U. S. DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY

ALACARTE USER MANUAL

Version 1.0

Compilation of digital geologic maps and associated databases
with ALACARTE, an easily used menu interface cast in geologic terms
that controls ARC/INFO, a commercial geographic information system

Carl M. Wentworth and Todd T. Fitzgibbon

November 1991

Open-File Report 91-587 C

CONTENTS SUMMARY

FIGURES

TABLES

CONTENTS

ALACARTE USER MANUAL

Version 1.0

Compilation of digital geologic maps and associated databases
with ALACARTE, an easily used menu interface cast in geologic terms
that controls ARC/INFO, a commercial geographic information system

Carl M. Wentworth and Todd T. Fitzgibbon

1991

INTRODUCTION

ALACARTE offers a convenient way to compile geologic maps in the computer as spatial databases that can be used to prepare both cartographic images and analytic derivatives. It is a menu-controlled shell, organized in geologic terms, that provides on-screen control of the program ARC/INFO, a commercial geographic information system (GIS). Input can be from imported scans, digitizer tracing, or on-screen tracing or mapping with a mouse-controlled cursor over a digital topographic base, and interactive editing can be done on-screen using a broad suite of edit functions. Compilations begun in other digital systems can be imported for completion as digital databases in ARC/INFO. The digital files that represent a geologic map can be used to prepare near-publication-quality color plots of the maps with full symbology or to create high-quality printing negatives. These files also constitute a digital database that can be used for computer-based query and analysis as well as for digital distribution of the map and associated data.

ALACARTE allows the non-specialist to use ARC/INFO without having to struggle with its excruciating details and hundreds of line commands. ARC/INFO is a powerful GIS that, because of its breadth and flexibility, requires considerable training and experience to be used directly from the command line. Even ARC/INFO experts will find that ALACARTE offers a preferable ease of use in working with geologic maps. Functions called by picking menu items on the screen include many complex sequences of ARC/INFO commands that are prohibitively time consuming or awkward to use directly. The menus are organized according to major compilation and editing procedures and permit great flexibility in working with maps. The system and ARC/INFO command lines are always accessible from within ALACARTE if needed.

This is not just a drafting system, although it serves that purpose well. ALACARTE-ARC/INFO supports the creation of a sophisticated geologic database in the course of compiling a digital geologic map. Lines, points, and the perimeters and identities of areas are recorded in vector form and can have essentially unlimited digital information attached to them. For display, symbols for lines and points and colors for areas are separately assigned to these features as a function of feature attributes in the database, which permits great flexibility in on-screen display, plotting, and preparation of printing negatives. Plots can be made at any stage in compilation using custom geologic line and point symbol sets, and can include a digital topographic base map. Plots made with high-resolution color plotters approach the quality of published maps.

The ability to manipulate and analyze the feature attributes and two-dimensional topology in the database of a digital map is a development offering great promise for geology. Various data layers can be overlaid for comparison or actually combined into a new map. The database can be searched both topically, according to feature attributes or information in other cross-referenced databases, and-or spatially, according to the location or spatial interrelations of map elements. Rules can be specified to control such searches and the way in which a derivative interpretation or statistical result is prepared. Data can be extracted from the digital geologic map for use in other quantitative or graphical operations and the result returned to ARC/INFO for further use.

Compilation of geologic maps with ALACARTE - ARC/INFO thus offers several important benefits: (1) efficient preparation for print publication, (2) easy map revision and preparation of derivative maps, (3) creation of a spatial database for use in computer-based manipulation and analysis, (4) the ability to make color plots of near-publication quality showing any or all aspects of a map database, and (5) the ability to store, transfer, and publish the resulting geologic map files in digital form. It is the combination of convenient drafting of geologic maps with uniformly high quality of line work and symbols, the ability to work interactively with all aspects of the maps in digital form, and the automatic creation of a digital database that makes ALACARTE - ARC/INFO an attractive system.

The ALACARTE user manual describes the value of compiling maps digitally using the ALACARTE-ARC/INFO system, summarizes the digital approach, and provides more detailed descriptions of ALACARTE and its use in compiling geologic maps. It is divided into five main sections:

Introduction - general information on the character and uses of ALACARTE-ARC/INFO, the design and compilation of digital maps, and how to get started.

Self-Guided Tour - a tutorial that introduces you to ALACARTE-ARC/INFO by demonstrating the parts of a digital map and their on-screen appearance and guiding you to use various ALACARTE functions to prepare a simple map.

ALACARTE Basics - description of the kinds of digital map features, the primary database, and the basic techniques involved in using ALACARTE-ARC/INFO.

Procedures - description of the procedures involved in entering and editing the various elements of a digital map and in preparing plots.

Structure and Functions - systematic listing of all bar and pulldown menus in ALACARTE and brief description of the function of each menu item.

There are two companion documents to this user manual that address other aspects of ALACARTE: (1) ALACARTE User Interface - AML Code and Demonstration Maps, (Open-File Report 91-587 A), which describes how to obtain the executable code, and (2) ALACARTE Installation and System Manual (Open-File Report 91-587 B), which describes how to install ALACARTE and provides technical details about ALACARTE.

Development of ALACARTE

ALACARTE is designed by T.T. Fitzgibbon and C.M. Wentworth, with assistance from P.K. Showalter, and is written by Fitzgibbon with assistance from Showalter, P.H. Rice, D.L. Knifong, T.A. Lindquist and others. R.K. Mark assisted in deciphering the Transform function. Creation of the program was stimulated by the confluence of several factors, particularly the emergence of powerful

and affordable computer workstations with high-resolution color displays, the experience gained from various CAD programs and the PC-based geologic compilation program GSMAP (Selner, G.I, and Taylor, R.B, GSMAP System version 7.0, U.S. Geological Survey Open-file Report 91-1), and commercial release of a full-featured vector GIS with a macro programming language that supports menus. ALACARTE is written in ARC Macro Language (AML) and runs in association with ARC/INFO (version 5.0.1) on UNIX and Prime computers. Its development was supported in the U.S. Geological Survey by programs for National Geologic Mapping and Development of Assessment Techniques and by the Survey's GIS Research Laboratory in Menlo Park.

Scope of Version 1.0

Work on the present version has concentrated largely on the set up and geographic projection of maps and the entry, editing, and attributing of map features (the Setup and Edit sections of ALACARTE). These address the map itself, and not cross sections, explanations, or other marginalia (except through access to MAPX). A Version 1.1 release is planned to include bug fixes, minor enhancements, and a revised manual. Further work will address cross sections and marginalia, will expand the more rudimentary sections on plotting, conversions, databases, and analytic procedures, and will accommodate version 6.0 of ARC/INFO.

ARC/INFO

ARC/INFO is a commercial geographic information system (GIS) that operates in vector mode (version 5.0.1). It supports a broad range of input, editing, and projection functions required to compile geologic maps, offers powerful plotting, analytic, and database functions, and continues to be improved by its vendor, Environmental Systems Research Institute (ESRI). Lines, areas, and points are stored geographically, can be plotted in a great variety of symbols, and can have essentially unlimited digital information attached to them. Various analytic functions are available in ARC/INFO for use with these data and the two-dimensional spatial topology that the program maintains for each map. Superposition of map layers on screen and in plots allows separation and overlaying of data and the use of digital topographic bases as backgrounds. Selected elements or areas can be extracted from maps and separate maps can be combined. ARC/INFO can be controlled by entering commands at the command line or through custom scripts and macros, of which ALACARTE is a sophisticated example.

ARC/INFO runs in multi-user form on a variety of mini-computers (such as Prime and VAX) and in both single- and multi-user form on various UNIX workstations and fileservers (such as Sun and Data General). In multi-user form, it can be used concurrently by numerous users working remotely from various kinds of terminals or from terminal emulators running on other computers (such as workstations, PC's, and Macintoshes). PCArc, a version of ARC/INFO that runs on IBM PC's and compatibles, is not addressed here because the PCArcprogramming language and GIS functions are incompatible with ALACARTE.

Version 1.0 of ALACARTE is designed to work with version 5.0.1 of ARC/INFO and has been tested on Sun, Data General Aviion, and Prime hosts and with remote access from some Tektronix terminals (4207, 4225) and terminal emulators (Isotek, TGraf, TNet, and VersaTerm-Pro) (see *System Details*, p 35, for details)**.**

Uses of ALACARTE - ARC/INFO

ALACARTE is designed for use by geologists to compile geologic maps and associated spatial databases, although non-geologic maps and databases are easily accommodated. Version 1.0 of ALACARTE focuses on the map itself -- its lines, areas, structural symbols, other points, and map-face annotation. Any or all of these features can be entered by hand from a digitizer and additional information can be entered into the database. Scanned linework converted to vectors can be edited and tagged in ALACARTE, and base maps can be imported as digital images from scanned originals or as attributed digital files (Digital Line Graphs). Point maps and database entries can be imported directly from tabular text files. Maps that have been digitized in other systems can be imported and processed or completed in ALACARTE-ARC/INFO.

The digital files composing these maps can then be plotted as line drawings or as full-color maps or can be used to prepare color separations for printing. Digital maps can be plotted in any projection at any scale, limited only by the detail and spatial resolution of the data. Various map layers can be overlaid at the same scale and in the same projection on screen or in plots. Overlaid or adjoining maps can be combined and part of a map can be cut out to create a separate map. Because a map in ALACARTE-ARC/INFO is a database and not just a picture, the map files can be queried in various ways to extract information or to create interpretations.

Print Publication - Digital compilation removes the necessity of final drafting or scribing and of hand preparation of color separations for printing, because high-quality plots and color-separation negatives for printing can be made directly from the digital map files. The digital contribution can range from linework and symbols for a black-and-white map through definition of polygons for color fill to the whole of a full-color map. The digital geology can be plotted to negatives and then combined with a photomechanical base or the base can be included as one or more digital layers.

Revisions - Once a map is in digital form, revision is as simple as changing the relevant parts of the map. The revised digital files can then be used to make plots or color-separation negatives of the revised map or can be released directly in digital form.

Compile New Work - If new mapping is compiled in the computer as field work proceeds, a hand-drafted author compilation need never be prepared, high-quality draft plots at final or enlarged scale can be made in color for office or field use at any stage of the work, and a digital map and database will be a painless by-product. Line input can be by hand digitizing from field sheets or by scanning of field originals or of photographic or hand-traced copies. Mapping or transferring from photos or field sheets can also be done directly on screen over the digital base. Previous mapping can be digitized and plotted on a digital base for use during field work. Where digitized or edited by the geologist author, correctly drawn line work will not be vulnerable to later modification by an assistant or draftsman. Field stations, fossil localities, and other data can be entered at points and then searched, plotted, and otherwise used in ongoing study and analysis as the mapping proceeds.

Small-Scale Compilation - The scale and projection of digital maps are easily changed, which makes the fitting of various source maps into a smaller scale compilation straightforward. Generalization can begin during digitization of sources and is aided by easy on-screen editing and a limited suite of generalization functions in ARC/INFO.

Comparison of Data Sets - Maps of different topics for the same area that should be used together are easily converted to a common scale and projection for direct visual comparison on screen or in separate or overlaid plots.

Map Analysis - A geologic map in ARC/INFO is a digital database that can be used for study and analysis and for the preparation of derivative products based on the geologic map. This database can be expanded in custom fashion to include whatever categories and forms of data are needed. Areal topology is automatically established by ARC/INFO, which permits spatial relations of all map elements and associated data to be used in computer-based query and analysis. Independent computer programs can be incorporated into analytic procedures, and information can be selectively extracted from a digital map for use in other programs.

Derivative Maps - Preparation of derivative maps from the primary database simply requires precise statement of the interpretive procedure and the availability of any other needed data in digital form. The areal units of different map layers can be combined, for example, or combined where specified conditions are met, and database attributes can be used and manipulated to produce new attributes. The resulting derivative maps can be plotted, printed, or released digitally with the same ease as the original geologic map.

On-Demand Printing - Plotting of geologic maps and derivatives according to specific requests can replace print publication where demand for a map is immediate, map content changes through time, or expected circulation is low. High-resolution color plotters can produce large maps of near-publication-quality in a few minutes. Such printing can also accommodate user specification of layers to be included and symbols and colors to be used. Different plots of the same map might thus combine or distinguish base separations or include or omit color fill of map units, or various topical layers for the same map area might be overlaid for comparison or joint use.

Digital Publication - The ability to prepare and use digital map files allows publication of the maps in digital form. Such publication can consist simply of a digital version of a standard geologic map or it can take advantage of the digital format to expand the map content. Possibilities include various topical map layers and associated data (such as fossil collections, chemical analyses, or radiometric ages), sequential map layers showing temporal changes (such as landslide or volcano histories), or the detailed sources of a smaller scale compilation.

Kinds of Digital Maps

Digital maps can take various forms that differ in the method of areal representation (raster or vector), in the kinds of features that are included (lines, points, areas, spatial interrelations), and in the amount of information that is attached to map elements. ALACARTE-ARC/INFO maps are recorded and edited in vector form in a highly flexible database. Raster versions of these maps are generated as needed, both for plotting and for use in various analytic procedures.

Raster maps and images are represented as a regular grid or checkerboard in which values are assigned to every cell (pixel). Information in each cell can be as simple as the presence or absence of black, as in a line drawing, or can be values representing such factors as colors in a satellite image, units in a geologic map, or altitudes in a digital elevation model. Resolution in raster maps and images is controlled by cell size, which in turn is determined by considerations of data character, intended application, and system capacity and speeds (raster files can be very large). Cells in plot files and

raster scans typically range from 200 to as fine as 1200 per inch on the map (grid spacing of 0.1-0.02 millimeters), whereas cell size in satellite images, digital elevation models, and raster geologic maps typically ranges from 10 to 100 meters or more on the ground. Some kinds of data are inherently raster, such as various kinds of remote images, altitude grids, and their derivatives. Raster form may also be chosen to speed analytic manipulation, because of the relative efficiency of performing arithmetic operations on cell values.

Vector maps, in contrast, store information only at points of interest, with their locations defined by x,y values in a coordinate system. Lines are represented by sequences of such points (*vertices*) connected by straight lines. The precision with which ALACARTE-ARC/INFO typically records x,y locations, 1 millimeter on the ground, is independent of map scale and far exceeds the requirements of most geologic work. The capacity for separately attaching information to each point, line, and polygon is essentially unlimited, with basic attributes placed in the primary database and other information cross referenced (related) from separate databases.

The maps are typically prepared as a series of layers that contain different kinds of information. The attributing of elements within each layer may be as limited as assignment to a single class or can involve an extensive database, perhaps with cross reference to other databases. A vectorized scan of a base map may be simply an un-attributed image, for example, whereas lines in a geologic map may be distinguished both by line type (contact, fault, etc.) and scale of source. The whole of a geologic map may be recorded digitally, or digital procedures may be used only on color boundaries to prepare color separation negatives for use with scribed or drafted line work in printing.

COMPILING A DIGITAL MAP

The basic steps in compiling a digital map in ALACARTE - ARC/INFO are much like those for a conventional map:

- Obtain a digital base map or other geographic framework for the map
- Enter the line work and attribute by type of line (tag)
- Process line work to identify closed polygons and tag those by geologic unit
- Enter structural data (oriented symbols, fold axes, etc.)
- Enter other points and associated data (fossils, chemistry, radiometric dates, etc.)
- Add graphic unit labels and other map-face text

The details of procedure will depend on your purpose in compiling the map digitally, on the character of the map, and on the available resources. Most of the work on a map can be performed from within ALACARTE with minimal use of the keyboard, except for scanning of base materials or line work. Scanning and plotting involve separate pieces of equipment as well as steps in ARC/INFO that are not all automated in ALACARTE.

Digital maps are organized in layers that separate different kinds of information (contacts and faults, areal units, structural data, etc.). They are entered into the computer first in their original projections, using latitude/longitude marks as registration, and can then be converted into other projections and combined with other maps. Data are entered by hand digitizing, by scanning and on-screen editing, or by importing pre-existing digital files. Scanning is most useful for line work, whereas point data are generally entered by hand.

Maps that have been prepared initially in GSMAP or other vector systems can be imported for completion or use, and raster drawings can be imported if a satisfactory means of converting them to vector format is available. Data in tabular text files can be imported and assigned to existing map elements or, where geographic locations are included, can be used directly to create a new map.

Compilation Goals

Geologic maps can be compiled digitally while original field mapping proceeds, as a means of converting an existing map into digital form, or to provide sources for smaller-scale compilation. The digital map can be intended for print publication or for a variety of digital applications, including on-demand plotting, digital publication, or use as a digital database for computer-based analysis. These differences lead to different requirements and procedures for digital compilation. Regardless of short-term goals, the value of a geologic map in the future will be greatly enhanced if it is available in digital form. Digital preparation by the author will ensure that the geology is represented as the author intends.

Print Publication - Production of a satisfactory graphic image of the geologic map from digital files for print publication requires that line work be edited for presentation at publication scale and that each line be tagged for assignment of plotting symbols. If map units are to be colored or patterned, all breaks in polygon boundaries are closed and polygons are tagged. Data for oriented symbols are digitized and a map layer is prepared that contains graphic unit labels, leaders, and any other map-face text. Unless a digital version of the base map will be used in printing, the finished digital geologic map and the photomechanical base must be fitted together for printing.

Digital Map and Database - On-demand plotting and digital publication require, at a minimum, the same suite of files needed for print publication, except that a digital version of the base map may be essential. The requirements for a digital database can be similar or expanded, depending on the application. Preparing a map database in digital form offers the opportunity to include any type of data that can be spatially referenced to the geologic map. Because there is no need to present all included layers or kinds of data concurrently, clear graphic presentation is not necessarily an issue.

Digital Base Map - A digital base map will be needed if the line work is to be fitted to the base in the computer, if plots are to be made that include the base, or if new mapping is to be entered directly into the computer as field work proceeds.

Entering Line Work - The best way to digitize an existing map will depend on the kind of original that is available and the character of the map. Ideally, line work should be scanned from an original that contains nothing but the lines, with all lines continuous and unmodified by thrust teeth or other ornaments. The effort of preparing such material for scanning must be balanced against the resulting decrease in the amount of on-screen editing that would be required if a more complex original were scanned. A tracing of the map can be made in pencil for scanning, a film negative can be edited with a fine paintbrush before scanning, or the map can be scanned directly. Hand-digitized lines require less subsequent editing, but hand digitizing is tedious in large quantities and can introduce error. Hand digitizing is generally required, however, to tag polygons (identify map units) and to enter structural data and other points.

Resolution and Simplifying - If the sole objective is a small-scale map generalized from larger scale sources, the best approach will probably be to trace and concurrently generalize the source maps at the

original (or a reduced) scale, scan and import these intermediate tracings, assemble the pieces onto the smaller scale base in the computer, and then complete the editing at final scale. If the source maps are needed in their original detail, however, then they must be digitized with full resolution and all the generalization carried out later on screen.

Geographic Framework

An essential step in preparing a digital map is to define its geographic framework. Unless the map is to be kept as a drawing in map inches, it must be assigned geographic coordinates in a specified map projection. During input, the projections of the source map and the digital equivalent must be matched. Mosaicking of quadrangles or incorporation of a map into a smaller-scale compilation may then require subsequent change in projection (a simple procedure in ALACARTE-ARC/INFO). Careful registration between layers and with the ground is essential both for accurate ground locations and to obtain adequate precision between layers for comparison and plotting.

BASE MAPS

Digital compilation of most maps will be greatly aided by having a digital base on which to edit and adjust the geology on screen and for plotting. Topographic maps can be scanned, converted to vectors, and imported to serve as base images or, where available, USGS Digital Line Graphs (DLGs) can be used. Scanned images have the advantage of including names, numbers, and symbols that can be read visually, whereas the lines in DLGs, which do not automatically display text and symbols, have attributes that can be used in map analysis and to assign distinctive plotting symbols. Attributes associated with the individual elements of the topographic map are not essential for on-screen editing or for plotting, although application of distinctive line symbols to some features, such as roads and railroads, can improve the appearance of the base. If the identity of elements in the base are to be used in analysis of the map, however, then attributed base layers will be needed.

Base maps can be scanned as composites or, preferably, in separations that will permit later distinction of the different components. If possible, the wider index and thinner intermediate contours should be separated during scanning or subsequent processing in order to allow them to be plotted with different line weights. A useful set of base separations prepared by scanning might include four layers, for which attribution is limited to the identity of the layers: index contours, intermediate contours, drainage, and culture. Closed water boundaries (needed to complete adjoining polygons in the geologic layer) can be extracted from the drainage layer or, where necessary, can be scanned separately.

The resolution at which a base should be scanned depends on the detail of the map and intended use. A typical resolution of 300-400 lines per inch is adequate for many maps for use on screen and for draft plots, but resolutions as high as 700-800 lines per inch may be needed to reproduce very detailed or intricate maps, especially where print or digital publication of the scanned base is intended.

The base image will be in scanner dimesions (typically inches) and, once imported into ARC/INFO, should be transformed into a set of digital registration tics in its original projection unless work is to proceed in map inches. Importing scanned geology and hand digitizing from a digitizer onto a base require that the projections of the geologic original and the base be matched. The base may already match the area and projection of the geology directly, or it may be prepared digitally by combining larger scale maps or cutting out part of a smaller scale map and then reprojecting.

Scans of physical mosaics of separate maps, in contrast to single quadrangles and smaller scale maps of uniform projection, may not be able to be projected together in ARC/INFO without internal distortion. This is because the maps in the mosaic may not share the same projection or projection parameters. These distortions, although generally small, can be significant both for location of map elements in spatial databases and for graphic presentation. The various parts of mosaicked maps should therefore be treated separately in the computer. Once all needed work in the original projections is completed, the separate parts can be combined digitally into a single projection. If needed, a photomechanical base can then be mosaicked by fitting each part to a plot of this common projection.

PROJECTION, SCALE, AND DIMENSIONS

The geographic projection of a digital map is determined initially by the projection of the hard-copy original (geology or topographic base), although this can be changed once a digital version has been made in the original projection. In hand digitizing, maps can be entered in inches and later transformed into the projection of the base map or can be transformed on the fly, the typical procedure in ALACARTE. In scanning, maps are entered in inches and later transformed into the appropriate projection. Any work with azimuthally oriented data will require a projected map.

Geographic registration is obtained by placing digital registration tics at graphic registration marks in the original map for which the latitude/longitude locations are known. Map dimensions in projected maps are recorded and measured in meters on the ground and locations are recorded as x,y coordinates in meters from the origin of the projection. Once in digital form, a map can be plotted in any supported projection at any scale. ALACARTE supports the projections most commonly used in geology in the United States (Lambert, Transverse Mercator, Oblique Mercator, Polyconic, UTM, Albers, DNAG, and the State Plane equivalents) and ARC/INFO supports a great many others as well.

Because projected maps are stored in ground coordinates, scale has no direct meaning for most ALACARTE maps except as a measure of the spatial resolution of the data. ARC/INFO maintains ground locations to a fraction of a meter on the ground, a meaningless precision for most geologic maps, and any digital map can be viewed or plotted at any scale. Enlargement beyond the input scale is easy, but adds no information and magnifies insignificant mislocations and line irregularities. It is important, therefore, to document input scales and resolutions and to qualify applications by the spatial resolution of the data.

MAP REGISTRATION

Accurate ground location of map elements and precise registration between map layers, always important aspects of maps, are even more important for digital maps. Not only do they bear on obtaining a good fit between the geologic layers and the topographic base for making plots, but they directly affect the quality of computer-based analysis that involves more than one map or map layer. Attend carefully to registration in preparing materials for input and whenever separate layers or sources are overlaid or combined.

The key to good registration is precise graphic registration marks of known location in the coordinate system of the original map (typically latitude/longitude) that can be used either from the digitizer or in scanned images to register the map geographically. If clear graphic registration tics or corners are not already present, add precise registration marks to the original map with a fine pen or stickup at four or

more perimeter points of known location, and include internal registration marks as well where possible.

Use these graphic marks to register the map on a digitizer for hand input and to place digital registration tics in scans and other imported maps. Once the digital registration tics are properly located in one map layer, they can be copied to create other precisely registered layers. Separately scanned layers should all be transformed into a common set of projected tics.

Map Features

The principal emphasis in digitizing maps is on the line work, because lines will require the most effort, just as they do in hand-drawn maps. Lines can be digitized in three basic ways. If the line work is clean and sharp and free of interfering clutter and background, it can be scanned and imported into ALACARTE - ARC/INFO for on-screen editing and tagging (assigning attributes). Or a pencil tracing can be made specifically for scanning. Some maps may better be traced from the original by hand on a digitizer (or on screen from an imported scan in the background). As a third alternative, new work can be mapped, or existing work transferred, directly by eye on screen over a digital topographic base.

Polygons are created by digitizing and tagging label points within the line boundaries to identify them and then processing the line work and labels together. All points (polygon label points, oriented structural symbols, field stations, etc.) are typically entered by hand. Tabular files of data (word processor or spread sheet) can be imported directly and assigned to existing map elements or, where point locations are included in the file, can be used to create attributed points directly.

Lines - In contrast to traditional ink work, all lines are digitized as continuous lines, regardless of intended line symbol, and are tagged (attributed) by line types (such as normal fault, concealed) that are selected from menus or entered from the keyboard. These tagged lines amount to templates to which any chosen line symbol can be assigned for screen display or plotting as a function of line type. A full range of geologic line symbols is available and others can be created in the symbol editor. Lines can be digitized by hand from a digitizer or on screen with a mouse-controlled cursor and can be concurrently tagged by line type. Line work from imported scans is first edited on screen to correct scanning artifacts and to close broken lines and is then tagged. Symbols for the various kinds of lines are assigned for plotting as a function of line type in the database.

Polygons - Closed polygons defined by the lines are established in a bulk process (the Clean or Build functions) and are identified by digitizing label points. These points are placed one to each polygon, regardless of its size, and can be tagged concurrently in ALACARTE. Area types such as geologic units can be entered from the keyboard or picked from custom lists that are entered as text files and then opened on screen as menus. This tagging of areas can be done either on screen or from a digitizer. Search-and-display techniques aid in the location of errors for correction: polygons without labels, with multiple labels, or with incomplete boundaries. Colors for different map units are assigned as a function of area type in plotting.

Structural Symbols - Structural data can be entered graphically from a digitizer or on screen. The symbols are not recorded directly. Instead, the type of structural feature and its orientation are recorded in the database for a point location. During on-screen display or for plotting, the appropriate symbol is assigned as a function of point type with the specified orientation at the recorded location.

Dip and plunge values are automatically placed on the map, but can be repositioned easily where desired. A full range of structural symbols is available and others can be created in the symbol editor.

Other Points - Other kinds of points (field stations, fossil localities, chemical analyses, radiometric dates, etc.) can be digitized and labeled. Any amount of information can be associated with a point in the database by entering it in the data input form, by importing existing digital files, or by cross referencing (relating) to other digital databases. Any entry in the database can then be displayed or plotted at the point or used in computer-based analysis of the map.

Unit Labels and Other Annotation - Graphic unit labels are entered as text annotation on the map. The polygon tags can be posted automatically at their label points to begin creating the graphic unit labels, but the posted tags are not fitted to the map for graphic presentation and will require editing. Other text, such as the names of faults, can be placed on the map at any angle or along curved lines. Various scalable fonts are available.

Database

A map compiled in ALACARTE - ARC/INFO automatically contains the essential elements of a map database. Each line segment, polygon, and point is uniquely identified and located. Basic topologic relations are determined and recorded each time the map topology is processed (built or cleaned), including line lengths, polygon areas, and identity of neighbors. Several additional items (fields) are routinely added to the database in using ALACARTE, particularly to record the types of line, point, and polygon and to record the orientation of structural features. Other items can be added as desired to record additional information about specific map elements, such as scale of source maps, fault names, characteristics of map units, or stratigraphic boundaries in wells. Any or all of these records are then available for automatic searches as part of various analytic routines.

Layers

Digital maps should be prepared in layers that distinguish kinds of information or features. Thus, although polygons must be separated from points because of the way ARC/INFO treats these two kinds of features in version 5.0.1, it is also desirable to separate them because they represent different kinds of information. Separating the map information into layers provides the greatest flexibility in on-screen use and plotting and minimizes processing time when working with one part of the data set. The design of layers for a map will depend on its content and purpose, but a good organization for a typical geologic map will include several layers. These can be changed during work on a map, because separate layers can be combined and specified elements in one layer can be moved into another.

Base - One or more base layers will typically be involved. If the base is to serve solely as a visual background, it can be scanned as a composite or in separations (topography, drainage, culture). If digital attributes in the base such as contour values are required, however, then digital line graphs (DLGs) of the base layers must be obtained.

Faults, Contacts, and Units - The lines define the main framework of most geologic maps and here include the map boundary and all contacts and faults, whether or not they will serve as polygon boundaries. If polygons are to be identified, then the boundaries of water bodies and any needed scratch boundaries must be included as well. Fold axes, cross-section lines, structure contours, iso-

grads, leaders for unit labels, and other cross-cutting lines should be placed in other layers to avoid complicating the polygons. When completed, the lines layer will contain nothing but the needed contacts, faults, and other polygon boundaries, all tagged by line type. Closed polygons (the distribution of map units) are identified through a bulk processing step (the build function) and their identities specified by digitizing a tagged label point in each polygon. Any polygon boundaries left incomplete during preparation of the lines layer will have been completed.

