULE, MONTH, NAMES, NATIONAL, NATURAL, NCHAR, NEXT, NO, NOT, NULL, NULLIF, NUMERIC, OCTET_LENGTH, OF, ON, ONLY, OPEN, OPTION, OR, ORDER, OUTER, OUTPUT, OVERLAPS, PARTIAL, POSITION, PRECISION, PREPARE, PRESERVE, PRIMARY, PRIOR, PRIVILEGES, PROCEDURE, PUBLIC, READ, REAL, REFERENCES, RELATIVE, RESTRICT, REVOKE, RIGHT, ROLLBACK, ROWS, SCHEMA, SCROLL, SECOND, SECTION , SELECT, SESSION, SESSION_USER, SET, SIZE, SMALLINT, SOME, SQL, SQLCODE, SQLERROR, SQLSTATE, SUBSTRING, SUM, SYSTEM_USER, TABLE, TEMPORARY, THEN, TIME, TIMESTAMP, TIMEZONE_HOUR, TIMEZONE_MINUTE, TO, TRAILING, TRANSACTION, TRANSLATE, TRANSLATION, TRIM, TRUE, UNION, UNIQUE, UNKNOWN, UPDATE, UPPER, USAGE, USER, USING, VALUE, VALUES, VARCHAR, VARYING, VIEW, WHEN, WHENEVER, WHERE, WITH, WORK, WRITE, YEAR, ZONE

Conclusions

This appendix provides a basic introduction to FieldLog project creation and import methods. For more detailed information, please refer to the FieldLog Reference manual.

When importing FieldLog v2.83 files into FieldLog v3.0, a wide variety of minor but irritating problems can occur. Check the FieldLog web site for tips and tricks, additions to the manuals, and for information on contacting the authors.