Structure - Structural data (bedding attitudes, lineations, etc.) are entered as a special kind of point at which the orientation data and point type are recorded. The oriented symbols that display this information on the map are generated at the time of screen display or plotting. Cross-section lines, fold axes, and structural contours can also be included here.

Stations - Field stations and all other points can be combined in a single layer or different kinds of points can be placed in separate layers to facilitate analysis. Text labels to identify the points or to report data (age, chemistry, etc.) can be included here or placed in the annotation layer.

Annotation - All map-face text (except dip or plunge values) can be placed in one layer. This will include map unit labels and leaders, fault names, point identities or data, and any special annotation. This is strictly a graphic layer that serves no database role. Any information that should be available for use in map analysis must also be placed in the appropriate database in association with particular map elements. Annotation can be generated automatically from database attributes for direct use or for subsequent editing.

Other layers - Various other topical features may best be placed in one or more separate layers. This is certainly the case for lines that would unnecessarily complicate the map-unit polygons.

GETTING STARTED

The ease of starting to use ALACARTE-ARC/INFO will depend on whether you must start from scratch or can join an established system. You may simply need to learn to use ALACARTE from an existing station or, at the other extreme, may need to obtain all the needed equipment and software before you can begin. Regardless, getting help from a local expert will make things much easier. Considerable computer expertise will be needed to procure and install equipment and software, whereas joining an established system from which advice is available will be relatively painless.

Equipment and Software

Arranging to use ALACARTE-ARC/INFO can be as simple as finding a station on an existing system from which to work or can involve setting up a whole new system. ARC/INFO is a commercial program for which a license must be purchased from its vendor, ESRI; ALACARTE is available from the U.S. Geological Survey at nominal cost. The basic requirement is to have ARC/INFO (and ALACARTE) running on an independent workstation or in multiuser form on a central machine (ARC/INFO host). Central hosts are accessed remotely over network or hardwired connections from color-graphics terminals or terminal emulator programs running on desktop computers (Macs, PC's, or workstations).

Considerable on-line storage is needed to hold the programs, provide work space, and hold active map files. Records for the complex example map in the Tour directory, for example, which represents

about 10 percent of the area of the 7-1/2 minute quadrangle, require 1,843 kilobytes of disk space (Unix, or 1123 Prime records). For that complete quadrangle, the base layers require 6 MB, the geology scan about 5 MB, and the finished geology and structure about 1.5 MB.

Digitizer input requires a digitizing table, tablet, or pad to be connected either to an independent workstation or to a terminal that is linked to an ARC/INFO host and is equipped with serial pass-through. Terminal emulators do not support digitizer input. Scanning input requires a means of obtaining scans, converting raster scans to vector form, and transferring the vector files to ARC/INFO. Plotting requires some kind of plotter and a means of getting plot files to it from ARC/INFO.

ALACARTE runs under ARC/INFO on a subset of the hosts supported by ARC/INFO. It has been tested on Sun and Data General workstations and Prime minicomputers, and should run unmodified on any Unix system supported by ARC/INFO. ALACARTE can be modified to run on DEC VAX/VMS systems, but will not run under PCArc on IMB PC's.

ARC/INFO is available in single-user mode for workstations and multi-user mode for workstations, fileservers, and minicomputers. The workstation monitor itself is used for display in single-user mode. Multi-user ARC/INFO is accessed over serial lines or Ethernet from Tektronix graphics terminals and terminal emulators running on IBM PC's, Macintoshes, and workstations that have no ARC/INFO license. Because the type and mode of access of scanners, plotters, and digitizers will vary between sites, you should consult your system administrator for details. ALACARTE is designed to support all the peripheral devices that are supported by ARC/INFO.

Learning to Use ALACARTE-ARC/INFO

ALACARTE is best learned by using it. This manual is designed both to introduce you to ALACARTE and to serve as a reference while you are working. Reading the manual will help you decide what uses you want to make of ALACARTE-ARC/INFO and how to go about it, but not until you actually sit down in front of a terminal and start playing with the menus, the automated demonstration, and the example map files will you really begin to learn to use ALACARTE.

Begin by reading the introductory sections of the manual. Then, with help from a colleague or your system administrator, find a station to work from, log in to the demonstration directory (Tour), start ALACARTE, and look around. The *Self-Guided Tour* of ALACARTE will lead you through the initial steps and help you run the automated demonstration of map elements, which shows you how maps and their constituent features look on the screen. Then explore the menu structure, experiment with the use of the different kinds of menus, and begin learning the functions and procedures of ALACARTE - ARC/INFO by following the tour instructions to prepare a simple map.

With this introduction, begin working on your own map. The sooner you do this, the better. Learning progressively as you work is more efficient than trying to learn the whole system in advance. Use the *Self-Guided Tour* and *Compiling a Digital Map* to determine the scope of ALACARTE and the issues you must address for your own map and focus on those issues in your exploration of ALACARTE. Then start work and refer to *Compiling a Digital Map* and other sections in *ALACARTE Basics* and *Procedures* to resolve problems as you go.

Before you begin your own work, you will want to consult your system administrator both to obtain an account on the system and to determine how to perform those operations that are specific to each

computer system (see *System Details*, p. 35). The quickest way to learn ALACARTE is to use it, consulting the various parts of the manual for help as necessary. It will also be useful to recruit a colleague who can help you when needed. Remember that mistakes can do no harm as long as you maintain a recent backup copy of your map. You can remove the effects of missteps with the Oops function and always have the choice of not saving any changes that you have made (see *Saving*, p. 80).

SELF-GUIDED TOUR

A first step in learning to use ALACARTE or to examine how it works is to run the automated ALACARTE demonstration, explore and experiment with the ALACARTE menus and functions, and then make a very simple map. You can do this on your own, once you have established the basic requirements: (1) you have a station to work from, (2) you have a login account on a host computer running ARC/INFO with ALACARTE, and (3) you know the few computer commands needed to call the host computer, log in, run ALACARTE, and quit when you are through. Consult *System Details* (p. 35) and a colleague or your system administrator for help with these. Throughout, remember that you may make some mistakes initially, but that recovery from most mistakes is easy and it is hard to do any real damage.

ALACARTE includes a map directory called *Tour* that contains a suite of demonstration map layers based on the geologic map of the Loma Prieta 7-1/2 minute quadrangle (McLaughlin and others, U.S. Geological Survey Open-File Map 88-752), which straddles the San Andreas fault on the San Francisco peninsula in California. ALACARTE will help you to copy this demonstration directory into your home directory for use in running the automated ALACARTE demonstration and in subsequent experimentation (use the Demonstration menu to copy the directory, as described in *ALACARTE Demonstration*, p. 16, and *Copy the Tour Directory*, p., 49).

The Tour directory requires about 2 megabytes (MB) of space (1000 Prime records). If disk space is short, as is often the case, consider logging in to a directory that already contains a Tour directory. If you do copy Tour into your own directory, be sure to delete it when you are through to avoid using unnecessary space. It is always easy to copy it again.

Before starting, it will be useful to have read the introductory sections of this manual (*Introduction*, *Compiling a Digital Map*, and *Getting Started*, p. 1-14) as well as *Starting ALACARTE* (p. 46). As you proceed, be sure to look at the other sections of the manual that are cited here, both to supplement the information provided here and to become familiar with the various parts of the manual.

How to Start

Go to the station from which you will work (terminal or computer), turn it on and/or start the terminal emulator, and call the host computer. When the prompt for the host system appears, log in to an appropriate directory. Exactly how to carry out these steps will depend on your particular system; see *Accessing Systems with ALACARTE-ARC/INFO* (p. 35) and consult a colleague or the system administrator for instructions: write the steps down precisely, for computers don't accommodate error or approximation very well.

Once you are in the appropriate directory (probably your home directory or a Tour directory set up for introductory use), start ALACARTE. The manual section *Starting ALACARTE* (p. 46) provides step-by-step instructions for doing this.

How to Quit

It is helpful, before you start, to know that you can get back out of ALACARTE gracefully. From any part of ALACARTE, move up and out of the hierarchy of bar menus by clicking on the right-hand item

on each of the bars until you reach the Alacarte bar, and then use **QUIT** to close ALACARTE and ARC/INFO and return to the system prompt.

Close an open pulldown, popup, or forms menu by picking **Close menu** or **cancel**, and close reports forms with **OK** or **Quit**. Picking **OK** on a forms menu will activate the function controlled by that menu. If you happen to do this and errors result, simply ignore them, close any reports forms that appear, and proceed. As long as you stay in your own copy of the Tour directory, the worst that can happen is that one of the Tour files might be modified.

If you have listed something on the screen from ALACARTE or have caused a question to be asked at a prompt in the dialog area, you may need to hit the return key (<return>) in order to reassert control from the current bar menu. If you have started a key menu, close it by entering a *9* (see *Using the Menus, p.* 59, to determine how to enter these numbers). If you have trouble entering a *9* from a mouse (some emulators are balky until set properly), try entering it from the keyboard and <Return>; this may yield errors, but it should close the key menu.

If you have gone out to one of the command lines, you will need to enter one of several commands in order to return to ALACARTE. Try *quit*, *exit*, *&return*, *QUIT*, or *QUIT STOP*, or consult *Command Lines* (p. 64) for a description of the use of these various commands.

Breaks - If all else fails, or a runaway process starts and takes over the system, terminate program operation with a break. On Unix hosts use CONTROL-C to do this, and on Primes use CONTROL-P (hold the control key and then hit the appropriate letter key). You will then be asked in the dialog area if you really want to do this, y/n. Try *n* (= no) first, and if this doesn't correct the problem, repeat the break and respond *y* (= yes). You should end up at the system prompt with ALACARTE -ARC/INFO closed down. Use this break procedure only as a last resort, because it can leave temporary files behind that will have to be deleted separately.

ALACARTE Demonstration

A good way to see how ALACARTE maps work is to run the automated Alacarte demonstration, which illustrates the structure of map data and shows how the various elements of a geologic map look on your display screen. Once the demonstration is started from the Alacarte bar menu, you simply page through the twenty-one illustrations by hitting <Return> (hit the key sharply and release immediately). These are not just pictures displayed on the screen, for the demonstration program is actually running ARC/INFO in the same fashion that you would in using ALACARTE. You can terminate the demonstration after any illustration and be returned to the Alacarte bar.

The demonstration illustrates the structure of map data through a series of illustrations and shows how the various elements of a geologic map look on your display screen. The demonstration starts with a full-color map containing standard line symbols and bedding attitudes (this can be slow to draw on a busy multiuser system) and then backs off to the more typical "wireframe" lines and uncolored polygons used in editing. The series displays the on-screen appearance and database for lines, polygons, structural data, and an example points layer containing fossil data, incorporates a digital base map as a background, and illustrates text annotation and the digital tics used for geographic registration.

To prepare for the demonstration:

1. log in and go to a Tour directory or, if none is available, to your home directory,
2. start ALACARTE and go to the first (Alacarte) menu bar (pick **none** for digitizer),
3. open the Commands popup menu by clicking on **[Alacarte]** at the left end of the Alacare bar,
4. open the Demonstration menu by clicking on **alacarte demo** on the Commands menu.

Start the demonstration from the Demonstration menu:

> **Start the ALACARTE demo. You must be in your copy of the ALACARTE tour directory. For more information click on the 'HELP' button.**
>
> **change to your copy of tour directory:**
>
> **/HOME/CWENT**
>
> **copy tour directory to current directory: copy tour**
>
> **Start demo HELP CANCEL**

You must be in a Tour directory in order to run the demonstration. If the pathname shown beneath the heading **change to your copy of tour directory:** does not end with the word TOUR (as is the case for the CWENT directory shown here), you are not in a Tour directory. If a Tour directory is available, you can click in the pathname blank and enter its pathname from the keyboard. Otherwise, click on the **copy tour** button to have ALACARTE place a copy of the Tour directory in your current directory and automatically move you to that new directory. This copying will take a minute or so.

Start the demonstration by clicking on the **Start demo** button.

The first frame is a brief description of the demonstration. Move on from this and proceed through the illustrations in sequence by hitting <Return> when you are finished with each panel or list. You can quit the demonstration and return to the Alacarte bar menu after any panel by typing *q* (for quit) before hitting the <Return>. The brief text in the dialogue area beneath each illustration describes the main points of each illustration.

When the demonstration is completed, or if you quit earlier, you will be returned to the Alacarte bar menu. Proceed then to look around in the menu structure, or close ALACARTE and return to the system prompt by clicking on **QUIT** at the right end of the Alacarte bar.

Experiment

You should explore the ALACARTE menu structure and experiment with how the menus and various ALACARTE functions work. You can start by just looking around without actually running any ARC/INFO functions, simply by not picking any menu items that are all lower case. Only lower case items actually do anything, the others just manipulate the menus. Consult *Using the Menus* (p. 59) to determined how these various kinds of menus work. Then follow the suggestions below to look around in the menu structure and experiment with some of the basic Edit functions.

Structure and Functions (p. 203) provides a systematic listing of all the bar and pulldown menus in ALACARTE and figure 4 (p. 205) shows the hierarchical framework of the bar menus.

Go down from the Alacarte bar to each of the six principal bar menus (but reserve the Edit bar for last - see below). These bars represent the principal functions of ALACARTE. Open some pulldown and popup menus to see what they look like and to become comfortable with using the menus. You can consult *Structure and Functions* to see what the various menu items do. In looking around, remember that you activate a menu item by moving the crosshairs over it and clicking a mouse button (or the space bar) and that you can always get back to the current bar menu by closing an open pulldown or popup menu (see *Using the Menus*, p. 59, for further information on picking menu items). If you do activate an ARC/INFO function and any error messages result, ignore them, close any reports forms, and proceed.

EDIT-BAR FUNCTIONS

Now that you have some idea of how to manipulate at least the simpler menus, try some of the control and edit functions that are used to display and work with a map. If you are beginning a new session, be sure that you are in the Tour directory, and then start ALACARTE and go to the Alacarte bar as you did to run the Demonstration.

Go down to the Edit bar (pick **EDIT** on the Alacarte bar). As described in *Edit Map* (p. 65), you must specify a map on which to work (the Edit Map); the Choose Map menu pops up to let you do this.

Pick the **Choose Map** button on this menu to list the maps from the current directory on the screen, and click on CLP.GEOL from the list to choose it (this is the polygon layer for the demonstration geologic map).

The Setup file for the map will be read and a report will appear on the screen:

Map currently being edited is: CLP.GEOL
in directory /REDHOME/CWENT/TOUR
Weedtolerance 0
Intersectarcs ALL
Arcsnap ON, 15
Nodesnap CLOSEST, 15
Grain 4.351 . . . .
Editdistance 61
Mapscale is 1:24000 **(0 indicates unknown)**
Mapunits are METERS
Click on QUIT to continue
QUIT

This report appears every time that you open an Edit Map. Use it to be sure that the map you have opened is the one that you intend to work on, and to check how the snapping tolerances are set. These settings control some important aspects about the behavior of the editing functions (see *Snapping and Other Controls*, p. 123). For now, note that you did open CLP.GEOL and that Arcsnap and Nodesnap are on with distances set to 15 meters in map units (that is, in meters on the ground). Close the report by clicking on the **QUIT** button.

You are now presented with the Edit bar, which provides access to the working bars for the different kinds of features in a map:

[Edit] | Map | LINES | PTS | AREAS | ANNO | TICS | Save | Dw | Zm | ^ALC |

This bar also offers two important pulldown menus, the Map pulldown and the Save pulldown, which are opened with **Map** and **Save**, respectively:

Map (**Map**):

choose edit map
show current edit map
show all open edit maps
remove edit map(s)
create new map

choose background
show current backgrnds
remove background
remove all backgnds

change workspace
show workspace
list dir

register map
describe map
record mapscale
record mapunits
show scale, units
change coord device

Save (**Save**):

cur map(ow)

cur map(new)

all maps (ow)

save-select?
save-symbol?
save-audit?
show settings

save setup
use setup

Open the Map pulldown by picking **Map** on the Edit bar. From this menu you can change the current Edit Map, add or remove backgrounds, and register a source map on a digitizer (see *Edit Bar Menu, Map Pulldown,* p. 211, for a systematic description).

The Save pulldown (open with **Save**) offers a range of save options (see *Saving,* p. 80, for a full discussion). Working on a map with ALACARTE-ARC/INFO, like working on a manuscript in a word processor, modifies a temporary copy of the document. You must save that temporary copy if you want to keep your work (and you can abandon new editing by not saving). Here at the Edit bar you can save the current edit map by overwriting the permanent file (**cur map(ow)**) or by specifying a new file (**cur map(new)**); you can also save from any of the various Options pulldowns in Edit, but only by overwriting the current map. While you are experimenting, you can avoid affecting any permanent files by not saving anything, but later you will want to be sure to save frequently as you work (at least once an hour).

Draw and Zoom Controls

Controls on which kinds of features in a map are drawn and what part of the map is shown on the screen are provided by two standard popup menus that can be opened from any bar in Edit (described

more fully in *Draw Controls*, p. 67, and *Zoom Controls*, p. 69). Use the Draw menu to define content (open with **Dw**) and the Zoom menu to navigate within the map (open with **Zm**):

Draw (**Dw**):	Zoom (**Zm**):
draw map	**zoomin(box)**
draw(noclear)	**overview**
set draw/back envir	**zoomout(#)**
	zoomin(#)
select many	
set drawsel symbol	**zoom 9/36**
draw select	**zoom 8/32**
set $symbol(S)	**xy box**
	Pan
auto dw sel on	
auto dw sel off	**draw area of:**
	selected features(S)
clear screen	**map boundary**
graphics on	**map corners**
graphics off	
	draw to scale
	save this frame
	redraw saved frame

Open the Draw menu and pick **draw map**. Nothing happens because at the Edit bar no features are turned on in the draw environment. You have control over which kinds of features in a map actually draw. Set the draw environment from the Draw/Back Environment menu, which is opened from the Draw menu with **set draw/back envir**. Open this menu, and turn arcs on in the foreground by picking the **ON** button opposite the **Arc:** heading (note that the setting changes from OFF to ON). Then draw again, this time using the **DRAW** button at the bottom of the open Draw/Back Environment menu. The menu will close and the lines in the geologic map will draw on the screen.

Now zoom in on the map. Open the Zoom menu and pick **zoomin(#)**; A prompt in the dialog area will instruct you:

Give zoomfactor, <Return> = 2:

Accept the default of a two-fold magnification of the draw area with a <Return>, and you will be asked to:

Enter center of zoom area

Do this by clicking on the map and the screen will be redrawn at a two-fold larger scale with the clickpoint at the center. You could also have entered a different magnification factor from the keyboard at the Zoomfactor prompt before hitting <Return>.

A common need during editing is to be able to zoom in on a map detail to fix it and then to restore the larger view. Try this by saving the current draw area (frame), zooming in on a detail, and then returning to the saved frame. Do this by opening the Zoom menu and picking **save this frame**. Then open the Zoom menu again and try the Zoombox function: pick **zoomin(box)** and, at the instruction

to define the box, click the diagonally opposite corners of a box on the map. When you click the second corner, the box will be redrawn to fill the screen. Finally, pick **redraw saved frame** from the Zoom menu to return to the larger view.

Return to the full area of features in the map with **overview** on the Zoom menu. Hit <Return> at the prompt:

Confirm: draw entire map, <Return> = yes?

Because a large map can take a long time to draw on some systems, especially if a busy background map is turned on, the Overview function asks in the dialog area that you confirm the action or cancel it by entering *n*(o).

Using Backgrounds On Screen

On-screen work is greatly facilitated by the ability to display registered layers in the background behind the edit map. Open the Map pulldown and choose CLP.INDEX as a background (pick **choose background**, then pick CLP.INDEX from the resulting list of maps) and specify a neutral gray color (15) from the Colors popup that follows. Then add CLP.HYDRO as a second background, and specify blue (4).

If you were to draw now, no backgrounds would appear on the screen. Just as with the edit map in the foreground, features in the background maps are controlled from the Draw/Back Environment menu. Turn arcs on in the background from that menu and draw. The gray index contours and blue drainage lines should now place the geologic lines in a topographic context on the screen. Note that the order in which the backgrounds draw is the order in which you chose them.

WORKING WITH LINES

The Edit bar offers access to subordinate bars from which you can work on the various kinds of features in a map: lines, points, areas, annotation, and tics. Lines are the fundamental component of geologic maps and are the most complex kind of feature.

Go down to the Lines bar (pick **LINES** on the Edit bar):

[Lines] | DIG | RSH | Snap | SYMB | Db | Sel | Op | Dw | Zm | ^EDIT |

This bar illustrates the basic character of each of the feature bars. They provide access to other bars from which to digitize and to modify that kind of feature (see figure 4, p. 205); for lines, these are the Digitize and Reshape bars. They also provide access to the Database pulldown menu and the standard pulldown and popup menus that are available from every working bar in Edit - an Options pulldown and the Select, Draw, and Zoom popups.

The features appropriate to each of the feature bars are turned on automatically for the edit map by ALACARTE. By coming down to the Lines bar, for example, you have automatically turned lines on in the foreground. This setting can be overridden or modified at any time from the Draw/Back Environment menu.

Start looking at lines by drawing the lines in CLP.GEOL in color according to their major identities: use **draw w/ default colors** on the Options pulldown to have ALACARTE search the database and color all faults red and all contacts aquamarine.

Now turn nodes on in the foreground and draw the map again; this will mark every intersection and change of line type in the edit map with a white dot. Do this by opening the Draw/Back Environment menu from the Draw menu and clicking the **ON** button for Nodes in the edit map, and then drawing.

You can examine the database for individual lines from the Database form (see *Using the Menus*, *Database Form*, p. 62, for a description). Open the Database pulldown (pick **Db** on the bar) and pick **forms** to open the Database form. Initially the form will contain no information, because no lines are selected. To display the database for a line, click on the **SELECT** button on the form, move the crosshairs onto the line, and then enter a *1* (in short, click on the line). The database entries for that line will be shown in the form:

Arc **Internal** 37 **User-ID** 1225

fnode#	32
tnode#	14
lpoly#	13
rpoly#	9
length	1290.031
clp.geol#	37
CLP.GEOL-ID	*1225*
LTYPE	*normal fault, inferred*
SEL	*0*
SYMB	*0*

SELECT NEXT SAVE WHO CANCEL

Note the kinds of information that are present. The items listed in lower case are controlled by ARC/INFO (see *Topology*, p. 56), whereas the upper case items are under your control and can be changed here from the keyboard or elsewhere using other ALACARTE functions.

Try changing the line type for this line. Click in the LTYPE box to highlight it and enter your first name from the keyboard. Saving such a change requires two steps, (1) saving it to the temporary open copy of the map by clicking on the **SAVE** button here, and then (2) saving the temporary copy before quitting ALACARTE.

Lines are added to a map from the Digitize bar. Go to that bar by picking **DIG** on the Lines bar:

[Dig] | dig | tag | Sel | ? | C | F | A | O | Mod | Op | Dw | Zm | ^LINES |

A current line type is maintained here at the Digitize bar that can be changed as you wish. Click on **?** to obtain a report of the current type (the default of contact, certain will be reported), and then change it to something else, first from the pulldown menus and then from the keyboard (see *Set Line Type*, p. 130, for a description of how to do this). The current line type is automatically assigned to new lines as they are digitized here and can be used to tag a selected line or to select lines by their recorded line types.

Try digitizing a new line (see *Enter Lines*, p. 131, for a description of this process). Zoom in to a relatively open area to add a line that crosses at least one existing line and connects at each end to other lines. Set a line type for the new line, start the Digitize routine by picking **dig** on the bar, and click in the vertices of the line using a *2* at the beginning and end nodes and a *1* to place each internal vertex. Close the Digitize routine with a *9*.

If you placed the ends of this new line within the snapping distance of the existing lines, Arcsnap will have closed the junctions precisely (watch for the lines to blink as they snap). The new intersection will also have been recognized by Intersectarcs and the lines will be split there and joined by a node. If you want to redo this line, back up with **oops** (on the Options pulldown, **Op**) and redigitize it.

Go back up to the Lines bar and look at these new lines in the Database form. The lines that you digitized remained selected after you closed the Digitize routine, and database entries for one of them will be displayed when you open the Database form. Note that the line type was recorded automatically in the LTYPE item. Cycle through the selected set of lines in the form by clicking on **NEXTREC**.

Now go down to the Reshape bar (pick **RSH** from the Lines bar) to look at line details and to change the shape of a line:

[Rsh] | C | E | Rsh | A | Sp | V | N | sm | sp | Se | Op | Dw | Zm | ^LINES |

Reshape (**Rsh**): Split/Combine (**Sp**): Vertex (**V**): Options (**Op**):

reshape(S1)	**split(S1)**	**add vertex(S1)**	**oops**
dash to solid	**split at vertex(S1)**	**delete vertex(S1)**	**Undelete(S):**
move in place		**move vertex**	**last**
Grain:	**combine arcs(S)**	**draw vertex(S1)**	**all**
grain *		**in red**	**for expression**
grain distance		**in other color**	**delete(S)**
Spline:			**select many**
help			**draw sel'd features**
spline(S)			**show sel'd features**
Densify:			**list attributes(S)**
help			**PUT**
densify default(S)			**get**
densify *(S)			**distance**
densify distance(S)			**where**
Generalize:			**flip line dir'n(S)**
gen default(S)			**change coord device**
gen *(S)			**save(OW)**
gen distance(S)			

The Reshape bar is complex because, in modifying the shape and interconnections of lines, you need a wide variety of edit functions ready at hand. Four of the pulldowns from the Reshape bar are listed here and a full annotated listing of the bar and its pulldown menus is provided in *Reshape (Lines) Bar Menu* (p. 217).

Most operations on lines require first that the line be selected. Two often-used select functions are located directly on the Reshape bar (Select Many - **sm**, and Select Polygon Within - **sp**), and a wide

suite of select functions is available on the standard Select popup menu (open here with **Se**; see *Selecting Map Elements*, p. 73, for an full discussion).

Select a long line on the screen by picking **sm** on the bar and clicking a *1* on the line to select it, as instructed by the key menu, and then close the key menu with a *9*. ALACARTE will redraw the selected line in yellow (the default Drawselect color).

Draw the vertices of this selected line by opening the Vertex pulldown (**V** on the bar) and picking **in red** under **draw vertex(S1)**. If red is not appropriate because of the color of the line, use **in other color** to pick a vertex color from the Colors popup.

Change the shape of the selected line by redrawing part of it on the screen. While the line is selected, open the Reshape pulldown (**Rsh**) and pick **reshape(S1)**. You will be instructed to

Enter the new segment <3 - Curve, 9 - Quit>

Click a new shape for the middle third of the line by clicking *1*'s: start by crossing the original line, then define the new shape, and end by crossing the original line again. When you close with a *9*, the new segment will become part of the line.

Nodes are special parts of lines that require separate treatment. Go down to the Nodes bar from the Reshape bar (pick **N** on the bar):

[Nodes] | move | Snap | Symb | Op | Dw | Zm | ^RSH |

The sole editing function that can be applied to nodes from the Nodes bar is to move them (see *Edit Nodes*, p. 136). Moving a node moves the whole intersection with all lines attached. (If you want to separate a line from an intersection, work with the end vertex of that line from the Reshape bar.) Move a node by starting the Move Node routine (pick **move** on the bar) and then following the key menu code; specify a node by clicking on it with a *1*, confirm the selection with a *4*, and then click a new location for the node with another *1*. Do this for as many nodes as you wish in sequence, and then close the routine with a *9*. After moving a node for practice, return to the Reshape bar (pick **^RSH**).

Lines have a direction that can be controlled. Open the Draw/Back Environment menu (from the Draw menu), turn Arrows on for lines, and draw. Note the arrow heads that mark the line directions. Note also that redrawing clears the vertex marks and removes the drawselect color from the selected line. Redraw the selected line with **draw sel'd features** on the Options pulldown. Now reverse its direction with **flip line dir'n(S)** on the Options pulldown. Turn the arrows off again.

Select a line and delete it. Try Select Polygon Passthru this time. Open the Select popup menu (pick **Se** on the Reshape bar), and set the Select Type to *select*, the Option to *polygon*, and the Choice to *passthru*. (In terminal emulators, making choices in this kind of menu may require moving the highlight with the tab or arrow keys and choosing a highlighted item with <Return>; see *Menu Operations*, p. 59.) In contrast to Select Within, Passthru selects lines that are crossed by the polygon as well as those enclosed by it. Select one line by crossing it with the polygon, then delete it with **delete(S)** on the Options pulldown.

Presume that you want to tag the two halves of a line differently in order to assign different line symbols to them in plotting. First you must split the line: select the line, this time by trying Select Polygon Within from the bar (**sp**). This requires that you enclose the target line with a polygon

clicked with *1*'s. With one line selected, open the Split/Combine pulldown (**Sp** on the bar), pick **split(S1**), and click on the selected line where you want it to be split. The line will be split at the clickpoint, and a node will appear there.

Go back to the Digitize bar (up to Lines and down to Digitize), chose a line type for one of the new line segments, and select and tag the line and then color it distinctively. You can do this most easily with **sel,tag,color** on the Select pulldown (open with **Sel** on the bar).

With this introduction to working with lines, try experimenting with the various functions. Open the Select popup, consult *Selecting Map Elements* (p. 73), and try selecting lines in various ways, including By Expression and with the Select-by-Current-Linetype functions. Consult *Edit Lines* (p.135) and try some of the other line-editing functions.

WORKING WITH AREAS

Areas (polygons) are addressed through the label points that identify them. Go down to the Areas bar from the Edit bar (pick **AREAS**):

[Areas] | DIG | MOVE | SYMB | Db | Sel | Op | Dw | Zm | ^EDIT |

Both lines and label points (arcs and labels) will be turned on automatically in the Draw Environment and any other settings you have made will be retained. When you draw the map, note that nodes are still on. Turn them off and draw again.

The principal bar in Areas is the digitize bar, from which you can digitize, tag, or retag label points. The only way to modify labels other than to retag them is to move or delete them. Go down to the Digitize (Areas) bar (pick **DIG**):

[Dig] | dig | tag | Sel | ? | key | m1 | m2 | m3 | Op | Dw | Zm | ^AREAS |

Like the lines bar, a current area type is maintained at this bar (pick **?** to check it). In contrast to lines, standard area types cannot be defined for a geologic map and the area type is set either from the keyboard (pick **key**) or from user-defined menus (see *Tag Polygons*, p. 162, for a discussion).

Look at the database for a label point by selecting and listing it (you could also use the Database form, which is reached from the Areas bar). To select a label point, open the Select pulldown (**Sel** on the bar), pick **select many**, click on the label point on the map, and close with a *9*. The selected point will redraw as a yellow dot. List the database with **list attributes(S)** on the options pulldown. The list will appear in the dialog area. (If not all the list can fit on the screen, you may be asked if you want to continue? Just use <Return> to do so.) Note the database items, and particularly the PTYPE, which is the record of the geologic unit to which this polygon is assigned.

You can display all the PTYPE entries for all the label points on the screen by opening the Options pulldown and picking **Post attribute: on**. Now every time you draw or zoom the PTYPEs will be posted. Later, when you want to turn this function off again, simply pick Post attribute:off on the Options pulldown. (Be sure to do this before you leave Areas.).

Digitizing new label points is as easy as setting the area type and clicking points: set a new area type from the keyboard (**key**), start the digitize routine (pick **dig**), and click some points at arbitrary locations on the map. As you click, the new points will draw, and if you still have Post Attributes on, the PTYPEs will be posted as well.

These points that you have just added are not yet recognized as part of the polygon topology of the map. That would require building the map for polygons (see *Topology*, p. 56). Were you to do that now, ARC/INFO would recognize that there are extra label points in some of the polygons. Delete these extra label points: because you have just digitized them, they should still be selected, and all you need to do is pick **delete(S)** on the Options pulldown.

Polygons in a map that has unedited polygon topology (as does the permanent file for CLP.GEOL) can be colored on screen (see *Color Selected Polygons*, p. 169). Open the Options pulldown and pick **color units in backgnd** to open the Color Units menu. Accept the default shadeset, pick the **unit to be colored** button and choose a unit to be colored from the list, then pick the **select color for unit** button to specify a color. Then draw. Polygons of the specified unit will be filled with the specified color. This coloring will continue with every zoom and draw until you turn it off by picking **color units: off** from the Options pulldown (be sure to do this before you leave Areas).

WORKING WITH POINTS

Points are used both to record such oriented structural data as bedding attitudes and lineations and to represent sample localities and other point data (see *Points and Point Data, p. 175*, and *Oriented Symbols and Data*, p. 179). Because points in ARC/INFO 5.0.1 use the same database file as polygons (the PAT), no single map layer can contain both types of features.

Go back up to the Edit bar and choose CLP.ATT for the current edit map. This is the layer in the demonstration map that contains bedding attitudes. Then go down to Points (pick **PTS**):

[Points] | Dig/tag | MOVE | SYMB | Db | Sel | Op | Dw | Zm | ^EDIT |

Digitize/Tag (**Dig/Tag**):

POINT
PLANAR
LINEAR
MAP SYMBOLS
no attribute

In contrast to the other kinds of features, there is more than one kind of digitize bar for points, because the different kinds of data recorded at points in ALACARTE involve different input routines and different database formats. The Digitize/Tag pulldown offers access to separate digitize bars for points, for planar features recorded at points, and for linear features recorded at points (Map Symbols is not implemented in version 1.0).

Go down to the digitize bar for planar features (pick **PLANAR** on the Digitize/Tag pulldown):

[Planar] | dig | tag | Chg | Sel | ? | Pt Tags | Set | Op | Dw | Zm | ^PTS |

Set Symbols (**Set**):

draw first time w/ current
show current settings

Choose markerset
Choose lookup table
Select db items

set dip numeral height
set attitude entry format

ALACARTE will automatically select and draw all the points in the edit map, using oriented structural symbols. The particular symbol used at each point is a function of the entry in the PTTYPE item in the database, and the orientation of the symbol on the map is a function of the azimuth recorded in the STRIKE item.

The association of a symbol with a point in drawing is controlled by a lookup table, which assigns symbols by number as a function of PTTYPE, and by the markerset of numbered symbols to which the lookup table refers. ALACARTE has automatically chosen the markerset for oriented structural symbols and the lookup table that assigns symbols sized for display at map scale. Because these structural symbols do not change size as you zoom, an alternate lookup table is available with which to draw double-sized symbols.

Change to this larger set of symbols: open the Set Symbols pulldown (pick **Set**), pick **Choose lookup table**, list the options (enter a *?* or click with the middle mouse button in the blank), pick CLP.ATT.LUT2X from the list, and then pick the **OK** button. In order to assign these new symbols to the points, you then open the Set Symbols pulldown again and pick **draw first time w/ current**, and the new symbols will draw on the screen.

If you don't like the size of the dip numbers in relation to the symbols, use the zoom functions to adjust, as the numbers do scale with zoom. (Or, use **draw to scale**, as described in *Set the Draw Scale*, p. 181.)

Select an attitude and look at the database. To do this, open the Select pulldown (**Sel** on the bar), pick **select many**, click on an attitude (at its center), and close with a *9*. The attitude will redraw in yellow. Then list the attributes from the Options pulldown (**list attributes(S)**), and hit <Return> if necessary to complete the report in the dialog area. Note the way that the structural data are recorded.

To digitize an attitude graphically, set the symbol type from the Point Tag pulldown and start the digitize routine. A full description of the procedure is given in *Enter Structural Data* (p. 183), but you can see how it works simply by following the instructions in the dialog area. Click at one end of the strike line, then at the other, and ALACARTE calculates the azimuth according to the right-hand rule, determines the midpoint of the strike line, and posts the symbol; finally, you enter the dip from the keyboard. ALACARTE records the data in the database, posts the dip on the map, and prompts for another symbol. Close the digitize routine with a *9*.

Look at the database for the attitude that you have just entered. Go back up to the Points bar (close the markerset report on the way), open the Database pulldown, and pick **forms**. From the form, pick **SELECT**, then click on the attitude.

WORKING WITH ANNOTATION

The dips on the screen are an example of text that can be incorporated into any map layer. ALACARTE both recorded the dips in the database and posted them as annotation on the map. These numbers can be selected and moved, and other text can be added to the map (see *Add and Edit Annotation*, p. 187).

To experiment with this, go to the Annotation bar (go up to the Edit bar and pick **ANNO**). For present purposes, simply accept the settings in the Annotation Environment form by clicking **OK**, and you will be at the Annotation bar:

[Anno] | DIG | CHANGE | Symb | Sel | Op | Dw | Zm | ^EDIT |

Like the other feature bars, this offers access to a bar for digitizing and one to change annotation. To move a dip number, go to the Change bar (pick **CHANGE**):

[Change] | Change | Move | Rot | sm | sp | Se | Op | Dw | Zm | ^ANNO |

The Select-and-Move routine on the Move pulldown offers cyclic Select One and Move functions: pick **Select and Move** and, at the prompt (1 = move 9 = Quit), click a *1* at the lower left corner of a dip number. The number will blink and you will be instructed to Point to the coordinate to move from. Do this with another click at the place on the number with which you want to reposition it. At the final instruction Point to the coordinate to move to, click where you want to position the number. The number will be moved and the prompt given to start another cycle, at which point you can close with a *9*.

To add some text to the map, go to the Digitize Annotation bar (go up to the Annotation bar and pick **DIG**):

[Dig] | add | Add options | Sel | Op | Dw | Zm | ^ANNO |

There are a great variety of ways to place annotation on the map, of which the simplest is the default. Pick **add** on the bar, and at the prompt Text:, enter any text string from the keyboard. When you hit <Return>, you will be instructed to Enter position (1); do so by clicking on the map, and the text will be placed at the clickpoint. Close the add routine with a <Return> at the Text: prompt. If your entry is too small to read, zoom in on it.

Make a Simple Map

Compiling a digital geologic map involves use of the edit functions and a suite of other functions to prepare layers and enter the data. You can explore this process without spending a great amount of time on any one editing step by making a simple map according the the following instructions. A more complete description of the process is given in *Steps in Preparing a Map*. The simple map will be a small part of the Loma Prieta quadrangle used in the ALACARTE demonstration.

Work in your copy of the Tour directory, do save your work this time, and don't hesitate to try things. The worst that can happen is that an attempted step will not work or, at the extreme, that you will freeze the system and have to break out (see *Self-Guided Tour, How to Quit*, p. 15). Focus on the procedures rather than on making an elegant map, and consult other parts of the manual as necessary.

MAKE THE LINES LAYER

The first task is to establish the geologic line work for the map. This can be done in various ways, but for this example you will use part of a scan of the conventional author line work for the Loma Prieta quadrangle. This drafting was scanned at 17 lines per millimeter (430 lines per inch), converted to vectors, and imported into ARC/INFO (layer CLP.SCAN17 in the Tour directory). To make the line work, you will prepare a tic framework and database, cut out part of the scan and put it into this prepared framework, and then clean up and tag the lines.

Prepare New layer

Go to the Setup bar and prepare a new layer for faults, contacts, and units, using CLP.GEOL as a template. Do this from the New Layer pulldown, call the layer *smpl.ln*, and include the save items. The Setup file and symbols lookup tables will be copied automatically from the template.

Define the Box

Go to the Edit bar (the new layer will be opened) and change edit maps to CLP.SCAN17. Then go to Lines, open the Snap pulldown, and set Intersectarcs to *ADD* and the Nodesnap distance to *0*. These settings will be important as you cut out and copy part of the scan into the new layer.

Go next to the Digitize Lines bar and use **zoom x,y(box)** on the Zoom menu to draw an area with x,y coordinates of:

xmin:	-3000
ymin:	8000
xmax	-1000
ymax:	9000

This will display a relatively simple area of the scan. Save the frame (Zoom menu), and look around at the scan a bit. Then redraw the saved frame (Zoom menu).

The next step is to digitize a box enclosing most of the draw area that will intersect all the lines and permit the box and its contents to be selected and copied into SMPL.LN. Start the digitize routine using **no attributes** on the Other pulldown (pick **O** on the bar); this will avoid producing ALACARTE errors due to the absence of a prepared database in the scan. Change the digitizing option from (line) to (box) by first entering an *8* (control - middle mouse button) to get the Options key menu and then a *6* (shift - right mouse button) to change to Arctype box.

From the resulting digitize prompt - (Box) User-ID: 22113 Points 0 - click a *2* at each of two opposite corners of the draw area to define an area that will be the simple map. Try not to intersect unit labels or attitudes (include rather than exclude). When you click the second *2*, the box will draw and intersect all the lines that it crosses. Close the digitize routine with a *9*.

Put Box into New Layer

Go to the Put bar (up to Lines, down to Reshape, pick **PUT** on the Options pulldown). Select the box and its contents with Select Polygon (**sp** on the bar) by clicking just outside the corners of the box (or use Select Box Within from the Select popup). Be sure that the whole box and its contents redraw in yellow (some 400-500 lines will have been selected); if not, try it again.

Now put the selected lines into the SMPL.LN layer: pick **put** from the bar, list the available maps from the form (*?* or click with the middle mouse button in the blank), and pick SMPL.LN as the receiving layer. When you start the function with the **ok** button, ARC/INFO will interrupt to ask:

```
Coverage  / /TOUR/SMPL.LN
  already exists.  Do you want to append  <Y/N>  :
```

Respond by entering y(es) <Return> and the selected lines will be copied into SMPL.LN.

Go back up to the Edit bar, choose SMPL.LN as the edit map, and save it (**cur map(ow)**) on the Save pulldown).

Clear the Excess

The next step is to delete everything from the scan you have copied into SMPL.LN that will not become part of the geologic line work; that is, all attitudes, dip numbers, unit labels, and leaders. Also remove queries, dots, and any other messy line elements that will better be traced from the original scan.

Work from the Reshape bar, and remember that it is easier to delete and trace than it is to repair complex messes produced by the scanning. The fastest way to delete this material is to use Select Polygon (**sp** on the bar) to enclose the target lines, then delete the selected set with **delete(S)** on the Options pulldown. Cross any lines with the polygon that you want to retain (this version of Select Polygon is Within; see *Selecting Map Elements*, p. 73), gather modest groups of lines in each selection round, and don't be delicate. Repairs and tracing are easy.

Edit the Lines

Once the debris is removed, you are ready to clean up the lines and tag them by line type. Your goal is to edit the existing lines in the scan into simple, continuous line work with no superfluous nodes and with all junctions closed.

Go up to the Edit bar and put the original scan in the background (CLP.SCAN17) with a distinctive color such as red (8) or light green (10). Come back to the Lines bar and set the snapping for line editing (this step is important):

weed tolerance	*0*
intersectarcs	*ALL*
arcsnap type	*ON*
arcsnap distance	*.02* (inches)
nodesnap type	*CLOSEST*
nodesnap distance	*.02* (inches)

Go to the Reshape bar, turn the scan on in the background (arcs on), turn Node Errors on in the foreground, and redraw the saved frame.

Your problems in cleaning up the lines are basically five: (1) close gaps in lines, (2) combine line segments across pseudonodes, (3) extend lines to make intersections, including with the bounding box, (4) adjust intersections that were deformed by the line thinning (which preceded conversion of the scanned lines to vectors), and (5) trace any missing or deleted lines.

Close gaps in lines by moving nodes (from the Nodes bar), by applying **dash to solid** (Reshape pulldown) where dashes are regular and gaps are relatively small, or by digitizing new line segments into the gaps (from the Digitize bar, and don't worry about line type at this stage).

Add lines by tracing from the Digitize bar. In this case you can set the line type appropriately, and then flag the line as tagged by coloring it (**set $symbol(S)** on the Draw menu).

Combine connected line segments (joined by pseudonodes) by selecting them and then applying **combine arcs(S)** (on the Split/Combine pulldown from the Reshape bar). Because there will be no changes in line type across pseudonodes in this example map, you can apply **Combine Arcs** to the whole map occasionally by selecting all the lines first (use Select ALL on the Select popup menu).

Connect T intersections by selecting and extending a line (**both ends *** on the Extend pulldown, and click the distance to extend on the screen) or by moving the end of one line across the other line (move the node), letting Intersectarcs create the intersection, and then selecting and deleting the dangle.

Adjust intersections by moving nodes.

Consult *Edit Lines* (p. 135) as necessary to determine how the various editing functions work.

When you think that you are done, draw with node errors on and check for incomplete intersections and other dangles and for pseudonodes in any of the lines.

Be sure to save your work.

Tag the Lines

Assign line types to the lines from the Digitize Lines bar. Set the line type, use **sel,tag,color** on the Select pulldown, and tag and color each kind of line. For this exercise, just use contacts and faults with the default modifiers, and conceal the faults beneath the landslide.

Be sure to save your work.

MAKE THE POLYGON LAYER

The polygon layer is made from the lines layer by first processing it to establish polygon topology from the lines and then tagging the polygons according to map unit. This is a very simple process compared with making the lines layer.

Build for Polygons

To build the lines layer for polygons (actually you will use Clean at this stage), go up to the ALACARTE bar (be sure that you have saved your work on lines), and then down to the General bar. Pick **Clean** from the Topology pulldown, specify SMPL.LN as the input map and *SMPL.PY* as the name of the output map. Retain the ALACARTE-set values of 0 for dangle and fuzzy tolerance, and start the process with **ok**. This will take a minute or so. (Because you started with a layer prepared for units as well as faults and contacts, the map already has a PAT and doe not need to be separately processed for units.)

Identify the Map Units

Tag the polygons from the Digitize (Areas) bar. Draw the map with the scan in the background, set the line type, pick **dig**, and click in the label points. You may want to use **Post attributers: on** to let you see the tags on screen as you proceed (see p. 25).

Some of the unit labels in the original scan are difficult to read. It isn't important for this exercise, but the suite of units in the example area consists of Qal, Qls, Tp, Tme, and Te2. You can zoom out a ways to help get a better perspective from the background scan.

Place one tagged label point in each polygon, regardless of its size. When you are finished, save your work, go to the General bar, and build the map for polygons (**Build** on the Topology pulldown). To help establish good practice, build into a new layer (call it *SMPL.PY2*).

Test the result with Labelerrors, which will check for unlabeled polygons and those with multiple labels (see *Edit Polygons*, p. 171). Pick **Labelerrors** on the Topology pulldown and specify the map name. Watch in the dialog area to see the report. If nothing is wrong, a single unlabeled polygon will be reported (the background polygon).

If more than that one polygon is reported, you have errors to correct. Consult Edit Polygons for procedures. Save your work and Build (or Clean) the map again after fixing any errors.

With a completed polygon layer, you may want to try coloring the units on screen, one by one (see *Color Selected Polygons*, p. 169).

MAKE THE STRUCTURE LAYER

The structure layer contains such oriented structural symbols as bedding attitudes and lineations and any structural lines, such as fold axes and structure contours. These lines are not included in the lines and polygons layers to avoid breaking up the polygons unnecessarily. A new layer is prepared using the polygon layer as a template and the data are entered, typically by hand. For this example, you will trace the attitudes that were included in the scan.

Prepare the Structure Layer

Go to the Setup bar and prepare a new layer for geologic structures called *SMPL.SR* with SMPL.PY2 as the template. Include the save items.

Digitize Attitudes

Digitizing attitudes is done graphically after setting the Symbols Environment (see *Oriented Symbols and Data*, p. 179). Got to the Edit bar, be sure the new structure layer is the edit map, the original scan is in the background, and add the polygon layer as a second background. Then go to the Points bar, open the Digitize/Tag pulldown, and go to the Planar bar.

Reset the lookup table to double-sized symbols: pick **Choose lookup table** from the Set Symbols pulldown, list the options, and pick CLP.ATT.LUT2X. Then draw the map with the scan and the geologic lines in the background. Nothing will draw in the foreground because there are no points entered as yet.

Enter the attitudes by tracing those in the background scan. Set the point type for the kind of symbol, start the digitize routine, and click in the attitudes and enter the dips (see *Enter Structural Data*, p. 183). Take care to click the ends of the strike lines in the proper order, as it is inconvenient to correct errors.

If you do want to correct a mistake, back up with **oops** (seven times per attitude) or select and delete the offending point, go to the Annotation bar and select and delete the dip number on the map, then return to Planar Points and reenter the attitude.

Be sure to save your work.

MAKE THE ANNOTATION LAYER

The Annotation layer is strictly a graphic layer that contains unit labels and leaders and any other map-face text (dip and plunge numbers are left in the structure layer). Graphic unit labels are created from the PTYPEs in the polygon layer and then edited, and any leaders or other text are added.

Prepare the Annotation Layer

Go to the Setup bar and prepare a new layer for **annotation + leaders** called *SMPL.AN* using SMPL.PY as a template. Then use **create unit annotation** on the New Layer pulldown to copy the PTYPE entries

from SMPL.PY into SMPL.AN. Keep the default feature type of POLYGON, specify the source and receiving layers and PTYPE as the source item, accept the other default entries, and run the routine.

Edit the Annotation Layer

Go to Edit, be sure that the new Annotation layer is the edit map, put the polygon layer in the background, and proceed down to the Annotation bar. For this exercise, accept the default values in the Annotation Environment menu. An Annosize of 0 produces a standard character size of .1 inch on the screen (and the height in map units thus depends on the current draw scale).

Turn arcs on in the background and draw the map (unit labels should draw in the foreground and geologic line work in the background).

You will also need to draw the attitudes in the background in order to arrange the graphic appearance of the map. To accomplish this, go to the Symbols bar (pick **SYMB** on the Annotation bar), and open the Points pulldown (pick **Pts**). Pick **draw cov in back** on the pulldown, and check on the popup menu that the current markerset and lookup table are ALCGEOL.MRK and SMPL.SR.LUT2X. If they are not, cancel the menu and set the markerset and/or the lookup table properly from the same pulldown. Then go back to **draw cov in back**, specify SMPL.SR in the blank for structure layer, and click **ok**. Now when you draw, the attitudes will be displayed in the background.

Use **draw to scale** on the Zoom menu to draw the map at a two-fold magnification over map scale (see *Set the Draw Scale*, p. 181), and you are ready to edit the annotation.

Move, delete, or copy the unit labels to produce the desired appearance. Go to the Digitize Lines bar and add any leaders that are needed.

Try adding a name for a fault using an Annotype of *LINE* to place it along the trace of the fault (see *Add and Edit Annotation*, p. 187, for discussion of the procedure).

Save your work.

ALACARTE BASICS

System details, database formats, kinds of menus, and various techniques and operations are fundamental to the use of ALACARTE-ARC/INFO. Refer to this section on ALACARTE basics as you are learning to use ALACARTE and then as questions arise.

System Details

You will need to know some basic details about your computer system in order to use ALACARTE effectively, particularly how to log in to your system, to move around in the directory structure, and to perform a few basic operations. Your system administrator should supply you with a system account, a user name and password, and may offer basic training in the use of your specific computer system, terminals, plotters, digitizers, and printers. Here we address basic system operation, hardware devices, the structure of ARC/INFO maps, and map workspace strategy.

ACCESSING SYSTEMS WITH ALACARTE-ARC/INFO

ALACARTE runs under ARC/INFO version 5.0.1 on UNIX workstations and fileservers and on Prime minicomputers. UNIX and Primos (the Prime operating system) use different commands, but the operations you need to perform and the directory structures are similar in the two systems. Refer to the four Quick Reference charts (tables 1-4, p. 42-45) that summarize basics about UNIX, the vi UNIX text editor, Primos, and the Emacs Primos text editor.

A normal ALACARTE session involves accessing the ALACARTE-ARC/INFO computer (host) from a workstation or terminal, starting ARC/INFO, and invoking ALACARTE. The exact sequence depends on the type of device, how it is linked to the host, and whether the device and host both support a windowing system. The typical configurations are described below. Your system administrator should be able to supply you with details.

Single-User Workstation

When ARC/INFO runs on a UNIX workstation in single-user mode, it is accessed from the workstation console (display, keyboard and mouse attached to the workstation). The ALACARTE startup sequence from a workstation console is as follows:

1. Power up the workstation, if it is not already on, and let it boot (start up and display the login prompt). Your system administrator may want to perform this step.

2. Log in at the workstation console.

3. Start the workstation's windowing system: Sunview on Sun workstations (not OpenWindows) or X-Windows/Motif on other workstations. Your account may be configured to start the windowing system automatically.

4. Optional: change directories to the workspace that contains your maps (you can also do this after starting ALACARTE).

5. Start ARC/INFO and ALACARTE (see *Starting ALACARTE*, p. 46).

Multi-User Host

ARC/INFO can also be run on a remote, multi-user host where it can be accessed from a graphics terminal, from a graphics terminal emulator running on a PC, Macintosh or UNIX workstation, from an X-terminal, or from X-Windows server software running on a PC, Mac, or workstation. These devices might be linked to the host by modem, direct serial connection, or local area network, typically Ethernet.

Terminals: ALACARTE can be accessed from those terminals supported by ARC/INFO that can display both graphics and menus. These are Tektronix terminals with model numbers of 4105 and above (for example, 4107, 4207 and 4225) and terminals from other vendors that emulate them. Most Tektronix terminals connect to host computers via a serial port either directly (hardwired) or through a modem or digital data-phone. Some more recent Tektronix terminals can connect through built-in Ethernet interfaces.

Terminal Emulators: Software that emulates Tektronix graphics terminals is commercially available for IBM PC and compatibles, Apple Macintosh, and various UNIX workstation computers. ARC/INFO (and therefore ALACARTE) specifically supports Grafpoint's Tgraf07 emulator, which is available for PC's, Macintoshes and UNIX workstations, and Synergy Software's VersatermPro Tektronix 4105 emulator for Macintoshes. Several other Tektronix terminal emulators work with ARC/INFO but are not specifically supported. Isotek (The Bristol Group, Ltd) for Sun workstations emulates the Tektronix terminals numbered 4225 and below and is known to work with ALACARTE. Most of these emulators support both serial and Ethernet connections.

X-Terminals: X-terminals connect to a host through Ethernet and display text and graphics under X-Windows. ARC/INFO 5.0.1 supports X-Windows on most of the UNIX platforms for which ARC/INFO is available. On Sun computers, however, ARC/INFO 5.0.1 runs under Sunview rather than X-Windows (OpenLook), and therefore X-terminals will not work with ARC/INFO on Suns. If you plan to use an X-terminal, it is important that your system administrator configure your account for the various permissions and environment settings required.

X-Windows: Just as there is software to emulate graphics terminals, software is available that displays X-Window graphics on networked PC's and Macintoshes. Check with your system administrator about appropriate software, network hookup, and configuration. UNIX workstations that do not have a local ARC/INFO license can access multiuser ARC/INFO on a UNIX host (typically a fileserver) over Ethernet and display the graphics on the workstation console. The requirements are that the host have X-Windows software installed, that ARC/INFO runs under X-Windows on that host (that is, not Suns with ARC/INFO 5.0.1), and that the workstation is running compatible X-Windows that is properly configured.

The ALACARTE startup sequence for multiuser ARC/INFO running on a remote host is generally as follows:

1. Make sure that your system (terminal, PC, Mac or workstation) is on and booted. If you will be using an emulator or X-Windows server software, you will need to start it before connecting to the remote host. If you will be using a workstation as a terminal or X-server device, you must login and start your emulation software or X-Windows system before making the connection to the host.

2. Establish a connection to the ALACARTE-ARC/INFO host. How this is done depends on the type of connection between terminal and host. If the connection is by Ethernet (as would be typical for an X-terminal or emulation or for X-server software running on a networked PC, Macintosh, or workstation), then the rlogin or telnet command is used. If a terminal is directly connected by serial lines, you simply log in. If the link is by modem or digital phone system, then some local command is required to call the host.

3. Optional: if the host is a UNIX system (other than Sun) and you are working at an X-terminal (or X-Windows server software running on a networked PC or Macintosh or a UNIX workstation), start the host's windowing system. ARC/INFO version 5.0.1 runs under Sunview on Sun systems, but only on workstation or fileserver consoles. You must use a graphics terminal or emulator in order to access multiuser ARC/INFO 5.0.1 running on a Sun host.

4. Optional: change directories to the workspace that contains your maps (you can also do this after starting ALACARTE).

5. Start ARC/INFO and ALACARTE (see *Starting ALACARTE*, p. 46).

NOTES ON SYSTEM COMPONENTS

A variety of peripherals may be available at a site in support of digital map compilation. These might include scanners, plotters, printers, and/or digitizers. Your system administrator should have information on what devices are available and how to access them. Here we briefly discuss some of the issues related to the use of peripherals, describe a typical workstation configuration, and touch on working with local-area networks.

Scanners - Individual scanners vary greatly in their capabilities and use but they must, at a minimum, be able to scan and vectorize black-and-white maps and convert them into a format that ARC/INFO can import. Other desirable features include raster-edit capability for scan-cleanup prior to vectorization, the ability to scan color originals, and network hookup. Some scanners are easily used, whereas others must be operated by specialists. Scanning is available commercially; in fact, any degree of map automation is available commercially, from a simple scan to creating a complete GIS database.

Plotters - The best type of plotter to use depends on the purpose of the plot and the expense permitted in making it. The simplest output is a screen-dump to a color or black-and-white dot-matrix printer. Small, high-quality plots can be made on Postscript laser printers and high-resolution color inkjet printers that support one of ARC/INFO's plotter formats. Large-format plots are made on pen plotters or electrostatic plotters. The speed and ability to color-fill makes the electrostatic plotter the preferred choice, where available. Electrostatic plotting is also available commercially. Pen plotters are useful

for simple check and line plots. Color fill is possible with the judicious design of fill patterns and a ready supply of fresh plotter pens.

Digitizers - Access to a digitizer is desirable, although its use may be minimal if all maps are to be scanned or imported digitally from other systems. A 24-by-36 inch digitizer will accommodate most standard USGS quadrangles. Smaller digitizers can be used by not registering the whole map on the digitizer at at once (given the presence of sufficient internal registration tics), although this approach is less satisfactory for large and unwieldy maps. Digitizers up to 40-by-60 inches with back lighting are available. Digitizers can be used with UNIX workstations (attached to the serial port) or with terminals (accessing ARC/INFO hosts over a phone system, direct serial connection, or Ethernet), but will not work with terminal emulators. ARC/INFO works best with a 16-key digitizer puck. Instructions for connecting a GTCO Digipad digitizer to a Sun workstation are given in the Appendix of the ALACARTE Installation and System Manual. Procedures for other digitizers may be similar.

Terminal Emulators - Most emulators of Tektronix terminals work satisfactorily with ARC/INFO if properly configured, but a few issues should be mentioned. A terminal emulator must offer overlaid dialog and graphics to work properly with ALACARTE menus. On some emulators, the menus are transparent and allow the underlying map to show through the menu text. This can make the menus very difficult to read, especially when they are displayed over a busy map. ARC/INFO is designed to work with a three-button mouse in conjunction with the keyboard SHIFT and CONTROL keys, in order to permit entry of single-digit numbers. Be sure to determine how an emulator works with your particular mouse (which may have only one or two buttons), with mouse-buttons plus the SHIFT and CONTROL keys, or whether it requires keyboard entry of numbers.

X-Windows - X-Windows (X-server) software running on a PC, Macintosh or UNIX workstation gives you all the functionality of a terminal emulator plus the advantages of multiple windows, although there are some limitations. The systems must be connected over a network for satisfactory performance, whereas terminal emulators operate acceptably at 9600 baud over phone lines or serial cables. X-Windows can only be used to connect to an ARC/INFO host that also runs X-windows and for which an X version of ARC/INFO is available and installed. Prime computers and Sun systems running ARC/INFO 5.0.1 do not support X-Windows access. (ARC/INFO 6.0 does run under X-Windows on Suns). X-Windows must be carefully configured to work. This includes setting up permissions to authorize the ARC/INFO host to display graphics on your screen (xhost command), setting your environment to enable the host to send graphics to your workstation (setenv DISPLAY command), and installing the required X-Windows libraries properly. Additional setup may be required if you will access ARC/INFO from a machine of different architecture than the ARC/INFO host. For instance, accessing ARC/INFO on an Aviion from a Macintosh running Mac-X may require aliasing fonts and other procedures. Ask your system administrator for help.

UNIX Workstation - A typical configuration for a UNIX workstation running ARC/INFO would include:

Minimum processor speed of 16 MIPS;
Minimum of 16 MB memory, 32 MB better;
Large color monitor with excellent definition (cheap monitors may be hard to read);
Mouse;
Digitizer with 16-key puck, 24 by 36 inch size adequate for standard quadrangles (optional);
Printer, or access to one over a network;

Additional items (attached to a stand-alone workstation or available over a network) that are important to efficient operation include:

Minimum of 1.0 GB hard disk space (unless few or small maps are to be worked on);
Tape drive, either 150 MB cartridge or 8MM Exabyte, for backup and loading software;
CD-ROM drive for loading software and data.

NETWORKING

If you work in a networked environment, then a basic understanding of how a network affects your work is helpful. Networks are intended to be transparent to the user, but can be confusing at first. When one talks about networks and GIS, one generally means Ethernet running in a UNIX environment, although other types of computer systems have networking thatmay operate in a similar fashion. A simple example of network use is in printing from a computer in one room to a printer in another.

Another common network function is fileservice, making hard-disk storage on one machine accessible to other machines over the network. Any UNIX workstation is capable of providing fileservice, but larger systems (called fileservers) with many hard disks are more commonly used. Fileservice is provided by mounting a fileserver disk or portion of a disk onto your own system. You may not even know which of the directories on your machine are local and which are remote. You change to and use directories in the exact same manner, irrespective of their physical location. The UNIX df command will report your disk configuration (along with other information).

A further consideration is the system on which you actually run ARC/INFO and ALACARTE. If you have an ARC/INFO license on your workstation, then you start ARC from the system prompt of that machine. If you do not have a local license, then you must log in to the ARC/INFO host, probably your fileserver, in order to run ARC. You must be running X-Windows or a terminal emulator on your local machine for this type of access. Because map files can be physically located on any machine, it is possible to run ARC/INFO on a fileserver but access maps on your workstation's local hard disk. Or, more commonly, you may run ARC/INFO on your local workstation and access maps located on the central fileserver. If this is confusing, ask a knowledgable user to sit down with you as you experiment with logins, changing directories, and running ARC/INFO.

USING ARC/INFO REVISION 6.0

The use of ALACARTE with ARC/INFO 6.0 is still experimental and is not recommended for normal work. ALACARTE is designed to run under ARC/INFO Revision 5.0.1 and limited testing under the preview version of ARC/INFO 6.0 on a Sun workstation shows that there are some problems and limitations, although much of ALACARTE does operate properly. Close menus by clicking on the normal ALACARTE close menu items (for example, **^EDIT**, or **close menu**) not by pulling the menu push-pins. ALACARTE has no specific code for this function and pulling a pin may hang the menu. Some ALACARTE functions will not operate properly because of differences in syntax between Rev. 5.0.1 and 6.0. When an execution error is encountered, it can be difficult to determine whether ALACARTE is still running.

WORKSPACES AND MAP FILES

ALACARTE-ARC/INFO maps consist of one of more map layers (termed coverages in the ARC/INFO user manuals) that are organized into map directories called workspaces. Each map layer consists of two components in the workspace directory, the map-layer subdirectory, and the layer's database tables in the INFO subdirectory. These two components are managed as a single unit by the ALACARTE-ARC/INFO management commands (see below) and must never be manipulated directly with system file and directory commands.

The name of the subdirectory for a map layer is that of the layer itself, typically an abbreviated quadrangle or sheet name followed by a filename extension indicating the type of layer (see *Layers* in *Compiling a Digital Map*, p. 11, and *Steps in Preparing a Ma*p, p. 85). Several files containing map features and coordinates and one or more ALACARTE files are located in the map layer subdirectory. Attribute tables for all map layers in a given workspace are located under the single INFO directory within that workspace. These tables are used in many ALACARTE operations and can be directly accessible from the INFO command line. Most operations do not require direct use of INFO, however, and **users are cautioned that data files can be damaged easily**. A log file in each map-layer subdirectory records the ARC commands used on the layer and the dates of their execution.

All the layers for an individual quadrangle map should reside in the map's workspace. More than one version of each layer may be present as backups; these should be numbered consecutively and archived and/or killed as soon as they are no longer needed. Only a single ALACARTE-ARC/INFO user should work in a given workspace at a time or else serious problems can result, because INFO is a single-user system. A workspace log file records all ARC commands run on layers in the workspace. Related workspaces should be organized into map-sheet or project directories.

ARC/INFO always operates on a temporary copy of your map. Many temporary files are automatically created and deleted during the course of an ARC session. If ARC/INFO crashes, some of these files may be left behind. If you don't delete these files, you can try to recover the lost edits by running **restore an edit session** (on the Files pulldown from the General bar). Also, never delete temporary files from a workspace in which someone is working: it will crash their session! Temporary files can build up in a workspace over time, however, and should be deleted. Their names always begin with xx on UNIX systems, where they can be deleted with: *rm xx**. On Primes their names start with T$, and they are deleted with: *delete t$@@ -nvfy*. You can create a UNIX alias for deleting temporary files by adding the following line to the .cshrc file in your home directory:

```
alias purge     'rm xx*'
```

The corresponding abbreviation on a Prime is created by entering the following command:

```
ABBREV -ADD PURGE DELETE T$@@ -NVFY
```

Typing *purge* will then delete all temporary ARC/INFO files in the current workspace. If you abort ARC with the system break (CONTROL-C on UNIX systems or CONTROL-P on Primes), no temporary files are left behind and you cannot restore an ARC/EDIT session.

WORKSPACE MANAGEMENT MENUS

ALACARTE provides functions (on the Files pulldown from the General bar) for managing map layers and workspaces:

Copy — Use this function to copy a map layer into another workspace. Do not use the system copy command (cp on UNIX, COPY on Prime) to copy map layers because it does not copy all the components of a map layer.

Rename — Use this to rename a map layer. Do not use the system rename command (mv on UNIX, CNAME on Primos) because it does not rename all the components of a map layer.

Kill — Use this to delete a map layer from a workspace. Do not use the system delete command (rm on UNIX, DELETE on Primos) because it does not delete all the components of a map layer.

create workspace — This creates a new map workspace (directory).

rm -r (UNIX)
DELETE (Primos) — Use the system Delete Directory command to delete an entire workspace or an entire project directory; exercise caution, however, to ensure that you specify the correct directory and that all files have been properly archived first.

cp -r (UNIX)
copy (Primos) — Use the system Copy command to copy entire workspaces. Afterwards you must use the ARC Externalall command to reset some database pointers (see below).

externalall — This executes the ARC command to reset database pointers after a workspace has been moved, restored from tape, or copied across a network.

Copy ALC files — This copies ALACARTE files stored in a map layer subdirectory to another map layer. These are the files whose filenames end in .alc, and include the projection file(s), the setup file, and any custom tagging menus. This step may be necessary after executing certain ARC commands at the command line that create a modified copy of a map layer, but which do not properly copy the ALACARTE files. If you need to create a setup file for a map use **copy setup file** (on the Options pulldown from the Setup bar) or **use setup** (on the Save pulldown from the Edit bar).

Table 1. **Primos Quick Reference**

Logging in and out:

OK, login username	(OK, is Prime system prompt on most systems)
password? yourpassword	(your password is not displayed on screen)
OK, logout	

CONTROL-P	Break (if process hangs) Hold down Control key and press the p key
ice	Reset after crash, places you in home directory

Basics:

Primos is case insensitive (either caps or lowercase are ok). INFO is case sensitive, generally all caps.

Filenames are free-form (may include periods, underscores) but must start with a letter, not contain @ or % or =

Pathnames take the form: <disk>partition>userdirectory>subdir>.....>filename (<disk> may usually be omitted)

For example: <user3>gis3>tfjordan>arcmaps>worldmap

A pathname may be substituted below where ever filename appears.

When you log in you are placed in your user or home directory, tfjordan in the example above. You move to other directories with the following commands:

up	move up in directory structure	down dirname	move down to named directory
attach path	move directly to dir specified by path	or	places you back in your home or origin directory
ld	list directory	slist filename	list file to screen (screen list)
spool filename	print file to system printer		

create dirname	create subdirectory dirname
delete filename	delete file or subdirectory name (don't delete ARC/INFO maps this way; use the ARC KILL command, or see ALACARTE General menu)
cname old new	change directory name or file name from old to new (don't change the name of ARC/INFO maps this way; use the ARC RENAME command, or see ALACARTE General menu)
copy old new	copy file or directory old to path new (don't copy ARC/INFO maps this way; use the ARC COPY command, or see ALACARTE General menu)

@	wildcard, e.g., delete @.aml deletes mynew.aml but not my.new.aml	
@@	wildcard, e.g., delete @@.aml	deletes anything.aml including my.new_great.aml.
	delete @@ deletes *everything* in current directory	
	use delete t$@@ -nvfy	to delete all temporary ARC files w/o verify prompts
>==	means to retain original names, e.g., copy @@.aml gis3>tfjordan>newamls>== copies all amls in the current directory to the newamls dir keeping their original names	
*>	denotes current directory, so that copy help.txt *>helpdir>== copies help.txt file to a dir named helpdir in the current directory.	

help command	provides online help for command, for example: help slist

Table 2. **Emacs Prime Editor Quick Reference**

Emacs is a screen editor available on most Primes as well on many other systems. The minimal Emacs commands needed to create and edit files are given below. Ask your Prime system administrator if Emacs is available, if special abbreviations have been created to access it, and for more information on advanced Emacs commands.

Emacs is normally configured by the ALACARTE-ARC/INFO system administrator to be accessible from '**screen editor**' on the ALACARTE commands menu (which is displayed by clicking on the left-most item on any ALACARTE bar menu). Emacs commands may be entered in either upper or lower case.

emacs filename -ttp vt100	filename may be new or existing. -ttp vt100 specifies a vt100 terminal (typical specification for Tektronix graphics terminals. See your system administrator for specific Emacs terminal information).
CONTROL-L	redisplay text. If you are using a Tek terminal and you get gibberish the terminal is probably not in ANSI (text) mode. Press the SETUP key on the terminal, type CODE ANSI, press the SETUP key again, then press CONTROL-L to redisplay the text. The text should now be displayed normally.
	Once emacs has started up you may simply start typing.
arrow keys	position cursor with the terminal arrow keys or, if these don't work on your terminal, use:

CONTROL-Z	up	CONTROL-N	down
CONTROL-B	left	CONTROL-F	right

CONTROL-A	move cursor to beginning of current line
CONTROL-E	move cursor to end of current line
CONTROL-V	move down one screen
Esc V	move up one screen. Press the Escape key, release it, and then press V.
BACKSPACE	delete character to the left of the cursor
CONTROL-D	delete character at the cursor
CONTROL-K	delete (kill) current line
CONTROL-X S	save and exit Emacs. Hold down the CONTROL key and press X, release both and then press the S key.
CONTROL-X CONTROL-C	quit Emacs without saving First enter CONTROL-X (hold down the CONTROL key and press X) and then enter CONTROL-C.

Table 3. **UNIX Quick Reference**

Logging in:

login: username	
password: yourpasswd	Your password is not displayed on the screen.
%	% is the standard UNIX csh (c-shell) prompt. (Note, ARC must be run in csh)

Logging out:

%CONTROL-d	Hold down Control key and press the d key, or
%logout	Some systems require typing logout rather than CONTROL-d, or
%exit	exit always works as logout command.

CONTROL-c Break (if process hangs). Hold down Control key and press c-key

UNIX is case sensitive. Almost all commands are lower case. UNIX comes in two flavors, BSD or Berkeley UNIX (Suns) and AT&T UNIX (Aviions). The commands given here work on both except as noted.

Filenames are free-form but shouldn't contain special UNIX characters. Recommend sticking to upper and lower case letters, numbers, period, underscore.

Note: The names of ARC/INFO coverages, workspaces and AML's must be lower case. They may be given in either upper or lower case from within ARC/INFO as ARC performs case conversion for you. INFO itself is case sensitive such that INFO filenames are generally all caps.

Pathnames take the form: /home/tfitz/arcstuff/mycoverage, where the first / refers to the root or top level directory. A pathname may be substituted below where ever filename appears.

When you login you are placed in your user or home directory, tfitz in the example above.

cd /home/pst/mydir	change directory to mydir specified with absolute pathname from the root dir /
cd dirname	change directory to a subdirectory in my current directory
cd	change to my home (login) directory
cd .. cd ../..	go up one directory, go up two directories
ls (ls -c) ls -l	list directory contents BSD UNIX (AT&T UNIX), long listing (both UNIX flavors)
pwd	display name of current directory (**p**rint **w**orking **d**irectory)
more	list contents of text file page-by-page to screen, advance with spacebar or Return, q to quit
lpr filename	print file to lineprinter
mkdir dirname	create subdirectory dirname in current directory
rm filename	delete file filename
rm -r dirname	delete directory dirname (don't delete ARC/INFO maps this way; use the ARC KILL command, or see ALACARTE General menu)
mv oldname newname	change name of file or directory or move it to new directory if different directory is specified with newname e.g. mv olddir /home/myname/newdir (don't change the name of ARC/INFO maps this way; use the ARC RENAME command, or see ALACARTE General menu)
cp oldname newname	copy file oldname to newname. May include complete pathname
cp -r olddir newdir	copy directory oldir to newdir. (don't copy ARC/INFO maps this way; use the ARC COPY command, or see ALACARTE General menu)
passwd	change your password
*	wildcard for filenames, e.g. *.* *.aml *
?	wildcard for character in filename, e.g. cov? could refer to cov1, cov2, etc.
man command	where command is any UNIX command. UNIX help. man ls gives help page on the ls command.

Table 4. **vi UNIX Editor Quick Reference**

vi is the standard UNIX screen editor (pronounced vee-eye; stands for **vi**sual editor), equivalent to Emacs on many other systems. It may be complex if used to its fullest extent, therefore recommend that you restrict yourself to these minimal commands at first. If you are using a workstation console you should have access to a mouse-driven window-based editor; if so, use it!

vi is normally configured by the ALACARTE-ARC/INFO system administrator to be accessible from **screen editor** on the ALACARTE Commands menu (which is displayed by clicking on the left-most item on any ALACARTE bar menu).

vi filename	filename may be new or existing. You are placed in "command" mode
arrow keys	when in command mode position cursor with the terminal arrow keys or, if these don't work on your terminal, use:

k	up	j	down
l	left	h	right

i	insert text starting *at* cursor location. I.e. press i and start typing.
	or
a	appends *after* current cursor position.
Esc	escape key to end insert mode and return to command mode
x	in command mode, deletes character under cursor
dd	in command mode, deletes current line
:	colon in command mode moves you to command line at bottom of screen with colon prompt for file manipulation commands:

:wq	write file and quit vi
:w	write file and continue
:w filename	write file to existing or new filename
:q	quit vi after saving edits
:q!	quit and do not save edits

You are returned to command mode following each file manipulation command (unless the quit command is given).

Summary:

Start vi with specified file

You are now in command mode. Position cursor, delete characters or lines, etc.

Insert or append once you have positioned cursor. Terminate insertion and return to command mode with Esc

Press colon when in command mode in order to save and exit, quit without save or perform other file manipulation operations.

Remember, there are many more commands and some people *actually like vi*!?!

Starting ALACARTE

You are ready to start ALACARTE once you have a terminal from which to work, have access to ARC/INFO and ALACARTE on the host computer, know how to log in and move through the directory structure, and know how to leave the host computer and close down your machine.

Begin by turning on your machine (start your terminal emulator) and calling the host computer. Log in to the account containing your map directory and go down to the directory containing the map that you want to work on. For your first exploration of ALACARTE, use the demonstration directory called Tour. Just how you perform these operations depends on your particular system (see *System Details*, p. 35) and will require information from a colleague or the system administrator. If no Tour directory is available, begin in your home directory and copy the Tour directory into it, as described at the end of this section.

Start ALACARTE from the system prompt by typing *arc* <space> *alacarte* followed by a carriage return (<return>):

systemprompt: *arc alacarte*

This command starts ARC/INFO and ALACARTE together and assures that when you quit ALACARTE you will be returned to the system prompt in your host computer. There may be other commands available in your system to start these programs (such as an abbreviation), but this method should always work.

SETTING THE DEVICES

Once ALACARTE has started, the first step is to tell it how to communicate with your machine. Later you can save a station file to provide this information, but initially you must specify the various devices and settings individually, using both the keyboard and some popup menus (see *Using the Menus* p. 59).

After the version of ALACARTE that you are running is reported, you will be asked if you want to specify a station file by which you can describe your equipment and desired settings automatically for ALACARTE:

Enter station name, if any, (do not include the stat prefix),
<RETURN> = NONE, ? = list, q=quit:

If you have already saved a station file, or if there is a standard one for the station at which you are working, enter the name of the station file here (that is, type in the name and hit <Return>). ALACARTE will bypass the Devices sequence, characterize your station automatically, and then display the first bar menu (Alacarte). If you can't remember the name of the station file that you want, enter `?` to list the custom station files in the current directory and the standard files in the ARC/INFO stations directory. The latter contains such standard stations as 4207 (for a Tektronix 4207 or equivalent) and 9999 (Unix workstation). ALACARTE searches for the station file first in the current directory and, if it is not found there, looks for a standard file of the same name. If the station file is not found, the Devices sequence starts automatically.

If you don't want to specify a station file, simply hit <Return> at the station prompt to start the Devices sequence. ALACARTE will ask you a series of questions about the devices that constitute your station. These must be specified before you can reach the first bar menu in ALACARTE, but they can also be changed later from within ALACARTE.

First, what kind of terminal are you using?

Please enter your terminal type, <RETURN> = 4207, h = HELP:

Enter the code for your terminal (table 5) or use the default (<return>) to specify 4207, indicating a Tektronix 4207 terminal or equivalent. ARC/INFO and ALACARTE support many terminals (and

Table 5. Graphics terminals/displays supported by ALACARTE

Terminal	Description
100	Selanar HiREZ 100XL
220	DEC VT220 with Selanar SG220 Graphics Board
250	GraphOn GQ-250
550	Visual 550
4105	Tektronix 4105
4107	Tektronix 4107
4109	Tektronix 4109
4111	Tektronix 4111
4125	Tektronix 4125 Note: Only newer or enhanced 4125 terminals are supported. See ARC/INFO release notes for details.
4205	Tektronix 4205
4207	Tektronix 4207
4208	Tektronix 4208
4208BW	Tektronix 4208 with menus in B&W instead of blue and white
4209	Tektronix 4209
4211	Tektronix 4211
4224	Tektronix 4224
4225	Tektronix 4225
4235	Tektronix 4235
4236	Tektronix 4236
4237	Tektronix 4237
4324	Tektronix 4324
4325	Tektronix 4325
4335	Tektronix 4335
4336	Tektronix 4336
4337	Tektronix 4337
TGRAF07	IBM PC or Mac using Tgraf07 or TNet07 4107 emulator
Versaterm or v	Apple Macintosh using VersaTerm Pro 4105 emulator
9999 or WS	Any UNIX workstation (e.g., Sun, DG, Tektronix, X-Terminal)
OTHER	Terminal/display device other than above

emulators) that permit display of menus and color graphics. Enter *h* (for help) to list both the supported terminals and the codes with which to specify them at this prompt. Because ALACARTE tailors the sequence of device questions to the responses, some of the following details are specific to this first response (here assumed to be *4207*).

How do you want to pick menu items from the screen?

Using one of the devices listed below, you will move a cursor (crosshairs) on the screen until it is positioned over the menu item and then click with a mouse button or the space bar. This question asks you to specify which device you will use:

Enter device used to pick menu items: m, c, or t
M(mouse), C(ursor, = joydisk), or T(ablet, = Tek 4957), <RETURN> = mouse:

To answer, enter the appropriate letter code (*m,c,* or *t*), or just hit the return key to pick the default. Because the best choice for a Tektronix 4207 is the mouse, that is offered here as the default.

The system now has enough information to present menus on your screen. From here on, any question for which the possible answers can be anticipated will be asked in the form of a menu.

What kind of digitizer are you going to use, if any?

Choose your digitizer type	- Pick your digitizer or pick **NONE.**
NONE	- pick **NONE** where no digitizer will be used in the session.
Altek AC90C/40C	
Digicon (metal puck)	
GTCO Digipad 5	
HI HIPAD	
" 1 button cursor	
Summagr. Bit-Pad 2	
" 1 button cursor	
Summagr. ID-2	
Talos/CalComp 600	
Talos/CalComp 2000	
Talos/CalComp 8000	
Talos/CalComp 9000	
Talos/CalComp 9100	
Talos/CalComp dual	
Talos/CalComp Wedge	
Tek 4957 + 4208	
Tek 4958	
Tek IGL LOCATE	
OTHER	- enter digitizer type (no validation by ALACARTE).
HELP	

If you won't be using a digitizer at all in this session, but instead plan to work entirely on the screen, answer **NONE**. Do this by moving the cursor (cross hairs) that has now appeared on your screen over the appropriate word(s) on the menu and then clicking with the left mouse button (or with the space bar, if you have no mouse). If you want to work partly on the screen and partly from a digitizer, you can specify the digitizer here or do so later from the Devices bar.

If you do indicate a digitizer, you will be asked how the digitizer is connected (the number or name of the serial port); pick **0** unless your system administrator has indicated otherwise:

Choose digitizer tty line	
0 (typical)	- usually the correct line.
OTHER	- specify digitizer tty line from the keyboard.
UNKNOWN	- close the menu with no tty line specified.
HELP	

On UNIX workstations this may be a serial-port device such as */dev/ttyb* (pick **OTHER** and enter at the prompt).

How do you want to specify map locations (map coordinates):

Pick coordinate input method	
mouse	- preferred method to control on-screen crosshairs.
cursor	- use where mouse is not available.
digitizer	- pick only for input from a digitizer.
keyboard (coords typed in)	- not installed in version 1.0 of ALACARTE.
tablet	- Tektronix digitizer tablet or equivalent.

The method used to specify map locations need not be the same as that used to pick menu items. And even if you have specified a digitizer, you can select **mouse** as the input device here, and change to digitizer input later (using **change coord device** on any Options pulldown or on the Map pulldown from the Edit bar). This question is tailored to earlier responses. For working with a 4207, **mouse** is the best choice. If you had specified a 4107 initially, the mouse option would be omitted here because the 4107 has no mouse.

Once the devices are specified, you are presented with the Alacarte menu bar, from which you can proceed to whatever part of ALACARTE that you want to use. (For a description of how to leave ALACARTE, see *How to Quit*, p. 15).

Copy the Tour Directory

If you want to copy the example Tour directory into your current directory, proceed as if you were going to run the ALACARTE demonstration. Open the Commands menu from the ALACARTE bar (click on the bar name, **[Alacarte]**) and pick **alacarte demo** from that menu to open the Demonstration forms menu. Pick the Copy Tour button in the forms menu:

copy tour directory to current directory: copy tour

The Tour directory will be copied from the ALACARTE directory into your current directory and this new directory will become the current workspace. You can then start the Demonstration or close the forms menu (**cancel**) and experiment with ALACARTE directly.

CHANGING THE DEVICES

The device settings can be changed within Alacarte at any time. You can change the coordinate input device from on-screen crosshairs to a digitizer or from the digitizer back to the screen from any Op-

tions pulldown in the Edit section. Simply open the pulldown (click **Op** on the bar), pick **change coord device**, and then pick the new device from the Coordinate Device menu that follows.

Any of the devices can be changed from the Devices bar, which is reached from any Commands popup menu. Open a Commands popup by picking the bar name (menu item at far left on every bar), pick **DEVICES** from the popup to go to the Devices bar, then pick **Devices** to open the Devices pulldown. The relevant parts of this menu are:

show devices	- list the current device settings.
station	- reset devices to those previously saved as a station file**.**
save station	(described below in *Saving a Station File*)
terminal	- specify a terminal type**.**
display:	
set to term	- set display device to match the presently specified terminal.
other display	- specify a display device name and a display option if desired.
digitizer	- specify digitizer from popup menu (or enter from **other**).
coord device	- pick method of entering map coordinates from popup menu**.**
fastmouse	- make crosshairs more responsive to mouse movements (terminals only).
fastdisk	- make crosshairs more responsive to joydisk movements (terminals only).

From this menu you can list the current device settings, reset the devices with a station file, or make individual changes in the devices. These individual options are like those already described under *Setting the Devices* (p. 46), except that Terminal and Display are separated. When you set the terminal in the Devices start-up sequence, the display is automatically set to match. Here, in contrast, you must set both the terminal (which controls presentation of menus) and the display (which controls presentation of graphics): after setting the terminal, use **set to term** to make the display match the current terminal setting, and use **other display** to set the display in some other fashion. This alternative may be desirable, for example, to improve the performance of some emulators or to avoid opening the graphics window in Edit on workstations (enter *0* as the display number). Such special settings can be saved in a station file for repeated use (see below).

The speed at which the crosshairs move on the screen of a Tektronix terminal can be increased for more efficient work: use **fastmouse** for terminals with a mouse and **fastdisk** for a 4107 or other terminal with a joydisk.

SAVING A STATION FILE

The current device settings in ALACARTE can be saved as a station file from the Devices bar. Pick **save station** from the Devices pulldown and then enter a name for the station file at the prompt in the dialog area. Keep the name short, simple, and specific. The station file is saved in the current directory, which means that you must be in that directory in order to use it. To change a station file, simply overwrite it by saving new settings with the same file name.

Use such a station file to set the devices automatically. This can be done at the station prompt that is presented when you first start ALACARTE or at any time from the Devices bar. Although the name of the station file will have been recorded with a standard prefix (stat_ or stat-) that will be included in the name if you list it, omit that prefix when you enter the file name at the station prompt.

Features of Maps

ALACARTE maps are composed of three principal kinds of features -- lines, areas (polygons), and points -- that are separately entered and recorded in ALACARTE - ARC/INFO. Each map element is uniquely identified in the database by number and its position is recorded with x,y values in the coordinate system of the map. Essentially unlimited information can be attached to each map element, although the content of the primary database should be limited to speed processing. The elements recorded in the map database serve in effect as cartographic templates to which symbols are assigned at the time of on-screen display or plotting. Map-face text (annotation) can also be included, but without database attributes, and uniquely numbered digital tics provide the initial geographic registration.

Elements can be entered in the map database directly by digitizing on the screen or from a digitizer. ALACARTE supports the concurrent tagging (attributing) of the elements according to the current [line, area, point] type, which is set by picking from menus or by entering from the keyboard. Existing elements can be selected on screen or from the digitizer and then tagged (or retagged) and can be selected according to the recorded tag. Polygons are identified in Edit by their label points, although the Select Outline function can be used to select closed polygon boundaries. Lines can be entered by importing scans to be edited and tagged, and all three types of elements can be imported as digital files from other systems, including tabular text files that include location (x,y).

Data associated with selected elements can be entered, viewed, or modified in the database form once the needed database items (fields) have been established.

Annotation can be entered from either the screen or a digitizer or can be created from entries in a database item. Like digital tics, annotation cannot have information attached to it in the database.

TICS

Digital tics provide the geographic registration for a map. They can be assigned geographic locations automatically when a map is started from the Setup bar or individually by working directly in INFO. Tics are automatically placed at arbitrary locations in imported scans during conversion into ARC/INFO. These tics are then moved on screen by hand to the location of graphic registration marks in the scan to control transformation of the scan into a framework of projected tics (see *Map Registration*, p. 115, and *Projections*, p. 101).

A minimum of four digital tics is needed in a map. When a regular quadrangle is started from the Setup bar (see *Start a New Map or Layer*, p. 93), ALACARTE automatically generates digital tics at the four map corners once you have specified the latitude and longitude of the southeastern corner. These tics are numbered clockwise from that specified corner. Internal tics can also be included automatically as an option (see *Projections*, p. 101, for numbering scheme). The tic framework of an existing map can be copied to form the framework of a new layer.

Digital tics can be added to a map (digitized), selected, deleted, moved, and renumbered. The tic number ($ID number) is the only information other than location that can be assigned to a tic. Because ARC/INFO will not tolerate duplicate tic numbers in a map, adding tics with duplicate numbers to a map (by digitizing, for example) will delete the existing tics with those numbers.

LINES

Line segments (termed *arcs*) are defined by a series of points with x,y locations that are connected by straight lines (*vectors*). These control points are termed *vertices*; the vertices at the beginning and end of each line segment are termed *nodes*. Nodes are automatically placed at line intersections by ARC/INFO, and otherwise continuous lines (no intersections) can be broken with *pseudonodes* to mark changes in attribute, such as line type (contact or fault, for example). Hanging nodes at unconnected ends of lines are termed *dangles*. Lines have a direction and therefore a right and left side, which are used in maintaining topologic relations in the database and in plotting such asymmetric line symbols as queries and thrust teeth. All line segments are continuous in the database, regardless of the intended line symbol, which is a graphic aspect addressed at the time of plotting.

Lines can be entered by hand digitizing or by importing scanned line work and editing on screen. Lines are tagged automatically during digitizing or during hand editing by applying the current line type, which can be set from standard or custom menus or from the keyboard. The shape and position of lines can be modified in a variety of ways (working from the Reshape bar), both internally by redefining vertices and externally by moving or rotating one or more line segments together. Individual line segments can be split and segments that are joined at pseudonodes can be combined. Arcs are limited to a maximum of 500 vertices. ARC/INFO will refuse to combine two arcs having more than 500 vertices and in digitizing creates a pseudonode at 500 vertices and automatically starts a new arc.

The database for lines (*arc attribute table*, or *AAT*), automatically records the following information:

fnode#	- identity of the *from* node (beginning of line).
tnode#	- identity of the *to* node (end of line).
lpoly#	- identity of the polygon to the left of the line.
rpoly#	- identity of the polygon to the right of the line.
length	- length of the line in map units.
[map name]#	- unique internal number assigned automatically by ARC/INFO.
[map name]-ID	- user ID number (= $ID), assigned by ARC/INFO or controlled by user.

Additional database items typically added in ALACARTE include:

LTYPE	- line-type tag recorded by ALACARTE.
SEL	- item used to save a selected set.
SYMB	- item used to save symbol assignments (such as color).

LTYPE is the default item in which the line tag is recorded by ALACARTE. LTYPE is automatically added to the AAT for the map when it is started in Setup and lines are specified or when a scan is prepared there for lines, and it and any other item can be added to a map database (to the AAT). SEL and SYMB can be added automatically during setup or separately later. The lines database can be viewed on screen and entries can be viewed or modified from the database form.

Plotting symbols for lines are of two principal types: (1) the simple, continuous lines used on screen for editing, to which colors can be assigned and saved for restoration after saving or in a new edit session, and (2) standard geologic line symbols that are assigned as a function of line type for hard-

copy plotting (see *Symbols*, p. 197). These geologic line symbols are not generally used on screen in editing (but see the first color frame in the ALACARTE demonstration). They maintain a constant size in both on-screen and hard-copy plotting, regardless of the scale of presentation.

POLYGONS

A polygon consists of a closed figure of lines and is identified by a label point located within that closed perimeter. Polygons are created initially by entering the lines that form their perimeters, but are not recognized by ARC/INFO until a processing step (Build or Clean) has been run for polygons. The perimeters of individual polygons (including internal boundaries, or "island" polygons) are limited to 10,000 arcs. Exceeding this limit around the boundary of any one polygon in a map can block the use of such bulk processes as Build.

The ends of line segments that constitute the perimeter of a polygon must close precisely. If the perimeter is even minutely incomplete, ARC/INFO will not recognize it as a separate polygon. Closure can be accomplished during digitizing by setting the snapping properly (see *Snapping and Other Controls*, p. 123) and taking care in placing the ends of lines. Small gaps in existing lines can be closed by hand editing or in bulk process (see *Edit Lines*, p. 135). It can be difficult to assure during line editing that all polygon boundaries are closed, particularly in complex maps, but several methods are available to find and fix broken boundaries later during polygon editing (see *Check Labels, p. 165*, and *Edit Polygons*, p. 171).

Label points for polygons can be entered from the screen or from an annotated plot or an original mounted on a digitizer. During digitizing, the label points are tagged automatically with the current area type, which can be set from the keyboard or by picking from a custom menu of map units (see *Digitize and Tag*, p. 162). Alternatively, the Createlabels function can be used to place a label automatically at the centroid of each valid polygon, and these labels can then be selected on screen and tagged (see *Tag Existing Labels*, p. 164). Once present, label points can be selected and retagged, moved, or deleted.

The database for polygons (*polygon attribute table*, or *PAT*), automatically records the following information:

area	- area of the polygon in square map units
perimeter	- length of the perimeter of the polygon in map units
[map name]#	- unique internal number assigned automatically by ARC/INFO.
[map name]-ID	- user ID number (= $ID), assigned by ARC/INFO or controlled by user.

Additional database items typically added in ALACARTE:

PTYPE	- area-type tag (polygon type) recorded by ALACARTE.
SEL	- item used to save a selected set.
SYMB	- item used to save symbol assignments (such as color).

PTYPE is the default item in which the area tag is recorded by ALACARTE. It is automatically added to the PAT for the map when it is started in Setup and polygons are specified or when a scan is prepared there for units, and it and any other item can be added to a map database (to the PAT). SEL

and SYMB can be added automatically during setup or separately later. The polygon database can be viewed on screen and entries can be viewed or modified from the database form.

Polygons in maps that have been built and not further edited can be filled on screen with solid colors and a limited set of colored lines as a function of area type. The label points can be assigned a variety of colored symbols that can be saved for restoration after saving or in a new edit session. In hard-copy plotting, possible area fills are limited only by the plotting device, except that only a small variety of overprints (shadeset patterns) are available in ARC 5.0.1.

POINTS

Points are defined by an x,y position on the map and are entered by clicking the position on the screen or digitizer or by importing a tabular list that includes x,y locations. Points can represent simple points (such as sample localities) or the position of such oriented features as bedding or lineation. These features can be planar (type, strike, and dip), linear (type, azimuth, and plunge), or such oriented relations as strike-slip arrows or bar and ball on a fault (type, orientation). Symbols and their orientations are specified for plotting as a function of these recorded data.

The database format for points is the same as that for polygons, but the PAT here is a point attribute table. Because the same attribute table is used, points and polygons cannot exist together in the same map layer (in ARC 5.0.1). The data automatically recorded for points are limited to the identification numbers:

area	- not applicable to points (always 0).
perimeter	- not applicable to points (always 0).
[map name]#	- unique internal number assigned automatically by ARC/INFO.
[map name]-ID	- user ID number (= $ID), assigned by ARC/INFO or controlled by user.

Additional database items typically added in ALACARTE:

PTTYPE	- point-type tag or type of oriented feature recorded by ALACARTE.
SAMPNO	- standard item for recording sample number.
STRIKE	- azimuth of oriented symbol.
DIP	- plunge or dip of linear or planar feature.
SEL	- item used to save a selected set.
SYMB	- item used to save symbol assignments (such as color).

PTTYPE is the default item in which the basic point tag is recorded by ALACARTE. It is automatically added to the PAT for the map when it is started in Setup and points are specified or where a scan is prepared there for point data, and it and any other item can be added to a map database (to the PAT). SAMPNO is the default item used by ALACARTE to record sample numbers for the Sample Number routine, and STRIKE and DIP are the items used to store azimuth and dip or plunge for structural orientations. The points database can be viewed on screen and entries can be viewed or modified from the database form.

A varied set of standard geologic symbols for both points and oriented symbols is available for on-

screen and hard-copy plotting (see *Symbols*, p. 197). Markerset ALCWRG.MRK is used by ALACARTE for displaying such oriented data as bedding attitudes and lineations during on-screen digitizing and editing. The symbol is assigned as a function of point type and is oriented according to recorded azimuth with the dip or plunge posted automatically as annotation. These symbols maintain a constant size in both on-screen and hard-copy plotting, regardless of the scale of presentation. A double size (2X) set of point symbols is also available (see *Set the Symbol Environment*, p. 180).

ANNOTATION

Map-face annotation (text) is entered from the keyboard at a prompt, entry by entry, and is placed on the map by a variety of methods. It can also be created automatically from database entries and then edited if desired. Annotation can be placed on the map as part of any map layer or in a separate annotation layer. The database content for annotation that has been entered directly is simply the annotation itself; there is no attribute table for annotation in which further information can be stored.

Annotation is entered and then placed on the map on screen (or from the digitizer) extending from an initial clickpoint along a specified straight or curved line at any angle on the map, or along or offset from an existing line in the map. Once entered, annotation can be repositioned and resized on the screen. The height of the text characters is expressed in map units and the characters scale with the map on the screen as display scale is changed with the Zoom functions. Although each map layer in ARC/INFO can have as many as ten separate *levels* of annotation, ALACARTE routinely uses only level 1.

Various IGL fonts are available in version 5.0.1 of ARC (see *Appendix B, Fonts*, in *ARC/INFO Symbols* of the *ARC/INFO Users Guide*) that are scalable and can be drawn or plotted in color. Combinations of font, color, size, slant, and letter spacing can be established in the Font Editor (on the Symbol Editors pulldown from the General bar) and saved as symbols in a text set that can then be used for on-screen or hard-copy plotting. The annotation used by ALACARTE (unless reset) is textset PLOTTER.TXT, symbol 0, in which the characters are easily read and quickly drawn on the screen. Annotation can be entered and displayed on the screen with this default set of characters and can then be converted to another font, size, etc., for final screen editing and/or plotting.

DATABASE ITEMS

The database for a map layer includes an attribute table for each kind of feature in the layer (arc attribute table for lines - AAT; polygon or point attribute table for polygons or points - PAT). These tables contain various fields (*items*), in which information about the individual map elements is stored (see *Features of Maps*, p. 51). Each map element is uniquely identified by the #ID number, which is assigned by ARC/INFO and cannot be modified by the user. The values of some other items (such as line length) are determined automatically from map relations. The attribute tables and these automatic entries are recreated for the specified feature type each time the map is built (or cleaned) for that feature.

Other items can be added to the attribute tables to record additional information. Standard items used in ALACARTE include LTYPE, PTYPE, and PTTYPE, in which the feature tag is recorded, and DIP, STRIKE, and SAMPNO for various kinds of points. The items for feature tags are added automatically to the database for maps that are begun in Setup, and any of these standard database items can be

added automatically with functions available on the Files pulldown from the General bar, once the map layer has been built (or Cleaned) for the feature type.

Custom items can be added as well. Be sure the map has been built (or cleaned) for the feature type, then use the Add Items forms menu to add the desired item (pick **Add item** on the Files pulldown from the General bar):

Additem - add item to Info file

<in file> . . . . . .
<out file> . . . . . .
<item name> . . . . . .
<item width> . . . . . .
<output width>. . . . . .
<item type> . .
{decimals} # . .
{start item} . . . . . .

OK HELP CANCEL

Fill in the blanks in the form:

<in file> - the name of the file to which the item should be added: call the Map Names popup (use ? or click the middle mouse button in the blank) and pick the file name that consists of the map name followed by the extension .AAT or .PAT, depending on the type of feature involved.

<out file> - same as the in file; this will be entered automatically.

<item name> - enter a name for the item; make it distinctive and keep it short (no more than 8 characters).

<item width> - enter the maximum item width (number of digits or characters).

<output width> - same as item width.

<item type> - kind of item; open a subordinate menu (*?* or middle mouse button) from which to pick:

- I - ASCII integer.
- B - binary integer.
- F - binary floating point number.
- N - ASCII floating point number.
- C - ASCII character string.
- D - date, stored as YYYYMMDD, but retrievable in various forms.

{decimals} - number of decimal places to be maintained for floating point numbers.

{start item} - existing item after which new item is to be placed (default is to place it last).

When you are satisfied with the form, click **OK** to activate the function and add the specified item to the specified attribute table.

TOPOLOGY

The spatial topology of a map is maintained by ARC/INFO through the operation of the Clean and Build functions. In its complete form, the map topology consists of (1) the identity and length of lines (arcs) and the identity of their *from* and *to* nodes (which define the direction of lines and their left and

right sides), (2) the identity of nodes and of the lines connected to them, (3) the identity of polygons, the identifying label points within them, and the lines that bound and define them, and (4) the identity of the polygons that adjoin lines on their left and right sides.

This topologic information is stored in the files that form the map database (arc attribute table, polygon attribute table, and others) and is established and revised through the operation of the Build and Clean functions on arcs and labels. Both functions analyze topology; the Clean function also adds nodes at intersections and can delete dangles and simplify a map to a specified resolution (through application of the Fuzzy tolerance).

The sequence of operations recommended for ALACARTE maps herein will produce and maintain well-defined spatial topology. Modification of the database files for a map directly from the INFO command line can introduce problems that ALACARTE cannot address. **DO NOT work on an ALACARTE map from the INFO command line** unless you fully understand what you are doing.

Build

The build function establishes or revises map topology and the associated databases, but cannot create nodes at intersections where unsplit lines cross. Use Build to create a database for a map with points, lines, or polygons (ALACARTE does this automatically for maps started or processed from the Setup bar), and to revise polygon topology as you label and edit the polygon layer of a map. Use Clean, instead, if you know that you have added crossing lines while Intersectarcs was turned off, or if a Build fails because it detects an intersection:

```
An intersection was detected while building polygons
[reports coordinates]
Use CLEAN instead of BUILD or alter the fuzzy tolerance if using CLEAN.
Bailing out of BUILD
```

Open the Build menu (pick **Build** on the Topology pulldown from the General bar):

Build - build topology and feature attributes

<input coverage> */REDHOME/CWENT/TOUR/TEST.LN*
{output coverage}
{POLY | LINE | POINT} *POLY . . .*

ok help cancel

Specify the layer to be built (input coverage: list with *?* or middle mouseclick in blank and pick from the list). Enter the name of a new version for the output map or omit an output name to build back into the input map. Building into the same map is generally harmless, but follow the general safety rule of moving to a new version of a map after every major increment of work. The default feature type in the menu is polygon, because with ALACARTE maps your principal use of Build will be to revise polygon topology as you are tagging polygons. Change to another feature type if appropriate.

Clean

The Clean function performs the same topologic processing as Build after first creating any needed

intersections and, if specified, deleting all dangles less than the indicated dangle length and simplifying coordinate geometry according to the resolution indicated by the Fuzzy tolerance. Clean is thus a more complex function than Build, takes longer to run, and can impose significant changes in a map. Use Clean when you first prepare a lines layer for polygons, and thereafter only if required because Build fails after detecting an intersection.

Open the Clean menu (pick **Clean** on the Topology pulldown from the General bar):

Clean - intersect arcs and build topology. # indicates use of default tolerance value. Tolerance values are in map units, typically meters.

input map	*/REDHOME/CWENT/TOUR/TEST.LN . .*	
output map	*test.py . .*	
{dangle length}	*0 . . . . . .*	**The default value (#) is read from the map's TOL file if it exists. Otherwise it is 0.**
{fuzzy tolerance}	*.001 . . . .*	**The default value (#) is read from the map's TOL file if it exists. Otherwise it is .002 if width of BND is between 1 and t00, else it is the width of BND / 10,000.**
{POLY | LINE}	*POLY . .*	

ok help show default tols cancel

Specify the layer to be cleaned (input map: list with *?* or middle mouseclick in the blank and pick from the list). You must also specify a new output map. It is not wise to Clean back into the input map (and ALACARTE will not permit it), because a failure in cleaning can destroy the map. Accept the 0 dangle length or change it to a larger value for specific purposes (in map units, typically meters for ALACARTE maps). Leave the Fuzzy tolerance at .001 map units or change it for specific purposes. You can also set a dangle length and fuzzy tolerance for the Setup file (TOL file) at the time you first start a map and then invoke these default values by entering # in the menu blanks here. Use **show default tols** to check that such default values are available and what they are. Clean will fail if there is insufficient disk space or if the map contains a polygon boundary with more than 10,000 arcs.

The dangle option in Clean permits the automatic deletion of all dangles (lines with at least one unconnected end) that are shorter than the specified dangle length. This option can be used to advantage to remove very small dangles, but care is warranted because many valid lines in a geologic map are dangles. ALACARTE automatically sets the dangle length to 0 in the form, but this can be changed.

The fuzzy tolerance defines a resolution that Clean applies to x,y coordinates throughout the map. Coordinates spaced closer than this distance are combined, a process that can remove tiny polygons (including slivers) and arcs and will thin out the vertices and nodes along lines. This simplification leads to movement of elements in the map. Keep the fuzzy tolerance as small a possible, but no smaller than .0001 (map units), because otherwise ARC/INFO will revert to the value in the map TOL file or to the standard defaults described on the Clean menu. ALACARTE sets the fuzzy tolerance to .001 as a compromise between a very small value and the longer processing time required by even smaller values.

ALACARTE Operations

A number of operations are basic to the use of ALACARTE. These include using the different kinds of menus, manipulating the display of a map on the screen, specifying (selecting) map elements on which to operate, and saving your work.

USING THE MENUS

To the user, ALACARTE consists of a suite of menus from which items can be picked both to move around in the menu structure and to drive ARC/INFO to work with maps. The main framework consists of a hierarchical series of bar menus organized according to different kinds of map operations fig. 4, p. 205). Each bar offers access to other menus and to various ALACARTE functions. The organization of the menus and a listing and brief description of each bar and pulldown menu item in ALACARTE is given in *Structure and Functions* (p. 203).

Several different kinds of menus are used. Three, the bar, pulldown, and popup menus, offer a variety of menu items that can be picked by clicking on them (move the crosshairs over the item and click with mouse key or space bar). On these menus the kind of operation produced by a menu item is indicated by its capitalization: menu items all in **CAPITAL LETTERS** take you to other bar menus, those with only **Initial Capitals** open popup or pulldown menus that close and return control to the current bar menu, and those all in **lower case** letters perform an action (typically on the edit map in the foreground) and then return control to the current bar menu.

Another type of menu, the forms menu, is used for database input and modification and for ALACARTE functions that require the specification of input and output maps, tolerances, options, and other variables. Blanks are provided into which information can be entered, or in some cases inserted by picking from subordinate menus.

The final type of menu, the key menu, is presented as part of certain basic ARC/INFO routines. Key menus offer various options that are selected by entering their associated numbers from the keyboard or the mouse.

ALACARTE also presents some kinds of information in popup reports that look like menus, but are not.

Menu Operations

Working with ALACARTE menus involves picking menu items and buttons, listing options from entry blanks and making a selection, and entering information from the keyboard. The methods used to do these things will depend on your particular system. Experimenting in a forms menu is harmless as long as you avoid the **OK** button.

Picking - Pick a menu item or a button by clicking on it or by highlighting it and then hitting the Return or Enter key (<Return>) or clicking the right button on a three-button mouse (for this mouse equivalent of <Return>, the position of the crosshairs on the screen is irrelevant). Click on an item by moving the crosshairs over it on the screen and then clicking the left mouse button (or hitting the space bar on some terminals).

Highlights - On many terminals and terminal emulators, one item on a menu will be highlighted when the menu is opened (the first item, the one last used from that menu, or the Quit or OK button). This highlight can be moved through the menu items before picking by hitting the tab or arrow keys. Pick a highlighted item in a menu with <Return> or by clicking the right button on a three-button mouse.

Entry Blanks - Forms menus contain blanks into which values or selections must be entered before the function controlled by the menu is activated. Highlight a blank by clicking in it (or by moving a highlight onto it) and then type the information from the keyboard and <Return> (that is, enter it from the keyboard). Where one of several known options is to be entered in a blank, the options can be listed in a subordinate by typing a `?` in the blank or by clicking in the blank with the middle mouse button of a three-button mouse. Pick an item from the resulting list to enter it in the blank. In some menus, the options are also represented by buttons (located above or to the right of the blank) that can be picked to enter an option in the blank.

OK, Quit, and Cancel - Popup reports and forms menus remain on the screen until they are closed or activated by picking an appropriate button. Pick a Quit or Cancel button to return to the current bar; use the OK button to start the function controlled by the menu using the settings shown on the menu. Pulldown menus can be closed by picking **close menu** or by picking another item on the bar above.

Help - Help items or buttons are present on many of the menus. Pick them to obtain whatever on-screen help is available in ALACARTE for that item. Help is not uniformly available, and may consist of a message from ALACARTE, display of the ARC/INFO help for the appropriate command, or nothing at all.

Bar Menus

The bar menus define the framework from which you work in ALACARTE (see figure 4 , p. 205). They draw across the top of the screen and remain (or return after various operations are completed) until they are deliberately changed by picking another bar-menu symbol (in **CAPITAL LETTERS**). The items at the outer ends of each bar show where you are in the menu structure. The left-most item on each bar is its name, which indicates either its general purpose (as, Edit) or what kind of feature the bar operates on (as, Lines). The right-most item on each bar, generally the name of the next higher bar, is the way to go back up (and out of) the hierarchy of bars (upward direction indicated by a caret, **^**). Pick an item from a bar menu by clicking on it. An example of a bar menu is the Alacarte bar, which is the first bar presented when you start ALACARTE:

[Alacarte] | SETUP | EDIT | PLOT | ANALYSIS | CONVERSION | GENERAL | QUIT |

Pulldown Menus

Most of the active functions in ALACARTE are picked from menus that pull down from the menu bars. Pulldown menus are opened by clicking on their menu items on the bar, which always have **Initial Capitals**. A pulldown menu drops down on the screen below its menu item, and the bar remains on the screen. The pulldown closes when an item is picked from it or from elsewhere on the bar. Pick

an item from a pulldown menu by clicking on it. An example is the Topology pulldown from the General bar:

[General] | Files | Topology | Symbol Editors | ^ALC |
Clean
Build
Tolerances
Labelerrors

close menu

Popup Menus

A number of standard menus that pop up on the middle of the screen can be called from various parts of the menu structure. The bar menu disappears temporarily when a popup menu is called. Once a function is picked from a popup menu (by clicking on it), that function is carried out, the popup menu closes automatically, and the current bar menu reappears. A simple example of a popup menu is the Choose Map menu, which appears when you go to the Edit bar from the Alacarte bar:

You must choose a map to enter the EDIT menu
help

choose map
change to new map dir

create new map

^ALC

Forms Menus

Most forms menus control functions that use variables which you specify by typing or by selecting from subordinate menus. Like popups, forms menus draw in the middle of the screen at the temporary expense of the current bar. The top lines of the forms menu describe the function that the menu controls. Below that, the variables to be specified by the user are listed with blanks to the right in which to enter the information. Ranged across the bottom are various control buttons, including the OK button that activates the function with the variables displayed in the form. Default options are provided automatically for those variables where typical usage for geologic maps can be suggested. A simple example of a forms menu is that for Build, a function that operates on an input map (coverage) to produce a new, output version of the map:

Build - build topology and feature attributes

<input coverage> *RED_HOME/CWENT/TOUR/TEST.LN*
{output coverage}
{POLY | LINE | POINT} *POLY . . .*

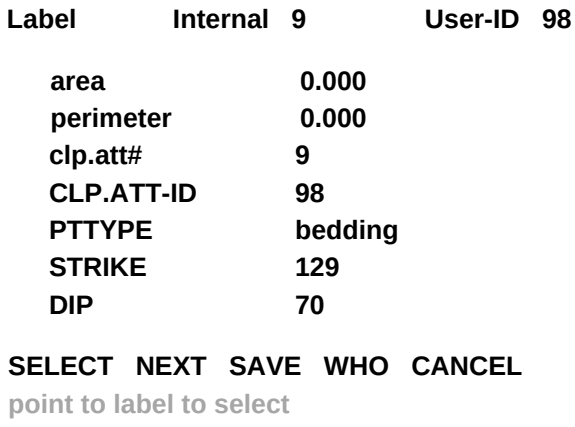
ok help cancel

When a forms menu is opened, the blank for the first entry to be made by the user is generally highlighted. Move the highlight through the items on the popup menu with the tab or arrow keys or click on the item to select it, enter variables in the appropriate spaces (this will override defaults or previous entries), and select the **OK** (highlight and <RETURN>, or click on it) when you want to activate the function with the specified variables. Where an entry is one of several known alternatives, such as the name of an existing map file, type a ? in that blank or click in it with the middle mouse button to open a menu of the options from which you can choose. Pick an item from such a list by clicking on it or by moving the highlight onto the desired option and hitting <RETURN>.

In blanks for an input map (coverage), the current edit map may be automatically shown as a default that can be overridden if desired. Similarly, the settings that you establish in the Select popup will remain until changed.

Database Form

The database form can be used to view the database for selected map elements or to modify the database by making entries from the keyboard. The database items are listed in the lefthand column and entries or blanks appear to the right. Open a database form by picking **forms** on the Database pull-down (**Db**) from the bar for the appropriate type of feature (lines, areas, or points). An example is a form for a bedding attitude in the Tour map layer CLP.ATT:



There are two different versions of the form, depending on whether or not there is a currently selected set of map elements when you open the form.

When no elements are selected, the control buttons are as illustrated above. While the form is open, you can select map elements from the screen or digitizer for inspection, change, or entry of database information. To do this, pick **SELECT** on the form (the instruction **point to [feature] to select** will appear below the button row) and then click on the desired element on the map. The current data for that element will be displayed in the form and you can make any changes or additions by selecting the appropriate part of the form and entering the desired information. Use **NEXT** to move the selection to an adjacent element on the map and **SAVE** to record new entries in the temporary map file. When you are finished with one map element, save any changes and pick **SELECT** to begin the sequence for another element, or close the form with **CANCEL**. When the input form is closed, no features will remain selected. You must also save your work in the usual fashion before quitting the edit session (see *Saving*, p. 80).

If there is a selected set when the input form is opened, data for the first map element in the set will be displayed in the form and a different button row will appear:

NEXTREC SAVE/NEXT WHO CANCEL

Scroll through the selected set by picking **NEXTREC** or, after making changes or entries that you want to save, pick **SAVE/NEXT** to save the displayed data to the temporary file and move to the next element in the set. Save your work in the usual fashion before quitting (see *Saving*, p. 80).

Key Menus

Key menus offer numbered lists of options that are used in controlling certain ARC/INFO routines. When such a routine is started by ALACARTE, the appropriate key menu appears in the dialog area and ARC/INFO waits for you to proceed. A simple key menu is used to control the Select Many function:

1 = Select 2 = Next 3 = Who 9 = Quit

and a more complex key menu is used to control the Digitize Lines routine:

```
----------Options----------
1) Vertex          2) Node              3) Curve
4) Delete vertex   5) Delete arc        6) Spline on/off
7) Square on/off   8) Digitizing Options  9) Quit
(Line) User-ID: 1 Points 0
```

How you enter the numbers to select the available options from one of these menus depends on what device you are using to enter map coordinates. If you are using the cursor as the input device for map coordinates, then you use the number keys on the computer keyboard to enter these numbers. If you are using a 3-button mouse for coordinate input, you enter the numbers with the three mouse buttons and use the Shift and Control keys on the keyboard to change their meaning:

Mouse Button:	Left	Middle	Right
[no key]	1	2	3
Shift	4	5	6
Control	7	8	9

If you are using a 1- or 2-button mouse with a terminal emulator, consult the emulator manual or an experienced colleague to determine how to control these menus.

Note that *9* is invariably used to close a key menu and terminate the function that it controls.

Popup Reports

Some reports provided by ALACARTE pop up in menu-like form on the screen at the expense of the current bar menu. An example is the report of snapping tolerances and settings produced by picking **show** from the Snap bar in Edit Lines:

Map currently being edited is : CLP.GEOL
in directory /HOME/CWENT/TOUR

Weedtolerance 0
Intersectarcs ALL
Arcsnap ON, 10
Nodesnap CLOSEST, 15
Grain 5.221496777343
Editdistance 61
Mapscale is 1:24000 **(0 indicates unknown)**
Mapunits are METERS
Click on QUIT to continue!
OK

Although the reports look like menus, they offer no controls except the OK (Prime) or Quit (UNIX) button, which will be highlighted when the report appears. When you are finished reading the report, click on that button or use <Return> to close the report and return to the current bar.

CUSTOM AMLS AND MENUS

A form menu accessible from any Commands popup (**run my aml or menu**) allows you to execute your own AML or Menu programs from within ALACARTE. Your program should record any environmental settings from ALACARTE that it changes (such as &severity) and then reset them before returning to ALACARTE. Exceptions are &amlpath and &menupath, which this routine handles. You can list and select from the form any aml or menu file located in the current directory; or specify a full pathname in the blank. Your aml or menu will start in the current ARC/INFO module, either ARCEDIT from within the Edit section of ALACARTE, or ARC from all other menus.

COMMAND LINES

The command lines for both the host computer and ARC/INFO are always available from within ALACARTE, and the Arcedit command line is available as well from within the Edit section of ALACARTE. You can go out to any of these command lines during an ALACARTE session, enter appropriate commands at the prompt, and then return to ALACARTE, all within the current working session.

Access to the command lines is obtained from any Commands popup menu, which is opened by clicking on the name (left-most item) of any bar menu (except those bars that are themselves called from a Commands popup, such as the Devices bar).

The relevant part of the Commands menus looks like this:

give one system command
give system commands
list dir
give one ARC/INFO command
give ARC/INFO commands
give one ARC/EDIT command
give ARC/EDIT commands

The ARC/EDIT items are present only on Commands popups that are opened within the Edit section of ALACARTE. To go out to a command line, simply pick the appropriate item from the Commands

menu. If you only want to give a single command, pick a give-one-command item and you will be returned automatically to ALACARTE afterwards. To return to ALACARTE after giving multiple commands, you will need to enter the appropriate command at the prompt:

To return from	Key
Host system	*quit* (Prime) or *exit* (UNIX)
ARC/INFO	*quit*
Arcedit	*&return* (**DO NOT QUIT**)

Do not quit from the ArcEdit prompt:

Do not use *quit* to return to ALACARTE from the Arcedit prompt, as this will cause your current ALACARTE edit session to be abandoned and will return you to the Arc prompt. Trying to return to Arcedit from that Arc prompt will start an entirely new Arcedit session and quitting from there will abandon your current ALACARTE session and return you to the system prompt.

All is not lost, however, if you do quit from the ArcEdit prompt by mistake. If you have made any changes to your map or database in the current ALACARTE session, ARC/INFO will interrupt to ask if you want to save. Indicate *yes*, and you will be asked if you really want to overwrite your original file. Answer *no* to that question and you will be returned to the Arcedit prompt. Now use *&return* to return to your current session in ALACARTE. The map(s) that you had opened as edit maps will still be open, but you will have to specify an edit map again with **choose edit map** on the Map pulldown from the Edit bar.

DIALOG

Various instructions and reports are printed on screen in the dialog area of terminals and terminal emulators. Text printed to this area is added line by line at the bottom of the screen and previous lines scroll upward across the screen. ALACARTE sets the dialog area as a default to the lower eight lines of the graphics area, out of the way of most menus and graphics. The option is always available from any Commands popup menu to reset the dialog area to **fullscreen dialog** in order to preserve dialog as it scrolls up the screen or to hold longer lists on the screen. Similarly, the eight-line **default dialog** can always be restored from any Commands popup. Some screen operations in ALACARTE may cause the dialog area to change to full screen. To reset it, simply pick **default dialog** from any Commands popup. On UNIX workstations screens, the dialog is displayed in the window from which ARC or ALACARTE was started and the number of dialog lines is not an issue.

EDIT MAP

The map layer that you can modify on the screen is called the *edit map* in ALACARTE (*editcover* in ARC/INFO terms). The current edit map is displayed in the foreground on the screen, either alone or overlaid on one or more background layers (see *On-Screen Backgrounds*, p. 66). The edit map is the active layer in which map elements (tics, lines, polygons, points, annotation) can be added (digitized) or selected and modified. Control over which kinds of features in the edit map are actually displayed on the screen (arcs, nodes, labels, etc.) is provided by the Draw/Back Environment popup menu (see *Draw Controls*, p. 67).

You specify the current edit map by choosing it from a Map Names popup menu (opened with **Choose map** on either the Choose Map popup or the Map pulldown from the Edit bar). When you first go to the Edit bar in an ALACARTE session, the Choose Map popup will intervene to request that you choose a map. Once in Edit you can choose other maps for editing, one at a time. Each map chosen for editing during a session (as many as nine concurrent layers) will stay open in the system until you close that edit map or leave Edit. The current edit map and other open edit maps can be listed with **show edit maps** on the Map pulldown from the Edit bar and open maps can be closed with **remove edit map**. Be sure to save any new work before closing an edit map.

ON-SCREEN BACKGROUNDS

While working on the screen you can display not only the foreground edit map on which you are working, but as many as nine separate background layers registered to the foreground layer, each drawn in a specified color. Backgrounds cannot be edited, but any background layer can be moved into the foreground for editing simply by choosing it as the current edit map (see *Edit Map*, p. 65).

The features in the backgrounds that are actually displayed on the screen are controlled from the Draw/Back Environment menu (see *Draw Controls*, p. 67). Be aware that detailed topographic maps can contain tens of thousands of line segments that may take many minutes to draw on the screen. It is wise, therefore, to zoom in to the area of interest before turning such a background on and drawing it on the screen.

The display of registered backgrounds has various applications. You can, for example, display a base map or its component layers (such as topography, drainage, and culture) behind the geologic line work while you are editing the lines, in order to fit the geology to the base as you work. You can edit an imported scan in the foreground over an unedited copy of the scan displayed in the background for comparison, or digitize on screen by tracing a scan in the background. Backgrounds can be used to display adjoining maps in the same projection in order to see relations across the boundary of the edit map as you work.

Backgrounds are picked from a Map Names popup of the current directory of map layers that is called with **choose background** on the Map pulldown from the Edit bar. This popup is automatically followed by a Colors popup from which you specify a color for drawing the background. Each further selection of a background adds to the current set of background layers. All current backgrounds are displayed together in the specified colors according to the back environment setting (see *Draw Controls*, p. 67). Temporarily avoid drawing current backgrounds by turning all features off in the back environment. List the current backgrounds with **show current backgnd**. Individual background layers can be removed from the current set with **remove background**, and all the current backgrounds can be removed together with **remove all backgnds**. Saving while backgrounds are chosen has no effect on the backgrounds.

Special backgrounds are produced by coloring polygons (see *On-Screen Coloring*, p. 168) and by displaying oriented symbols in the background (see *Display Symbols in Background*, p. 184). These background displays cannot be controlled from the Draw/Back Environment menu, but are set and turned off separately from individual menu items.

DRAW CONTROLS

Once an edit map and any backgrounds have been chosen, they are not automatically drawn on the screen. You control when the edit map is drawn on the screen, whether the backgrounds are shown, and which kinds of map features in the foreground and the background layers are actually drawn on the screen. These controls are provided by the Draw popup menu, which is opened with **Dw** on any bar in Edit. Changing the area of the map that is displayed on the screen from the Zoom popup will also draw that new area of the map on the screen (see *Zoom Controls*, p. 69).

ALACARTE sets a default draw environment in Edit that depends on the current bar. Nothing is set to draw from the Edit bar, whereas going to one of the other bars below it automatically turns on the feature(s) in the edit map appropriate to that bar. All elements in the map of that feature type will be drawn on the screen when you pick **draw map** on the Draw menu or one of the zoom items on the Zoom menu.

Draw Menu

Direct user control on drawing is also available, however, which is important when working with maps on the screen. The principal control is through the Draw/Back Environment popup menu (described below), although the Draw menu offers a variety of other controls as well.

This is the draw popup menu, with annotation and interleaved descriptions:

[DRAW] - name of the menu.

The currently defined draw area can be redrawn, with or without first clearing the screen; this will use the current settings for the draw and backenvironment as well as the currently defined draw area:

draw map - clear the screen and draw the currently defined map area.
draw(noclear) - draw currently specified map features without first clearing the screen.

Open the Draw/Back Environment menu (**set draw/back envir**) to specify which kinds of features in the foreground edit map and the background maps will actually draw on the screen (see *Draw and Back Environment*, p. 68), or to check the present settings:

set draw/back envir - open Draw/Back Environment popup menu.

Reset the drawselect color used in drawing the currently selected set of elements, draw that selected set, or assign a session color to the selected set (such independent assignment of symbols is not available from the Digitize Planar and Linear Points bars):

select many - select one or more map elements by clicking on them; close with a *9*.
set drawsel symbol - pick color for drawing selected set from popup; default = yellow.
draw select - draw the selected set in the current drawselect color; color lost on redraw.
set $symbol(S) - pick color or other symbol from popup menu to assign to selected set.

When map elements are selected in ALACARTE they are automatically redrawn with the current drawselect color or symbol to show which elements are selected; although ALACARTE runs this

function as the default , you can turn it on and off either here or from the Select popup menu:

auto dw sel on	- draw map elements in drawselect color (default = yellow) when selected.
auto dw sel off	- omit drawing map elements in drawselect color when selected.

The screen can be cleared of graphics and the automatic display of graphics during ALACARTE and ARC/INFO routines can be turned on and off:

clear screen	- clear image from screen.
graphics on	- enable drawing of graphics.
graphics off	- disable drawing of graphics.

You can go directly to the Zoom popup without first returning to the current bar (if, for example you have opened the Draw popup by mistake) or you can close the Draw popup:

Zm(zoom)	- close the Draw menu and open the Zoom menu directly.
help	- display ALACARTE description of menu.
cancel	- close the Draw menu and return directly to the current bar menu.

Draw and Back Environment

Control on which kinds of features of a map are actually drawn to the screen, such as lines, labels, and tics, is obtained through the draw and back environments, which are set from the Draw/Back Environment popup menu. The Draw environment, which controls which kinds of features in the foreground edit map are drawn, is reset automatically in ALACARTE to the appropriate feature types as you move from one bar menu to another in Edit. These automatic settings can be modified or overridden and the background(s) can be controlled directly from the Draw/Back Environment popup, which is opened from the Draw popup with **set draw/back envir**:

Set edit map drawing environment (drawenvironment):

Arc:	ON	**< ON**	**OFF**	**IDS**	**ARROWS**					
Node:	OFF	**< ON**	**OFF**	**IDS**	**ERRORS**	**DANGLE**		**PSEUDO**		
Label:	OFF	**< ON**	**OFF**	**IDS**	**Anno:**	OFF	**< ON**	**OFF**		
Tic:	OFF	**< ON**	**OFF**	**IDS**	**Link:**	OFF	**< ON**	**OFF**		

Set background drawing environment (backenvironment):

Arc:	ON	**< ON**	**OFF**	**IDS**	**ARROWS**					
Node:	OFF	**< ON**	**OFF**	**IDS**	**ERRORS**	**DANGLE**		**PSEUDO**		
Label:	OFF	**< ON**	**OFF**	**IDS**	**Anno:**	OFF	**< ON**	**OFF**		
Tic:	OFF	**< ON**	**OFF**	**IDS**	**Link:**	OFF	**< ON**	**OFF**		

OK DRAW HELP DRAWENV HELP BACKENV CANCEL

The features that can be controlled from the menu are listed as headings (**Arc:**, **Node:**, **Label:**, **Tic:**, **Anno:**, **Link:**) and the items to the right of the **<** opposite each heading are buttons to turn those features on or off. The current setting is reported next to each heading.

In brief, these features are:

Arcs - arcs are line segments; each segment has an identification number (**IDS**) and a direction (**ARROWS**) that can be displayed.

Node - nodes are line junctions; each node has an identification number (**IDS**) that can be displayed; **DANGLE** marks nodes at unconnected ends of lines; **PSEUDO** marks nodes at junctions along otherwise continuous lines; **ERRORS** displays dangles and pseudo-nodes together with different symbols.

Label - labels are points of various kinds, including oriented structural symbols and label points for polygons; each label has an identification number (**IDS**) that can be displayed.

Tic - tics are digital registration tics; Each tic has an identification number (**IDS**) that can be displayed.

Anno - annotation is text, including numbers; no distinction is available here between the 10 levels of annotation possible for a map layer in ARC/INFO, **ON** turns all levels on together.

Link - links are tie points between two specified map layers that are used in the rubbersheeting function ADJUST in ARC/INFO .

In using the menu, if you want to turn the arcs on in the edit map, for example, click the **ON** button to the right of the **<** in the Arcs row. The setting will appear in the blank: **Arc:** ON. If you want the arc user-ID numbers ($ID) or the line directions to be shown as well, click **IDS** or **ARROWS** instead. To turn the arcs off, simply click **OFF** in the arcs row. The backgrounds are controlled in similar fashion (the background settings apply to all current backgrounds together).

This menu remains on the screen until you deliberately close it. You can set several items for the foreground and/or for the background, and then either activate these settings and close the menu with the **OK** button or activate the settings and draw directly from this menu with **DRAW**.

Take care when turning arcs on for a base map in the background that you don't unintentionally use a draw area that covers much of the map. You can wait many minutes for a large area of such a base map to draw and then find it illegibly crowded with lines on the screen.

ZOOM CONTROLS

The Zoom menu provides control over what part of a map is drawn on the screen. Although the entire area of a map can be draw on the screen at reduced scale, most maps are much larger than the screen at map scale and much editing is done under considerable enlargement. The Zoom menu provides a means of going directly to specified parts of the map and of changing scale or position on the map relative to the current draw area. All the zoom and pan functions redefine the draw area and draw that new area of the map on the screen according to the current settings for draw and back environment (see *Draw Controls*, p. 67). The Zoom menu is opened from the various bar menus in Edit using **Zm**.

This is the Zoom popup menu, with annotation and interleaved descriptions:

[zoom] - the name of the menu.

Any rectangular part of the current draw area can be redrawn to fill the limiting screen dimension by

clicking the diagonally opposite corners of the rectangle (zoom box) on the screen; or, the whole map area can be drawn:

zoomin(box)	- draw the area of a box defined on screen by clicking opposite corners.
overview	- draw the whole area containing map elements for the current edit map.

The map area displayed can be increased (and the display scale decreased) by zooming out around the center of the current draw area by any specified zoom factor (enter factor or use 2X default) or, a more limited area can be displayed at larger scale by zooming in with any specified zoom factor around a new center that you click on the screen; zoom factors less than 1.0 will reverse the effect for each function:

zoomout(#)	- reduce the map about its present center; enter the factor (<1 enlarges).
zoomin(#)	- enlarge the map; enter the factor (<1 reduces) and click on new center.

Two popup menus can be opened from which to pick a specific part of the map to be drawn: **zoom 9/36** divides the map (area within the outer tics) into 9 rectangles (3 X 3) and each of these ninths into quarters, whereas **zoom 8/32** divides the map into 8 rectangles (4 wide, 2 high) and each of these eighths into quarters:

zoom 9/36	- select new draw area from the Zoom 9/36 popup menu.
zoom 8/32	- select new draw area from the Zoom 8/32 popup menu.

A zoom box can be defined by entering the x,y coordinates of its lower left corner (Xmin, Ymin) and its upper right corner (Xmax, Ymax) from the keyboard; the coordinates can be obtained for these corners of a box to be redrawn later by using the Where function on any Options pulldown:

xy box	- draw box defined by entering coordinates (xmin, ymin, xmax, ymax).

The Pan popup allows the draw area to be shifted about 70% in any of eight directions without change in display scale, or a new center can be specified by clicking in the current draw area on the screen:

Pan	- shift the draw area from the Pan popup menu.

The area occupied by any selected set of map elements can be drawn without knowing where those elements are on the map; the area of the map that actually contains lines or other features (**map boundary**) or the whole map area bounded by digital tics (**map corners**) can be drawn for the current edit map (use <return> default) or for any specified map (enter name or pathname):

draw area of:

selected features(S)	- draw area containing currently selected set of map elements.
map boundary	- draws area containing all features in any specified map (disregards tics).
map corners	- draws area defined by the outermost digital tics in any specified map .

The map can be redrawn to any specified scale on the screen (assumes a screen width of 9.25 inches) around a center that you click on the screen:

draw to scale	- draw the map to any specified scale around a center clicked on screen.

The map area currently displayed on the screen (draw area, or frame) can be saved and this saved frame can be redrawn later, regardless of the intervening zoom history:

save this frame - save coordinates of current draw area; can then **redraw saved frame**.
redraw saved frame - draw the area previously defined by **save this frame**.

You can go directly to the Draw popup without first returning to the current bar (if, for example, you have opened the Zoom popup by mistake) or you can close the Zoom popup:

Dw(draw menu) - calls the Draw menu without first returning to the current bar menu.
help - call ALACARTE description of menu.
cancel - close Zoom menu and return directly to the current bar menu.

Zoom Strategies

The Zoom functions are used constantly during editing both to select parts of the map for display and scrutiny and to enlarge small parts of the map for detailed work. Skillful use of the Zoom functions can save much time and help assure that all parts of the map are systematically addressed.

Whole-Map Overview

Draw the entire map on the screen with **overview**, **map boundary** or **map corners**. If only part of the map area contains map elements, or the map elements extend well beyond the outermost tics, use **overview** or **map boundary** to fill the screen with that part of the map. Use **map corners** to draw the map area out to the outermost tics. Overview operates from the current edit map, whereas Map Boundary and Map Corners let you specify the map layer from which the draw area will be determined:

Give name(s) of map(s), <Return> = current map:

Typically you will simply hit <Return> to specify the current edit map, but this prompt lets you specify a different map (enter map name at the prompt and <Return>) or to specify more than one map to define a composite draw area (enter map names in any sequence, separated by spaces). This is useful particularly where you are working on screen concurrently with overlaid or adjacent maps in the same projection.

Drawing the whole of a busy map on the screen can take quite a while. Be sure that Nodes and any detailed background maps are turned off and, if your purpose is simply to find and zoom to some smaller part of your map, consider displaying only the tics or using Zoom 9/36 or Zoom 8/32 instead.

Zoom to a Specified Area

Three of the Zoom functions allow you to specify a particular part of the map without first drawing the map on the screen. Both **zoom 9/36** and **zoom 8/32** open popup menus from which you can specify various parts of the map directly. Zoom 9/36, which is designed particularly for 7 1/2 and 15 minute quadrangles, allows you to specify any of 9 parts of the map (3 high, 3 wide) or any quarter of those ninths. Zoom 8/32, which is designed for 1/2 x 1 and 1 x 2 degree quadrangles, allows you to specify any of 8 parts of the map (2 high, 4 wide) or any quarter of those eighths. Either function can be used for any map, regardless of format, but map elements located beyond the outermost tics may not be included.

The third specific function, **xybox**, permits you to describe a zoom box by entering the map coordinates of its lower left and upper right corners. Use this function to display any particular part of a map or to return in a new edit session to an area that you left unfinished in the last. Determine (and record) the coordinates of the box corners in advance while the area of interest is on the screen (use **where** on any Options pulldown to click first the lower left corner of the area and then upper right; this reports the coordinates in the same order in which they must be entered in the Xybox form).

Pan

The Pan popup that is opened with **Pan** lets you shift the draw area from the current area about 70 percent in any cardinal direction without changing the display scale. Use it to adjust the position of the draw area or to move systematically around the map.

Zoom In or Out

The most frequently used Zoom function is **zoomin(box)**, at the top of the Zoom menu, which allows you to click in the current draw area the opposite corners of a box of any size to be redrawn to fill the whole screen. Use this to zoom in on particular areas or map elements.

Where you want to control display scale, use **zoomin(#)** instead. Specify a magnification factor at the prompt and then click on the center of the new display. By specifying a factor of *1*, this function can also be used to reposition the draw area to a new center within the current area.

Zoom out around the center of the current draw area by picking **zoomout(#)** and entering a magnification factor at the prompt.

Draw to Scale

You can draw a map on screen at any specified display scale with **draw to scale**. This is useful in checking whether more smoothing of lines is needed (draw at about twice the intended cartographic scale), for example, or as a check in generalizing. It is important in working with oriented symbols, which do not scale with changes in the size of the draw area (see *Set the Symbol Environment*, p. 180). A standard screen width of 9.25 inches is assumed for this scale calculation. To correct for a different width, use:

Scale to specify = (desired scale) X (width of your screen / 9.25)

Save Frame

On-screen editing typically involves selecting part of the map for work and then going back and forth from that area to enlarged displays of the various places that require work. The Save Frame function (**save this frame**) allows you to save a draw area, proceed through any sequence of Zoom functions, and then return to that area with **redraw saved frame**. By saving the current work area on a map, you can zoom in for detailed work and then redraw the work area to select the next problem on which to zoom in.

SELECTING MAP ELEMENTS

Editing, tagging, and other operations on map elements require first that the particular elements be specified (selected). Line segments, points, polygon label points, annotation strings, and digital tics can be selected using the selection functions, whereas nodes can be selected only as part of the Move Nodes routine. A powerful suite of functions allows precise identification of map elements by techniques that range from clicking on individual elements (such as a line segment) or surrounding a group of target elements with a box or polygon, to searches of the map database according to specifications about such attributes as line type, line length, or sample number. Selection functions operate on the kind of map feature represented by the current bar (such as lines from the Reshape bar).

All the selection operations either create a new set of selected map elements or modify the currently selected set. Some ALACARTE - ARC/INFO functions require that only one map element be selected, whereas other functions operate on a selected set of any size, including the whole map.

The basic suite of selection functions is available on the Select popup menu, a few functions that are used frequently are directly available on some bar and pulldown menus, and the functions that select according to current [line, point, area] type are located on the Select pulldowns from the various Digitize bars.

Select Popup Menu

The Select popup menu illustrates the several kinds of selective actions and the various ways to specify which elements are to be selected. It is opened with **Se** or **Sel** on various bars and on the Select pulldowns in Edit):

Select map features by logical expression or using current
coordinate device: MOUSE

Type: ASELECT **: < select aselect reselect unselect nselect**

Option: FOR **: < one many all outline dangle connect**
box polygon screen < limit: within passthru
choice: passthru

for expression (enter below):
: *$id = 216*

by length

Auto draw select:
: DRAWSELECT **: < on off set draw color >** 7

ok help cancel

The heading reports the current coordinate device (here **MOUSE**). Check this to remind yourself whether you are currently set to work from the screen or the digitizer. Then set a selection type and an option, plus any further information required by the option, turn Auto Drawselect off if the draw time will delay you, and activate the specified selection function with the **ok** button.

The selection types describe the principal selective actions that are used to create a new selected set or to modify an existing set:

select	- define a new selected set.
aselect	- add more features to the currently selected set.
reselect	- define a new selected set from within the current set.
unselect	- remove features from the currently selected set.

A fifth kind of action operates on the whole map:

nselect	- select all elements in the map that are not currently selected.

The option specifies the method by which that selection type will operate; some options are specific to lines, whereas others apply to any kind of map feature:

one	- select one map element by clicking on it; automatic return to current bar.
many	- select multiple elements by clicking on them in sequence; close with a *9*.
all	- select all elements in the whole map.
outline	- select the polygon boundary that includes the click-selected line (click just inside the desired polygon within an edit distance of the line).
dangle	- select all lines that have at least one unconnected (dangling) end.
connect	- select all lines that are connected to any of the lines in the currently selected set.

The next three options operate by defining areas within which map elements will be selected; for lines there is a choice between selecting only those lines that are completely within the defined area (**within**) and those lines that are at least partially within the defined area (**passthrough**):

box	- select all features completely enclosed (the default) or at least intersected by a box clicked on screen.
polygon	- select all features completely enclosed (the default) or at least intersected by a polygon clicked on screen.
screen	- select all features at least partly included (the default) or completely included in the current draw area.

The last two options require a relation of the form *$id = 216* (see *Select by Attribute,* p. 76). With **for expression**, this relation is entered in the blank below the heading (as in the example above); with **by length**, the conditions and length are specified in a popup menu:

for expr.	- enter the expression by which to select.
by length	- specify line length and conditions from popup menu.

Select By Hand

Specifying one or numerous map elements to be selected from many elements can be done by indicating their map positions with the crosshairs on the screen or digitizing puck from a digitizer. The

selection technique used will depend on the number of elements to be selected, their map distribution, and the ease of starting one or another of the functions from your particular location in ALACARTE. The techniques are described here in terms of selecting a new set, but the same principles apply to the other types of selective actions (aselect, etc.).

Select One or Select Many

Where only a few elements are to be selected, use Select Many. Start the select function, click on the map elements, one by one, and then close the selection routine with a *9*. You can pick as many elements as desired before closing the routine. Each element so identified will blink on the screen and be reported in the dialog area. When the routine is closed and Autodraw select is on, ALACARTE will then redraw the newly selected set in the drawselect color (default = yellow) and the total number of elements selected will be reported in the dialog area. Select One can be used where only one element is to be selected if it is convenient to use from your particular location in ALACARTE.

Select Many uses a key menu:

1 = Select 2 = Next 3 = Who 9 = Quit

Click *1* (left mouse button) to select, follow if necessary with one or more 2's to move the selection through a group of closely spaced elements to the desired one, and close the selection routine with a *9*. Each element will blink on the screen when it is identified and then, when the selection routine is closed, the selected set will be redrawn in the current drawselect color on the screen.

A line is selected by clicking near it anywhere along its length. ARC/INFO will search outward from your clickpoint as far as the edit distance (see *Snapping and Other Controls*, p. 123) to find the line and identify it. To avoid catching the wrong line within the search distance, avoid clicking where the line approaches others. To select all the lines that join at a node, in contrast, click several times at that node with Select Many (or use Select Polygon Passthru). Points and polygon label points are selected by clicking on them. To select an annotation string, click at the lower left corner of its first character. If the elements are too crowded on the screen, zoom in.

Select Many is available on the Select popup menu, on some bar menus (pick **sm**), and on some pulldowns. Select One is available from the Select popup and the Put bar (**so**).

Select Polygon

Select Polygon can be used to select all the elements in an area simply by clicking a line around the group, and can also be used to isolate one or more line segments in a complicated group of lines. The default option choice is Within, but this can be changed to Passthru where desired.

Start the routine, and you will be instructed to:

Define the polygon

Click *1*'s to define a rough polygon around the target elements and end with a *9* (because you are not digitizing an arc, you don't need to define nodes at the start and end of the polygon line). Use as few points as are needed to enclose or cross the target or excluded elements and don't bother to close the polygon.

Within - Only those line segments that are completely within the polygon will be selected. This means that you can deliberately **exclude** particular line segments from the selection by crossing them with the polygon boundary.

Passthru - Both those lines enclosed and those intersected by the polygon will be selected. In contrast to the Within choice, this means that you can deliberately **include** particular line segments in the selection by crossing them with the polygon boundary. There need not be any lines completely enclosed in the polygon.

Select Polygon is available on the Select popup menu, and with the default choice of Within is available on some bar menus (pick **sp**), and on some pulldowns.

Select Box is similar to Select Polygon, but is less flexible in its use. It, too, involves the choice between Within and Passthru. It is available only from the Select popup.

Select Screen

You can select every map element that is displayed on the screen (the current draw area), including, in the case of lines, either just those that are completely included on the screen or also those that are only partially included. In contrast to Select Polygon and Select Box, the default choice for Select Screen is Passthru. If a large number of elements are displayed on the screen, you may want to turn Auto Drawselect off before selecting, simply because of the time required to redraw all the elements.

Select Outline

The outline (perimeter or boundary) of a closed polygon can be selected with Select Outline by clicking just inside any part of the outline. The click must be within the select search distance and inside the polygon for which the outline is to be selected. The resulting selected set will consist of all the line segments that form the boundary of the polygon. Use this function to test a polygon boundary or to find the opening between two linked polygons (listed by Labelerrors as being one polygon with two labels).

Select By Attribute

Map elements can also be selected through database searches which identify all elements that meet specified criteria. This can be as simple as selecting all the line segments that are tagged with a specified line-type, such as fault, concealed, or selecting two polygon label points by specifying their User ID numbers ($ID). More complex logical expressions can be used as the selection criteria, such as selecting all lines having lengths within a specified range or all polygons having a perimeter/area ratio within specified bounds.

Select by [feature]-type

Map elements can be selected according to the feature type with which they have been tagged (line type, area type, and point type, which are recorded in the database items LTYPE, PTYPE, and PT-

TYPE, respectively). Such selection is most easily accomplished from the Select pulldown from the various Digitize bars. This is the relevant part of that pulldown for lines:

Sel by current linetype:
select
aselect
reselect
unselect

To select a set of lines tagged as Contact, concealed, for example, set the current line type that way and then pick **select** under **Sel by current line type:** from the pulldown. The database will be searched and all lines so tagged in the map will be selected.

To color the different kinds of contacts in a map with different colors, for example, first select all the contacts (set the linetype to **all cntcs, for select**, and select by current linetype), assign the color for one kind of contact to all the contacts, unselect that linetype from the selected set, assign the next color, unselect that linetype, etc.

These Current Type functions can be made to apply to other items in the database of a map by changing the feature item. Do this with **change lines item** (or equivalent) on the Database pulldown from the Lines, Points, or Areas bar.

Select for Expression

You can specify an expression to be used in searching the database. The new selected set will consist of all elements in the map that fit the expression. The criteria can involve numeric and/or character items with the logical relations described using the suite of arithmetic and logical operators and connectors listed in Table 6 (p. 78). To make such a selection, Click **for** on the Select popup and enter the expression in the blank:

for expression (enter below):
: [*type expression here*]

Some examples of simple expressions illustrate the method:

$ID = 234	- this will select the element(s) having User ID number 234.
$ID = 234 or $ID = 235	- this will select those elements having User ID numbers 234 and/or 235.
PTYPE = 'Qal'	- this will select all the polygon label points having tags of Qal.
PTYPE = 'Qal' or PTYPE = 'Qt'	- this will select all the polygon label points having tags of Qal and/or Qt.
NUM <= 50 and NUM >= 25	- this will select all the map elements for which the value of the numeric item NUM is in the range 25 to 50.

Be sure that each part of an expression is separated from the others by spaces and that, for repetitive criteria, the item is repeated (such as $ID or PTYPE). Entries in character fields must be enclosed in single quotes. Numerical comparisons require that the target item be numeric.

Table 6. Operators and connectors for selection expressions

Place character strings in single quotes. For more information, see *Feature Selection* in the Arcedit Users Guide, and particularly the table of Logical Expressions, p. 8-5.

+	- plus
-	- minus
/	- divided by
*	- multiplied by
=	- is equal to
<>	- is not equal to
>=	- is greater than or equal to
<=	- is less than or equal to
>	- is greater than
<	- is less than
CN	- contains the single character string next specified
NC	- does not contain the singe character string next specified
&	- connects expressions that must all be true
OR	- connects expressions any of which must be true
XOR	- connects expressions only one of which must be true

Select by Length

Selection by line length is automated through the Length Select popup, which is opened from the Select popup: pick **by length** to specify the option. The **ok** button will open the Length Select popup, from which you pick the appropriate length relation and then specify the desired length in map units from the keyboard or by clicking a distance on the screen:

```
Enter length in map units (typically meters), or hit <Return>
to pick length with CURSOR:
```

Selection Strategies

Various objectives in working with a map will be best served by different selection techniques or combinations of techniques. None are unique, but some of the more common possibilities are described below.

Select One Element

To select one line, point, polygon label point, or annotation string, use Select Many (or Select One), click on the element (and close the routine), and then assure that the intended feature was actually selected by checking which element redrew in the drawselect color. A report in the dialog area should indicate that one element is selected. Where the elements are crowded, change the identified element with a *2* (2 = next) until the target element blinks and then close the routine. If this doesn't work, zoom in closer.

On the Reshape (Lines) bar, various editing functions require that a single line segment be selected (indicated by **(S1)** at the end of the menu items). Here you can start the Select Many routine directly from the Reshape bar with **sm**. Click on the line of interest, be sure that a line was actually identified (line blinks and identity is reported in the dialog area), close the routine, and check that the intended line is the one that redrew in the drawselect color.

If the lines are crowded and you have trouble picking the right one, you can always zoom in, but first try isolating the line with Select Polygon. Pick **sp** from the Reshape bar to start the Select Polygon Within routine, click a polygon that encloses the target line but crosses all the adjacent lines, and close the routine. Check as before that the correct line is selected. Also, because Select Polygon can catch tiny lines that are too small to see except at extreme enlargement, check the report in the dialog area to assure that only one line is selected. Or start Select Polygon Passthru from the Select popup menu and simply cross the target line with a small polygon.

Select Several Elements

To select several elements, use Select Many and click on the several elements wanted. In some cases it may be faster to use Select Polygon or even Select Screen to select the group containing the target elements and then to remove the unwanted elements from the set with Unselect Many or Unselect Polygon.

Clots and Overlaid Elements

Test for the presence of local clots of elements, including tiny lines, by clicking a polygon (Select Polygon) around the suspected clot and then checking the dialog area to see how many elements are selected. Where overlaid elements are suspected, use this polygon technique or click with Select Many over the suspect element until no further elements are selected, then check to see how many have been selected. Overlaid elements can occur where you have mistakenly entered the same element more than once. Small clots of lines can occur on imported scans or where you have moved a node across a vertex in a connecting line. They may be suggested by a slight bulge in a line or at an intersection, or by the inability to combine adjoining line segments. Overlaid elements that are not identical in location may be revealed by overwide plot symbols.

Isolate a Cross-Cutting Line

Use Select Polygon to select a line that crosses other lines, such as a leader in an imported scan or a fault cutting layered rocks. Clicking with Select Many is likely to catch unwanted nearby lines.

Most, But Not All Elements

Where you want to select most, but not quite all the elements in some area, the fastest method may be to select all the elements in the area and then unselect those not wanted. Use Select Polygon or Select Screen to select all the elements in the area and then Unselect Many or Unselect Polygon to remove the unwanted elements.

Limit the Extent of a Database Search

If a selection by attribute (or For Expression) need only apply to part of a large map, it may save time to select all the elements in that part of the map first with select Polygon or Select Screen (you may want to turn Auto Drawselect off), and then reselect to conduct the database search. Reselect operates only on the elements in the currently selected set.

Multiple Operations on a Selected Set

If more than one operation will be performed on a set of elements, arrange the work to permit all those operations to be performed while the set is selected, rather than selecting the same set several times. A common example -- to select a set of elements, tag them, and then color them (session color) -- has been automated as **sel,tag,color** on the Select pulldowns from the various Digitize bars. This routine begins by starting the Select Many routine for you to click on the wanted elements and then, when you close the routine with a *9*, tags the newly selected set with the current [feature]-type and presents the Colors popup from which you can assign a session color to the same selected set.

Progressive Selections

Where all the elements in an area are to be operated on, but with different values for some database item, it may be most efficient to use a progressive selection technique. A simple example is to color all the lines in an area, most in red but some in green. Start by selecting all the lines and coloring them green. Then unselect the few lines intended to be green and color the rest red. The basic principal is to start with the category having the fewest elements, leave them behind by unselecting them, and then to proceed on progressively through larger groups, reserving the largest for last. Where the unselection is done automatically rather than by hand (as with Unselect For Expression or Unselect by Current [Feature]type), the particular sequence used is not as important.

SAVING

When you open an edit map and change it in ALACARTE, the changes are not automatically recorded in the permanent file for that map. Instead, the changes are recorded in a temporary file that was created when you opened the map. If you want to preserve your new work, you must deliberately save this temporary file.

Two principal options are available when you save: you can overwrite the existing file for the map, or you can leave that unchanged and save the modified map as a new version. Because each new version that you save will require additional space on the storage device (typically a hard disk), you should be sparing in saving as a new map, but it is important to have a fairly recent version available in the rare event that the current working version becomes corrupted.

The basic principle to follow is always to save as a new file after radical treatment of the map, including such bulk processes as deletion of all tiny lines in an imported scan, running Generalize on the whole map, or cleaning the map. Or, save or copy as a new version before operating on the map. In addition, in order to keep a fairly recent version available as one form of backup, save as a new file after each significant new increment of work. After assuring that these files are in order, delete the last previous version to minimize your storage requirements (after archiving, if appropriate).

A map can be saved from three places in ALACARTE: from any Options pulldown in Edit, from the Save pulldown from the Edit bar, and from the ARC/INFO interrupt that appears when you leave Edit without having saved after changing a map. The Save pulldown illustrates all the available save options:

cur map(ow)	- save current edit map by overwriting the existing file.
cur map(new)	- save current edit map as a new file; enter new file name.
all maps (ow)	- save all open maps by overwriting existing files.
save-select?	- set save to include current selected set of map elements (SEL item).
save-symbol?	- set save to include current symbols assigned to elements (SYMB item).
save-audit?	- set save to include audit trail.
show settings	- report save settings.
save setup	- save current settings to setup file.
use setup	- pick existing map from which to read and use setup file for current map.

The current edit map can be saved by overwriting its permanent file (which replaces the earlier version of the map with the current version), the current edit map can be saved as a new file (you will be prompted to enter a new file name), or all the open edit maps can be saved at once by overwriting their permanent files. The Options pulldowns offer only the overwrite option for the current edit map (**save(OW)**), whereas saving at the ARC/INFO interrupt saves all open edit maps by overwriting.

You must save before quitting after an edit session in order to preserve your work, but you may want to save during an edit session as well. Although it is not likely, your system can crash without notice, and you want to avoid loosing several hours of work if it does. Saving an edit map cancels all current symbol assignments (such as session colors), which requires that they be reassigned after the save. Frequency of saving is thus a compromise between the time required and vulnerability to loss. An optimum frequency is probably every 45 minutes to an hour. Because it is hard to remember to save while you are working, one useful rule is that, when you think of saving, do so.

If ALACARTE crashes while you are editing and you cannot make anything work, you can keep your temporary files for later restoration by terminating communication with the host rather than performing a system break (CONTROL-P or CONTROL-C). Breaking out of ARC and answering *yes* to Are you sure (y/n): causes the temporary files containing your current edits to be deleted. Instead, hang up the data phone, turn off the terminal, quit the session window, or the equivalent to terminate communication with ARC. Then you can use **Restore edit session** (on the Files pulldown from the General bar) to recreate the lost edit map.

The second set of items on the Save pulldown is designed to aid resetting your map after saves. In any one session, you can include in your saves the currently selected set of map elements, the current set of symbol assignments (such as session colors), and/or an audit history of your work. To do this, simply pick the appropriate item(s) from the Save pulldown and enter *y*es at the prompt(s). Then each time you save during the session, that additional information will be saved. During an edit session ALACARTE will automatically restore the selected set and assigned symbols after each save. This information can also be recovered in a new edit session by picking **restore save** from any Options pulldown in Edit. Do this before you begin work, or you will lose any newly established selection or symbols.

The third set of items on the Save pulldown provides a way of saving the current snap settings to the Setup file for the edit map and of copying a setup file from another map (specify from a Map Names popup) for use with the current edit map.

CUSTOM TAG MENUS

You can make your own menus and open them from the appropriate digitize bars in Edit to set the current tag type (line type, area type, etc.) that is maintained at the digitize bars. These menus are specific to a particular map layer and are automatically saved and copied with that map. Three such menus can be prepared for each kind of tag, and each menu can contain as many as 100 entries. Picking tags from such menus avoids the risk of misspelling that is present when you enter a custom tag from the keyboard.

You will need to learn how to use the screen editor that is opened on your system by ALACARTE (see *System Details*, p. 35, and/or consult your system administrator).

To prepare a custom menu, go to the directory for the map and then open the menu for Custom Tag Menus (pick **create tagging menus** on the Prepare Scans pulldown from the Setup bar):

Create or edit custom tag menu using the system editor: vi

Name of map for which tag menu is to be created or edited:

/REDHOME/CWENT/TOUR/CLP.GEOL

Create new tag menu or Edit existing tag menu Choice : NEW

Select tag menu to create or edit:

AREAS1	**AREAS2**	**AREAS3**
LINETYPES1	**LINETYPES2**	**LINETYPES3**
LINEMODS1	**LINEMODS2**	**LINEMODS3**
POiNTS1	**POINTS2**	**POINTS3**
ATTITUDES1	**ATTITUDES2**	**ATTITUDES3**
LINEATIONS1	**LINEATIONS2**	**LINEATIONS3**

Selected tag menu: area1.alc

OK editor help CANCEL

The type of editor installed for your system will be reported at the right end of the first line in the menu. Specify the name of the map for which the menu is intended (list maps with *?* or middle mouseclick in blank, then pick the name). Indicate whether you want to prepare a new menu or edit an existing one by picking the appropriate button (**Create new tag menu** or **Edit existing tag menu**); your choice will be noted at the right. Then specify the tag menu involved by picking the button that represents both the type and the menu number (**1**, **2**, or **3**). The selected tag menu will be reported (including its .alc extension).

When you are ready, pick the **OK** button to open the screen editor. If you are starting a new menu, ALACARTE will automatically insert the first four lines of the new file for you. If you are editing an existing file, that file will be opened in the editor.

The first four lines of the file consist of computer instructions, menu headings, and a CANCEL button for the menu; for example:

```
1   3     area3.alc,  ALACARTE custom geologic unit tagging menu 3
2   0  0
3   Select unit Tag:
4   CANCEL
5
```

Following these four lines, you should enter your custom tags, one to a line, using the procedures specific to your screen editor and terminal.

Organize the labels as you wish (stratigraphically or alphabetically, for example). The items will be arranged in sequence, row by row, in the menu. Short entries are best, but do not exceed 32 characters. If you include spaces in an entry, be sure to enclose the whole entry in single quotes.

The file should look like this (an example for unit labels):

```
 1   3     area3.alc,  ALACARTE custom geologic unit tagging menu 3
2   0  0
3   Select unit Tag:
4   CANCEL
5    Qal
6    Qls
7    Qt
8    Tv
9    Ttl
10   'unmapped area'
```

When you are finished, save the file from the screen editor. ALACARTE will place it in the map subdirectory (the map name is actually the name of its subdirectory, which contains the AAT, PAT, and other files that constitute the map). The .alc extension on the file name will cause ALACARTE to copy the menu file when you save or process the map to a new map name.

Edit an existing menu in the same fashion. Note that when you save a new tag menu, it will overwrite any existing file of the same name for that map.

PROCEDURES

Various procedures for use with ALACARTE - ARC/INFO are systematically described for reference during planning and work with maps. These procedures represent the principal steps involved in compiling a map in ALACARTE - ARC/INFO. The particular methods described here work effectively, but the system is very flexible and many operations can be carried out in more than one way.

Steps in Preparing a Digital Map

This section describes the steps and operations involved in preparing a standard ALACARTE geologic map and provides cross references to the more detailed discussions elsewhere in this manual. The general issues in compiling a geologic map with ALACARTE-ARC/INFO are discussed in *Compiling a Digital Map* (p. 6).

PLAN THE WORK

Before you start, decide how you will prepare the map and why you are working digitally (see *Compilation Goals*, p. 7). Choose a map scale and a base map and projection, select your source materials, and decide how best to enter the line work and other data into the computer (use table 7 as a guide, p. 89). Will the base be digital, or will the digital geology be fitted to a photomechanical base, and how will you accommodate a physically mosaicked base?

If your objective is solely print production, you can be concerned only with cartographic appearance at map scale, whereas if the digital map is to serve as a digital database or will be released digitally, you may want to attend more carefully to small scanning artifacts and the details of line shapes. There may be additional database fields (items) required, including one for some measure of spatial resolution, and you will want to assure that full topologic relations are established. If you are compiling a map from larger scale sources, decide whether you will want to have digital versions of the source maps at their original resolutions or whether you can incorporate the first step in simplification for the smaller compilation scale into tracings that you prepare for scanning input.

Design the Map

Select the base map and the projection for the final map (see *Projections*, p. 101). Separate the information that the map will contain into appropriate layers (see *Layers*, p. 11) and choose distinctive file names for the layers. A standard ALACARTE geologic map can consist of at least eight layers:

Base (assuming that base separations will be scanned)
- culture - [map name].clt
- drainage - [map name].drn
- index contours - [map name].idx
- intermediate contours - [map name].int

Lines (after completion, the lines layer is used to start the Areas layer and is then abandoned)
- faults, contacts, water and scratch boundaries, map boundary - [map name].ln, .ln2, etc.

Areas (polygons)
- map units (and all information from the Lines layer) - [map name].py, .py2, etc.

Structure

orientation data, fold axes, structural contours - [map name].sr, .sr2, etc.

Other Points

field stations, fossil localities, sample localities, chemical analyses

radiometric dates, wells, or other data - [map name].pt, .pt2, etc. (or a more specific designation)

Annotation

unit labels (and leaders), fault names, point labels, other map-face text - [map name].an, .an2, etc.

Naming Map Layers - Your objective should be to make the names distinctive and short (typically no more than eight characters). You want to be able to determine from the file name alone what the layer is and which is the most recent version. One simple way to accomplish this, as illustrated in the list above, is to use a short abbreviation for the map name and indicate the kind of layer with a suffix. Leave space in the suffix for trailing numbers to indicate sequence as you edit and save new versions.

Procedure

Plan the sequence of steps that will be required to prepare the map. This will depend particularly on whether and how you obtain a digital base and whether you decide to enter the line work by hand digitizing or by scanning. The typical sequence for the geologic data in a standard ALACARTE geologic map is shown in figure 1 (p. 87), which illustrates the contrast between line input by scanning or by digitizing. Most other data in the map will require hand entry, although a scan can serve as an on-screen background from which points or oriented structural symbols can be traced. The boxes in the figure mark the steps that involve hand work; of those, the work with lines will take the largest amount of effort, just as it does in conventional work with a pen.

BASE MAP

It is strongly recommended that you obtain a digital version of your base map to work with on screen and to be able to include in plots (see *Base Maps,* p. 8). If the base map (or base separations) will be scanned, you must assure that sufficient registration is present on the originals before they are scanned, because precise registration cannot be established later (see *Map Registration*, p. 115).

Obtain the files for the digital version of the base map (or layers) and convert them into arc coverages (see *Import from Vector Source*, p. 155).

Prepare a projected tic framework, adjust the tic registration, and transform the base layers into the projection of the original base map using the Prepare Scans sequence, as described below (see *Tic Framework and Database*, p. 88).

Mosaics - physical mosaics prepared from maps of adjacent quadrangles will not be in a single coherent projection, and therefore will not fit exactly with a geologic map prepared with a common, mathematically projected tic framework in ALACARTE - ARC/INFO. Scan the quadrangle base maps separately and prepare them in their original projections. Then reproject them into a common projection. This can be done before compiling the geology or after the geology has been compiled as separate digital quadrangles (but remember that the projection of the tic framework must match that of the source map initially). If the geology must be fitted back to a physical mosaic of the quadrangle bases, the best procedure is to prepare the base mosaic over a scale-stable plot of the projected tic framework of the digital map. This will assure the closest fit between the two. In any case, the

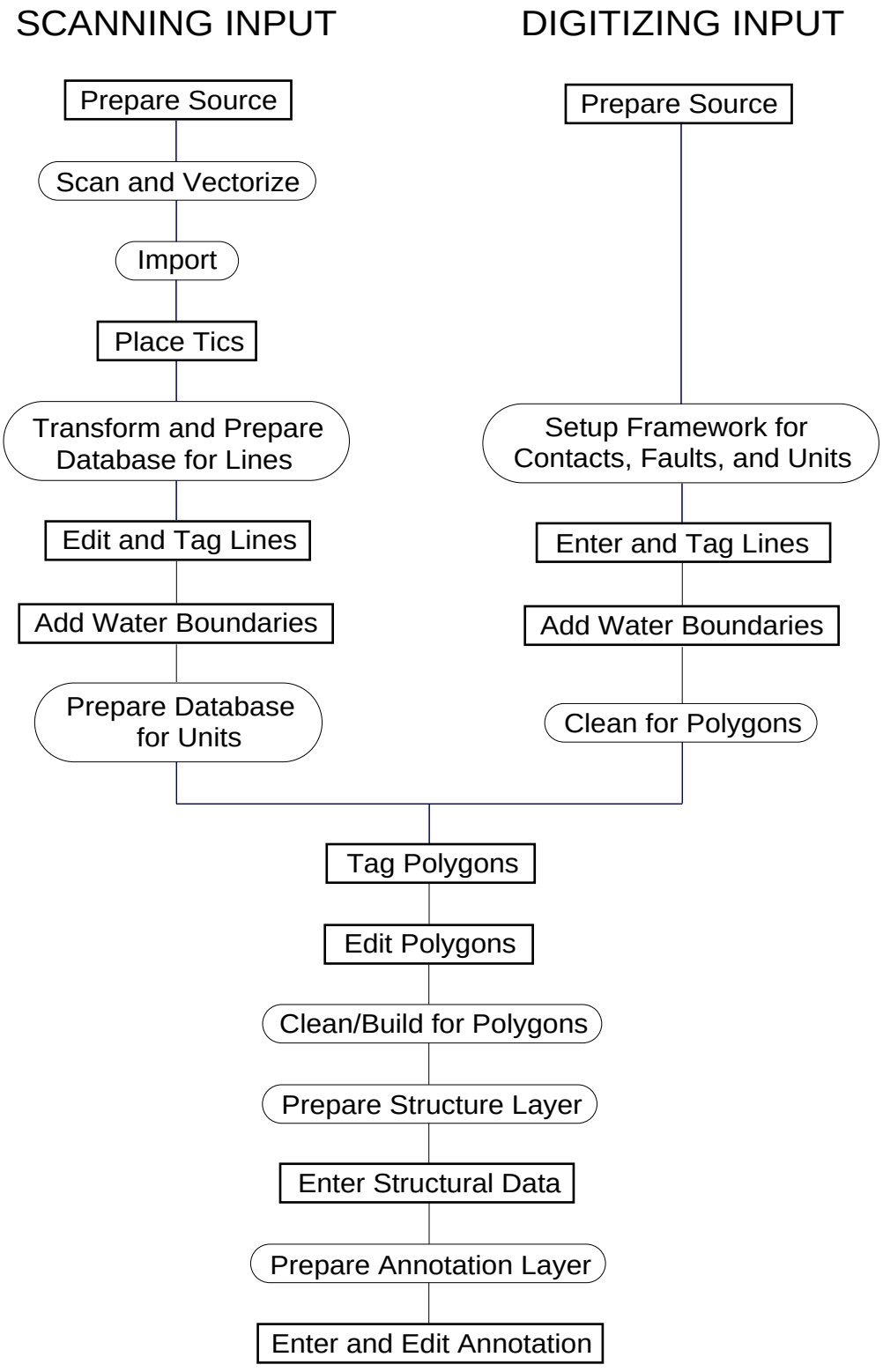


Figure 1. Principal steps in preparing a standard ALACARTE geologic map. Ovals mark processing steps, boxes mark steps involving hand work.

disparity between quadrangle projections is small, and it may be satisfactory to force a fit between base and geology by transforming the geology into tics fitted precisely to the corners of the mosaic, using the projective option (see *Projections*, p. 101).

GEOLOGIC SOURCES

Choose your source materials and decide how you will enter them. Work from scale-stable materials where possible, but even good paper maps can be used because of the x,y scaling included in the Transform function (see *Transform*, p. 105). Distortions caused by folds can be overcome if enough latitude/longitude tics are available by registering each section between the folds separately. Be sure to include an adequate number of graphic registration marks (see *Map Registration*, p. 115).

Hand digitize where only a few lines are involved or a scanner is not available. Otherwise, scan the source maps directly or make a tracing specifically for scanning. Include the first round of generalization in the tracing, if appropriate.

Scan a map directly where the line work is sharp and uncluttered by line ornaments (teeth, queries), abundant labels and leaders, or background. Some base images can be dropped during scanning, but a test will be required with your specific map. Tracing may be preferable even with a clear original if most of the lines are dashed or dotted.

Make a tracing where the source is not satisfactory for direct scanning. Use a non-smear pencil on plastic, maintain a fine, regular line, and make all lines continuous regardless of intended line symbols. Omit all thrust teeth and other ornaments. Mark each change in line type along otherwise continuous lines with a small cross tic to impose a node in the line and flag the change in the scan. Add graphic registration marks with stickup or fine drafting.

Import and process the scanned geology in the same fashion as a scanned base.

TIC FRAMEWORK AND DATABASE

Most work in compiling geology digitally will be done in the context of a map in a particular projection with associated databases for lines, polygons, and points that have been prepared with standard ALACARTE database items. The procedure differs slightly depending on whether the input of lines is by hand digitizing or by scanning (see *Start a New Map or Layer*, p. 93).

Once a projected tic framework has been prepared for a base layer or for the lines layer, it can be copied to prepare other layers (by specifying the projected layer as a template for the other layers). Use the ALACARTE functions available from the Setup bar, and specify the appropriate kinds of map features to assure that the database is prepared properly. Where lines will be entered from a digitizer, make the tic framework from the New Map pulldown, and prepare the database for faults, contacts, and units.

If you have started with a scan, be sure that the tic registration has been established (see *Start a New Map or Layer, p. 93, Projections*, p. 101, and *Registering Imported Scans*, p. 116), and use Step 2 (**transform**) on the Prepare Scans pulldown to make the projected tic framework and transform the scan into it. Prepare the scan for lines with Step 4 (**prep database**), regardless of its topical content.

Table 7. Worksheet for compiling a digital geologic map.

Map name - _____; abbreviation for file names: ____
Geologic source - _____ _____ _____ (medium, scale, reference)
Base map - _____ (layer(s), type (scan, DLG, DEM), source)
Registration - establish at lat.-long tics in every original: existing drafted stickup

		file name	date	comments
Scans (base layers, geology, other)				
Raw vectorized scan -	placed in working directory	_____	_____	_____
Unprojected scan -	converted to ARC coverage	_____	_____	_____
Tic framework -	set up using projection worksheet	_____	_____	_____
Place tics in scan -	establish tics for transform; record numbers and coordinates of tics to be used			
Projected scan -	_____ (transform type)	_____	_____	_____ (RMS error)
Check registration -	compare other layers with _____ (master layer)			
Lines Layer (contacts, faults, various kinds of boundaries) [mapname].ln				
Input Method -	hand digitize scan and edit scan and trace trace and scan map on screen			
Line types -	make list of kinds of lines in map and line types to be assigned			
Prepare layer -	set up new map for faults, contacts, and units (use projection worksheet, table 8) or prepare projected scan for lines;	_____	_____	_____
Edit Scan:				
Bulk editing	_____ (Matchnode, spline, other)	_____	_____	_____
Edit and tag	(number the versions)	_____	_____	_____
Hand digitize:				
Digitize and edit	(number the versions)	_____	_____	_____
Boundaries -	_____ (add and/or connect map, water, scratch, and any other boundaries).	_____	_____	_____
Areas Layer (polygons): [mapname].py				
Process or prepare -	clean lines layer for polygons or prepare edited scan for units	_____	_____	_____
Area types -	make list of unit labels and-or make a custom tagging menu (Areas1, 2, and-or 3)			
Label units -	hand digitize or use Createlabels and select and tag			
Edit -	(build polygons as needed)	_____	_____	_____
Structure Layer [mapname].sr				
Setup new layer -	use [mapname].py as template	_____	_____	_____
Digitize oriented data and add fold axes				
Points Layer (sample localities or other points) [mapname].pt, .sl, or other specific name				
Setup new layer -	use [mapname].py as template	_____	_____	_____
Digitize oriented data and add fold axes				
Annotation Layer (unit labels, leaders, and other map-face text) [mapname].an				
Setup new layer -	use [mapname].py as template	_____	_____	_____
Copy unit tags -	use **create unit annotation** to copy unit tags from PTYPEs			
Edit -	move, add, and delete labels; add leaders; add other map face labels and text			

In either procedure, be sure to include the Map Boundary option if you are working with geologic lines for a regular quadrangle; this will be needed to close polygons around the boundary of the map. Add an equivalent outer boundary (such as a scratch boundary) around an irregular map outline by hand.

Prepare base scans for lines, as this will permit you to tag lines in the base layers if occasion requires (such as to identify closed water boundaries in the drainage layer for later incorporation into the polygon layer).

LINES LAYER

The lines layer will contain all the contacts, faults, and any other lines that will bound map units (polygon boundaries). Do not put any other kinds of lines in this layer (fold axes, isograds, structural contours), because they will unnecessarily break up the map-unit polygons. If the lines will be edited from an imported scan, be sure that the scan has been processed with Step 4 (**prep database**) on the Prepare Scans pulldown to prepare it for lines. A map begun for faults, contacts, and units from the New Map pulldown will already have a database prepared for lines.

Enter lines by hand from a digitizer or by tracing on screen over a scan (see *Digitize Lines*, p. 129). Decide how you will tag the various kinds of lines (make a list) and then begin. If you are working from a digitizer, choose the lines layer as the edit map, register the source map on the digitizer, superimpose a transparent overlay on which to monitor progress and problems, set the line type, and start digitizing. For on-screen digitizing, simply draw the scan or base map over which you will work in the background behind the lines layer, and begin digitizing lines. Set the line type for the kinds of lines you are adding, or be sure to retag later. Every line will be assigned the current line type at the time it is digitized. Be sure to save occasionally.

If you are editing a scan for lines, work on screen to remove all extraneous material, correct scanning artifacts, connect and combine lines as appropriate, and tag all the lines (see *Process and Edit Scans*, p. 155, and *Edit Lines*, p. 135). Consider bulk processing to close gaps (Matchnode) or smooth irregular lines (Spline or Generalize), but be sure to test the effects first and to work on a copy of the map, as unwanted effects can be common.

Review your work on screen with Node Errors turned on to check for problems that require correction (see *Edit Lines*, p. 135) and/or make and examine an edit plot.

If a scanned image contains fold axes or other lines that you will want later, consider copying them into a temporary storage layer before deleting them from the lines layer. The simplest method is to color them as you encounter them and, when you are ready to clear out a section of the map, to select them by their color ($symbol), use the Put function to copy them into the temporary storage layer, and then delete them from the lines layer. Later you can edit and tag them in the temporary layer and incorporate them into the structure or other specialized layer.

If you did not include creation of a map boundary in the initial preparation of the lines layer, you will want to add a boundary around the line work to close map-unit polygons. Do this by digitizing a scratch boundary (place a node in that boundary at the end of each dangling internal line, with nodesnap on, to connect the boundary) or by starting a new map to make a projected map boundary and then adding it to the lines layer with the Put or Get function. Be sure to connect internal lines to

the boundary. Similarly, add open water boundaries to the lines layer and connect adjoining lines to them. Obtain the water boundaries from a digital base map (drainage layer) or hand digitize them from a copy of the base.

POLYGON LAYER (UNITS)

Start the polygon layer by processing the lines layer for polygons (see *Prepare the Polygon Layer*, p. 161). For a map containing hand digitized lines, which should already contain a database prepared for polygons, simply clean the map for polygons and specify the new polygon layer for the output map. For a map containing scanned lines, process the layer for units (polygons) with Step 4 (**prep database**) in the Prepare Scans sequence.

Tag the polygons by geologic unit either by digitizing tagged label points or by running Createlabels and then selecting and tagging each label point (see *Tag and Edit Areas*, p. 161). The practical difference between these two methods is in the kinds or errors that can result and the methods used to find and correct them (see *Check Labels*, p. 165). You can set the area type from the keyboard, but be careful about misspellings. If, instead, you prepare and use a custom tag menu to set the area type (see *Custom Tag Menus*, p. 82), the spellings will be constant, but be sure to pick the right item from that menu. Use the methods described in *Check Labels* to check your work, correct polygons with incomplete boundaries before adding labels to them or fixing PTYPEs that have been changed in multiple label points by a build, and take full advantage of the methods available to help you find errors (see *Check Labels*, and *On-Screen Coloring*, p. 168).

Createlabels - The Createlabels function applied to an untagged map will place an untagged label point at the centroid of each valid polygon (see *Run Createlabels*, p. 164). (Be sure that you are using ARC/INFO 5.0.1, as in earlier versions the label can be placed outside the boundary of irregularly shaped polygons.) It can be difficult to find and select these label points (use the **sel,tag,color** item) and they may not be where you want the label point to be, particularly as its location determines where the unit label will be posted when you start the annotation layer (see *Add and Edit Annotation*, p. 187). It can also be difficult to find intended polygons that have incomplete boundaries. The only errors will be those imposed by erroneous tagging and by incomplete polygon boundaries.

Hand Digitizing - Placing the label points by hand will give you more control over the locations of the label points and will be somewhat faster than the Createlabels approach. Errors can include assigning the wrong tag to a polygon or placing a label on the wrong side of the boundary of a small polygon (zoom in on it). More important is the effect of building the map with polygons that contain more than one label point, which will occur where polygon boundaries are incomplete. ARC/INFO will arbitrarily convert the PTYPEs of all label points in a valid polygon to the same entry. Where you find that multiple labels exist (with Labelerrors) because of a broken polygon boundary, be sure to check the PTYPEs of those labels and correct the erroneous one(s).

Note that you will probably want to build the map for polygons several times (see *Topology*, p. 56) as you enter and edit the labels and tags, in order to be able to use the on-screen coloring techniques to find remaining problems (see *On-Screen Coloring*, p. 168).

STRUCTURE LAYER

Start the structure layer from the New Layer pulldown and specify the polygon layer as a template (see *Start a New Map or Layer*, p. 93). Enter and tag any structural lines (fold axes, contours) by hand digitizing or by copying from an edited scan with the Get or Put function.

Enter bedding attitudes and other oriented structural data from a digitizer or by tracing over a scanned background image (see *Oriented Symbols and Data*, p. 179). Be sure to set the Symbols Environment properly first. Superimposing a template over the structural symbols for graphic entry from a digitizer can increase the precision of specifying strike and of the calculated location of the data point. (Make a transparent template on which a strike-and-dip symbol 3-4 inches long is drafted, with the dip line located precisely at the center of the strike line; number the ends 1 to the left and 2 to the right, looking down dip, to guide the sequence of clickpoints.)

Adjust the location of dip or plunge numbers from the Annotation bar (see *Add and Edit Annotation*, p. 187). In doing this, be sure to specify the markerset and lookup table for the symbols and set the Symbols Environment to show the structural symbols and numbers on screen in proper spatial proportion (see *Set the Symbol Environment*, p. 180).

ANNOTATION LAYER

Start the annotation layer from the New Layer pulldown by preparing a new layer for annotation and leaders (specify the polygon layer as the template) and then posting all the unit identities from the PTYPE item of the polygon label points with **create unit annotation** on the New Layer pulldown (see *Copy Annotation from Database*, p. 98).

Edit these unit labels from the Change Annotation bar. Move, delete, and copy the unit labels and add short leaders (from the Digitize Lines bar) to provide appropriate graphic labels for the map units.

Be sure to display the geologic line work and the oriented symbols in the background for reference. Choose the polygon layer as a background and turn on background lines and labels. Display the oriented symbols with **draw cov in back** after setting the markerset and lookup table properly (see *Display Symbols in Background*, p. 184). Set the draw scale to match the size of the structural symbols (2X will be best) to assure that the structural symbols and numbers draw on screen in proper spatial proportion (see *Set the Symbol Environment*, p. 180).

For some purposes you may want to color selected map units instead, using a custom coloring program to color polygons in the background (see *Custom Colorfill*, p. 170). Specify the polygon layer in this program explicitly, rather than using the edit-cover version of the program, because the edit cover will be the annotation layer, not the polygon layer. (Note that polygon coloring and displaying oriented symbols in the background cannot be done concurrently.)

Add any other map-face text here as well. This might include the names of major faults and identification of any special points in the map, such a wells or fossil localities. These point identifiers can be posted from the database of the points layer in the same fashion as the unit labels (see *Copy Annotation from Database*, p. 98).

Start a New Map or Layer

Starting a new map or layer involves two principal steps, (1) defining a framework of digital registration tics at known locations in a specified map projection, and (2) preparing the database of that empty map for the intended kinds of data. An equivalent process is available to prepare imported scans. The various functions available from the Setup bar make these procedures straightforward. Start a new projected map from one of the options on the New Map pulldown, make a projected tic framework for a scan there or from the Prepare Scans pulldown (Transform step), and copy the tic framework from an existing map for a new layer from the New Layer pulldown. These maps will all be projected maps in which the dimensions are meters on the ground in the specified projection. The initial projection is that of the source map, but once the map is in digital form this can be changed as desired.

The use of the Setup functions is described here, but also see *Projections* (p. 101) for a description of projection issues and the Transform function and *Map Registration* (p. 115) for discussion of establishing, checking, and improving registration of map data to the earth and between layers. The full procedures for working with scans are addressed in *Process and Edit Scans* (p. 155).

Maps can also be started with rectangular coordinates with dimensions of inches on the map. Unless such a map is later transformed into a projection, however, it will not support work with such oriented structural data as bedding attitudes.

It is wise to plan your map before actually starting it. Choose a base, determine the scale and projection, decide how the data will be entered, determine what map layers you will want, and establish registration procedures (see *Compiling a Digital Map*, p. 6, and *Map Registration*, p. 115). If you plan to compile geology on a digital base map, start by obtaining and preparing the digital base as a projected map (see, for example, *Registering Imported Scans*, p. 116).

You will be asked to specify map scale. For digital maps, the principal significance of scale is as a measure of the spatial resolution of the map data. This is important because a digital map can be displayed or plotted at any scale, regardless of the scale from which the map was digitized. The scale of a digital map is also used by ALACARTE to determine the size and placement of such annotation as dip values for bedding attitudes. Where the scale of a source map is larger than that of the digital map being compiled, you should decide whether you want to do any necessary simplifying prior to digitizing or later in the computer, and therefore what the scale (resolution) of the digitized source map will be.

PROJECTED FRAMEWORK AND DATABASE

The Setup functions all use the same basic suite of routines, with differences depending on the database features, use of an existing map as a template, and creation of a projected map boundary in the process. The New Map procedures are the most complete, and their description will thus explain the whole suite of routines.

The several New Map options (on the New Map pulldown from the Setup bar) create an empty map containing digital registration tics at designated latitude/longitude positions in a specified projection. Tics can be placed automatically at the corners of a standard quadrangle or can be specified individually for non-standard maps. For standard quadrangles, internal tics and a projected map boundary connecting the corner tics can be generated automatically.

ALACARTE Version 1.0 supports seven projections that are commonly used in geology in the United States: Lambert Conformal Conic, Transverse Mercator, Oblique Mercator, Polyconic, Universal Transverse Mercator (UTM), Albers Equal-Area Conic, and the special DNAG projection, as well as the State Plane equivalents. Consult *Projections* and your source map (or the base map, or Snyder, 1987; see reference on p. 102) for the information that will be required by the Setup routine in order to establish a map in the projection that you specify.

New Map Sequence

To begin the New Map sequence, pick the option from the New Map pulldown that contains the kinds of map features that you want (either in terms of geologic features or of lines, points and polygons, as noted below). A sequence of questions is then presented through forms menus in which you name the map, specify map scale, enter tic locations, define the projection, and enter values for several edit and topology parameters (the sequence of questions differs for standard quadrangles and non-standard maps). The whole procedure requires only a few minutes (You can terminate the sequence at any time by picking **cancel** from any one of the forms menus). Once the map is created, you can modify the database format, if necessary, by adding and/or deleting database items (see *Database Items*, p. 55).

Kinds of Features

Specify the kinds of features that you plan to enter in the map by picking the appropriate menu item on the New Map pulldown; ALACARTE will prepare the database for those features and add the standard items used in ALACARTE for them:

faults, contacts, units	- lines and polygons; LTYPE and PTYPE items.
unit boundaries only	- lines; PTYPE item (no LTYPE).
geologic structures	- fold axes and oriented structural features (lines and points); LTYPE, PTTYPE, STRIKE, and DIP items.
sample localities	- points; PTTYPE and SAMPNO items.
annotation + leaders	- lines and annotation; LTYPE item

Map Name

Specify a name for your new map that is distinctive and short enough that suffixes can be added to identify other layers (such as *loma,* followed by layers such as *loma.ln* for lines; see *Design the Map*, p. 85). Check the pathname indicated in the **change map dir** blank to be sure that you are in the directory in which the new map is to be placed and, if necessary, change directories before proceeding.

Standard Quadrangle or Non-Standard Map

Indicate that your map is a standard quadrangle and designate its scale by picking the map scale here; or, for a non-standard map, pick **none** here, which will later permit you to enter the tic locations individually, then specify the map scale on the next menu. To specify a scale not listed on the menu, click in the **Other:** blank and enter the denominator of the scale ratio (omit commas).

Specify Tic Locations

For a standard quadrangle, enter the latitude and longitude of the **southeast** corner and ALACARTE will calculate the location of the other corners automatically and place a digital registration tic at each. For non-standard maps, enter at least four tics located near the outer corners of the map. ALACARTE will prompt you for these in sequence, and then offer the opportunity to add as many more as you wish, one at a time. In specifying tic locations, you can enter degrees, minutes, and seconds separately, or use decimal degrees or minutes in any combination.

Internal Tics

For a standard quadrangle, indicate whether internal tics should be generated - *Y*(es) or *N*(o). These tics will be placed automatically at the interval standard for the designated scale of quadrangle (2.5' at 1:24,000, 5' at 1:62,500, 7.5' at 1:100,000, and 15' at 1:250,000). See *Projections* (p. 101) for the numbering pattern used by ALACARTE For non-standard maps, specify any internal tics as part of the tic entry process above.

Map Projection

Pick the projection of the map. The projection of the digital map must match that of the source map, at least initially. Any change in projection is made after a digital version of the original has been prepared.

Projection Parameters

Various parameters will be requested, depending on the projection specified for the map (see *Projections*, p. 101). Enter these as they are requested by the sequence of forms menus. As in specifying the location of tics, latitude and longitude can be entered in degrees, minutes, and seconds separately, or in decimal degrees or minutes in any combination.

False origin

Reposition the origin for the map coordinates (meters on the ground) by entering values for x and/or y. For most maps you can leave the values at *0*. Do not use a false origin for a State Plane map (see *Projections,* p. 101, for the false easting required to convert Transverse Mercator and Lambert maps to the State Plane origin).

Edit and Topology Tolerances

Specify map scale and, particularly for maps to contain lines, set the various parameters that are used during editing (see *Snapping and Other Controls*, p. 123). By specifying them here while setting up the map, you will record them in the setup file for the map, from which they will be reset for you automatically every time you open the map for editing. These stored values can be changed later if desired by setting new values during an edit session; the setup file can be changed by saving such reset values. Only the weed tolerance and edit distance need attention for maps that will contain no lines.

Set default edit tolerances for this map:

	meters	or	inches	
weed tolerance	*1*.		*0*	- keep small (as, *0-1* meter).
intersectarcs	*ALL*			- use *ALL* for most work.
arcsnap distance	*12*		*.02*.	- typical value: 0.01-0.03 inches.
arcsnap type	*ON*			
nodesnap distance	*12*		*.02*.	- typical value: 0.01-0.03 inches.
nodesnap type	*CLOSEST*			- generally use *CLOSEST*.
extend distance	*12*		*.02*.	- as above, or set in Edit**.**
extend direction	*BOTH*			
edit distance	-1			- use -1 here; reset temporarily in Edit

ok help cancel **Map scale =** 24000

Default values for the fuzzy and dangle tolerances (used by the Clean function) can be recorded here in the Setup file, but can be overridden from the Clean menu when appropriate. The tic match tolerance can be used to prevent work on a poorly registered map by automatically rejecting any registration on a digitizer that does not meet the tolerance, but you may prefer to reserve control of that decision to the occasion.

Set default topology tolerances for this map, in meters:

	meters	or	inches	
fuzzy tolerance	. . . . .		. . . . .	- typically use 0.001 inches.
dangle tolerance	. . . . .		. . . . .	- typically use 0.
tic match tolerance	. . . . .		. . . . .	- typically leave blank.

ok help cancel **Map scale =** 24000

Quadrangle Boundary

You can have a quadrangle boundary added automatically to a standard quadrangle (answer **Yes** to the question). If you will ever want a boundary for the map, this is the place to create it, because ALACARTE will bend the boundaries properly in the map projection.

Select and Symbol Items

Include these items (answer *Yes*) to add the items SEL and SYMB to the database if you will want to be able to save a selected set or the current symbol assignments (such as line colors) between map saves and edit sessions. Adding these items does no harm, in any case.

Check the Plan

Check the report to be sure that the plan for the map is as intended:

These are the parameters for your new map layer:

map name:	Geol.ln	
quad type:	'7.5 24'	(7-1/2 minute quadrangle, 1:24,000)
map scale:	24000	
map units:	meters	
make quad boundary:	.true.	
add symbol/select items:	YES	

click for projection info:	**projection**
click for edit snapping info:	**snapping**
click for topology tolerances info:	**tolerances**

make map now **cancel**

Click on the **projection**, **snapping**, or **tolerances** buttons to list those settings, respectively. If everything is correct, pick **make map now** to have ALACARTE proceed to make the map, otherwise **cancel** the procedure and start again.

Once all the needed information is entered and you start the processing, ALACARTE proceeds to create the named map layer in the current directory with tics at the specified latitude/longitude positions in the designated projection. When this process is completed, which can take several minutes, you will be returned to the Setup bar menu and notified with a beep. The new map will be the selected map if you proceed down to the Edit bar.

New Layer Sequence

The options for kinds of features for a new layer are the same as for a new map (except for creation of a unit labels layer, discussed below). Once the process is started by picking an option from the New Layer pulldown, the sequence proceeds to ask for a name for the layer (and offers a place to change directories, if necessary), for specification of a template from the set of existing maps, and for instructions about adding database items for saving symbols and a selected set (SYMB and SEL). These instructions are listed for inspection, and then you are given a change to cancel or proceed to make the map. No opportunity is available to make a projected map boundary. Make that separately from the New Map pulldown or copy one from an existing layer if it is needed.

Prepare a Scan

The procedure for scans is somewhat different, because the scan contains map elements that must be retained. Once the scan has been imported and converted to ARC/INFO, follow the instructions in *Registering Imported Scans* (p. 116) to place the scan in a projected framework of tics. The database is prepared as a separate step, in contrast to the New Map and New Layer sequences. Pick **4. prep database** from the Prepare Scans pulldown to open the Build Database menu:

Build database files needed for the layer type specified below
name of map: . . . . . .
layer type: . . . . . .
add symbol and select items?: YES **YES NO**
ok help cancel

Specify in this menu the desired options for processing the projected scan. Use a ? or middle mouse click in the Layer Type blank to list the options for selection, and click on the **YES** or **NO** button for SYMB and SEL. Pick **ok** to start the process or quit with **cancel**.

COPY ANNOTATION FROM DATABASE

Information stored in a database item of one map layer can be copied automatically into another layer and posted at the locations of the associated map elements. Use this procedure, for example, to start an annotation layer for a geologic map by entering unit labels from the PTYPE item of the polygon layer for subsequent editing. Start by preparing a new layer with **annotation + leaders**, then add the database information using **create unit annotation** (both are located on the New Layer pulldown from the Setup bar). Entries in any database item (character or numeric) for any kind of of map feature (polygon label points, lines, or points) can be posted in this fashion.

Create feature annotation - creates annotation for a specified map layer from database values

<feature type> . . . . . .
<cover to receive annotation> . . . . . .
<source cover used for annotation> . . . . . .
<feature source item used for annotation> . . . . . .
<annolevel> 1
<mapscale> 24000 . . . . . .
<mapunits> METERS . . .
<text height> 0.1 . . . . . .

ok help cancel

Enter ? or a middle mouse click in the blanks to list the options and pick the layer just prepared to receive the annotation, the map from which the annotation will be obtained, and the database item in that map containing the information. Leave the annolevel at 1 unless you have good reason to change it, enter the presentation scale for the map, pick the units for the map (meters for ALACARTE maps), and specify a height for characters in inches on the map (note that the default of 0.1 is standard for unit symbols). Activate the process with **ok**. The contents of the specified database item will be added to the receiving layer as text annotation at the locations of the associated map elements.

SIMPLE MAP FRAMEWORK

The Create Map routine can be used to make a map framework without preparing an associated database. Three different options are available depending on where you are in ALACARTE: you can copy an existing tic framework and its dimensions (from the Files pulldown from the General bar, the Choose Map menu, or the Map pulldown from the Edit bar), you can enter tics from a digitizer or on

screen in map inches (from the Choose Map menu or the Map pulldown from the Edit bar), or you can create a map with unit dimensions and no tics (from the Files pulldown from the General bar). Use these procedures particularly where you do not need the database preparation or where you want the dimensions to be inches on the map.

Create Map from General Bar

The tics and dimensions of an existing map can be copied without any associated database preparation. Pick **create map** from the Files pulldown, enter the name of the new map (layer), and specify the template map. The new layer will be placed in the current directory, but a template in another directory can be used by entering its full path name. The new layer will have the tics and dimensions of the template, but you will have to attend to any needed database preparation separately (see *Prepare Map Database*, p. 100).

Create - create an empty map layer. Tic locations may be copied from another map layer.

name of new map: . . . . . .

optional: name of map to use tics from (tic bnd cover):

. . . . . - enter template name (or pathname).

ok help cancel

An empty map containing no tics and with unit dimensions (xmin=-1, ymin=-1, xmax=1, ymax=1, with origin at center) can be made from this menu by not specifying a template (leave the blank empty). Tics can then be added on screen (from the Tics bar in Edit).

Create Map from Edit

The tics and dimensions of an existing map can also be copied from either the Choose Map popup menu that precedes the Edit bar or from the Map pulldown from that bar. Pick **create map** to start the routine, enter the name of the new layer, and specify the template map.

Create - create an empty map layer. Tic locations either entered with current coordinate device (mouse, digitizer, etc.) or copied from an existing map layer.

name of new map: . . . . . .

Note: When asked to 'Enter initial boundary' click just outside (an inch is OK) the lower-left and upper-right margin of your map.

optional: name of map to copy tics from (tic bnd cover):

. . . . . .

ok help cancel

Create Unprojected Tic Framework

An unprojected tic framework with dimensions in inches on the map can be prepared with the Create Map routine in Edit by not specifying a template (leave the blank empty). You then digitize the tics directly from a map registered on the digitizer or on screen by tracing a background or working free-hand (note that the tics will not be drawn on the screen as they are entered). Map coordinates will be in digitizer inches or arbitrary units. This method can be useful where you do not intend to project the map, or at least not until further work is done with it.

Start by mounting your source map on the digitizer or displaying a digital source on screen in the background. Be sure that you are in the directory to receive the map and that the coordinate input device is set to match your input source (digitizer or on-screen mouse). Then start the routine by picking **create map** (from the Choose Map menu or the Map pulldown). Enter a name for the new map in the form, leave the template name blank, and then at the prompt in the dialog area, digitize at least four tics:

> Creating [map name]
> Digitize a minimum of 4 tics.
> Signal end of tic input with Tic-ID = 0
> Tic-ID: - prompt to enter a tic from digitizer or screen.

First type the number of the tic at the Tic-ID: prompt and enter it (<Return> from the keyboard or <A> from the digitizing puck), then click precisely on the tic location on the digitizer or the screen. Do this for each tic that you want to digitize, then <Return> with no number entered to close the routine. The new map will then be the current edit map at the Edit bar.

Prepare Map Database

You may need to prepare the database of a map created outside of Setup before working on it in ALACARTE. Depending on the need, this can be done piecemeal or with options from the Prepare Scan Menu. You may want to prepare the database for working with lines, points, or polygons in advance of entering map elements and/or you may want to add additional items (fields) to the database. You may also want to add a setup file to the map.

In the piecemeal approach, build the map for the appropriate map features (**Build** on the topology pulldown from the General bar) and then add whatever database items are needed (**Add Item** on the Files pulldown from the General bar; see *Database Items,* p. 55).

Alternatively, use the options on the Prepare Scans pulldown from the Setup bar. Here you can build the map for the appropriate map features (lines, points, polygons) and add any standard ALACARTE items to the database (such as LTYPE, PTYPE, or PTTYPE).

To add a setup file to the map, use **create setup file** on the Prepare Scans pulldown (from the Setup bar) or set and save the desired settings in Edit. To set snapping in Edit, choose the map and either copy a setup file from an existing map (**use setup** on the Save pulldown from the Edit bar) or set new snapping tolerances (**set snap** on the Snap pulldown from the Lines bar). Save these settings with **save setup** (on the Save pulldown from the Edit bar).

Projections

ALACARTE is designed to work with maps in one of several standard projections using the 1927 North American Datum (NAD27) and with locations and dimensions recorded in meters on the ground in the appropriate x,y coordinate system. In these maps north is at the top, azmuthal data such as strike or plunge direction are properly recognized, and adjacent maps can be mosaicked in a common projection. During the initial entry of map data into the computer you must work in the projection of the source map, but once a map is digitized, its projection can be changed. Projections are specified in two circumstances in ALACARTE, when a projected map is started or a scan is transformed from the Setup bar, and whenever a map is changed from one projection to another.

Scanned maps that have been imported into ARC/INFO have dimensions in inches (or less commonly in centimeters or millimeters) referenced to the digitizer, and these must be converted into meters in the matching projection. This is done with the Transform function, which places the scanned image into its projection coordinates according to the location of equivalent digital registration tics in the input scan and in the projected framework of the receiving map. Maps that are started from the Setup bar in ALACARTE are automatically placed in a specified projection. In hand digitizing with ALACARTE, the transformation from the coordinates of the digitizer into such a projected map is done automatically as you enter each map element. Details of the procedures involved in transforming maps are described in *Start a New Map or Layer* (p. 93), *Map Registration* (p. 115), and *Process and Edit Scans* (p. 155).

Once a map is properly recorded in its original projection, it can be converted into another projection with the Project function. This might be done, for example, to overlay different maps of the same area, to place the geology on a different base map, or to mosaic several quandrangles together in a common projection (using, for example, the Append or Mapjoin function on the Boundary pulldown from the Analysis bar). The Project function can also be used to convert a file of latitudes and longitudes into the corresponding x,y coordinates in a specified projection, or vice versa.

Accurate placement of a map image by Transform and any subsequent changes in projection depends on the quality of the initial registration, which involves both the precise identification of latitude/longitude registration marks in the source map and the precise placement of digital registration tics at those graphic marks in scans (see *Map Registration*, p. 115). Good registration is important both for plotting and printing and for overlays, analytic work, and the preparation of derivative maps.

SUPPORTED PROJECTIONS

Version 1.0 of ALACARTE supports seven projections that are commonly used in geology in the United States: Lambert Conformal Conic, Transverse Mercator, Oblique Mercator, Polyconic, Universal Transverse Mercator (UTM), Albers Equal-Area Conic, and the special DNAG projection, as well as the State Plane equivalents. To prepare an empty map (a projected geographic framework of a map) in one of these projections from the Setup bar in ALACARTE, you need only specify the projection, the needed projection parameters, and the map location in latitude/longitude; ALACARTE does the rest of the work in ARC/INFO to create the digital map (see *Setup Details, p. 102*, and *Start a New Map or Layer*, p. 93). Many other projections are available, but use of these will require

working in naked ARC/INFO. More information about projections and their application to maps in the United States can be obtained from:

Snyder, J.P., 1987, Map projections - a working manual: U.S. Geological Survey Professional Paper 1395.

ALACARTE assumes the 1927 North American Datum (NAD27), which uses the Clark spheroid of 1866. Almost all USGS topographic quadrangles are in NAD27, although some include NAD83 corner tics as well. Any work directly in NAD83, which ARC/INFO also supports, will require use of the native PROJECT command in ARC/INFO. Conversion from one datum to the other can be accomplished using the ARC/INFO CONTROLLINK and QUADLINK commands. Maps projected outside ALACARTE can be used in ALACARTE with some limitations. If a map is not in meters, the snapping menus in the Lines section of ALACARTE will not translate from map units to inches properly.

Before the late 1950's, large-scale USGS quadrangles were prepared in the Polyconic projection, whereas more recent 7-1/2 and 15 minute quadrangles typically use Lambert or Transverse Mercator. Lambert is used for states of predominantly east-west extent and Transverse Mercator for states of north-south extent (Oblique Mercator is used solely for the Alaskan panhandle and the Great Lakes).

The projection reported on the more recent quadrangle maps may still be Polyconic, despite this change, but the practical effect of treating these maps as polyconic rather than as their actual projection is generally insignificant. The difference in the length of the diagonal of a 7-1/2 minute quadrangle between Polyconic, Transverse Mercator, and Lambert projections ranges from 0.001 mm (0.00004 in.) to 0.05 mm (0.002 in.) (Snyder, 1987), and in the worst case is thus less than half a line width. Because the coordinate origin for any polyconic map is at the center of its southern latitudinal boundary, regardless of location on the earth, it is necessary to convert to another projection for comparison or mosaicking with maps of adjacent areas.

The State Plane projection represents the projection details of large-scale quadrangle maps that are actually Transverse Mercator, Lambert, or Oblique Mercator, such that the projection parameters can be specified simply with a single State Plane zone. Using State Plane in ALACARTE and specifying the appropriate zone number (see Table 9, p. 110) is thus equivalent to using the actual projection and projection parameters of the map.

The UTM projection is used for many intermediate-scale maps, such as the 1:100,000 and 1:250,000 quadrangle series, and the Albers projection is used for small-scale maps in the United States. The DNAG projection, selected by the Geological Society of America for use for the Decade of North American Geology, is Transverse Mercator with its central meridian at 100 degrees and a scale factor of 0.926.

SETUP DETAILS

Starting a new map from the Setup bar (New Map pulldown) requires that you answer a series of questions about the map projection and the location of the map on the globe. The information about projection that is needed in this process is listed in Table 8 (p. 109). This information can usually be obtained from the text at the lower left corner of the source map or, where not reported on a geologic map, from the equivalent topographic map. Snyder (1987) also provides a number of useful tables of projection data.

For State Plane maps, do not confuse the State Plane zone with UTM zones (look for the word *projection*), as many maps contain UTM grids but are in a different projection. For example, the following information

> Projection and 10,000-foot grid ticks: Hawaii coordinate system,
> zone 3 (transverse Mercator) Clark spheroid 1866. etc.

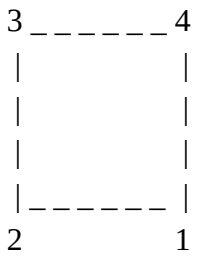
indicates that the State Plane zone is Hawaii 3, which represents a Transverse Mercator projection. The zone number to specify in ALACARTE for this State Plane Zone (for this example, 5926) is then determined from Table 9 (p. 110). To convert the origins of Transverse Mercator or Lambert projections to that equivalent to a State Plane projection, simply impose the appropriate x shift by including it as a false easting in the projection file. This can be done either for maps already in those projections or as part of the file used to convert from some other projection. This shift is typically

> Transverse Mercator - x shift of 152,400.3048 meters (500,000 feet)
> Lambert Conformal Conic - x shift of 609,601.2192 meters (2,000,000 ft)

See Snyder (1987, p. 51-57) for discussion of the Oblique Mercator application and more details and exceptions.

The location of a map is indicated by specifying the latitude and longitude location of digital registration tics in the map (typically corners). ALACARTE menus have input fields in which latitudes and longitudes are entered by quadrant, degrees, minutes and seconds. The values can be entered in any format, including degrees-minutes-seconds, decimal degrees, decimal minutes, decimal seconds, and any combination. Latitudes are either north of the equator (positive) or south (negative). Longitudes are either east of the Greenwich meridian (positive) or west (negative). Maps in the continental United States therefore have north latitude and west longitude. The longitude value and its hemisphere are specified in separate fields in ALACARTE when setting up a new map (a negative longitude value will not be accepted in the degrees field), but the negative sign for west longitude must be included in preparing a separate projection file.

For regular quadrangles, only the location of the southeast corner need be specified; ALACARTE calculates the other corners and generates digital registration tics at all four locations. Corner tics are numbered in a standard way for regular quadrangles in ALACARTE. Tic 1 is at the southeast corner and the numbers progress clockwise:



Internal tics can be included automatically in regular quadrangles as an option. They are numbered as follows for 7 1/2 and 15 minute quads:

3	5	6	4
7	8	9	10
11	12	13	14
2	15	16	1

For 1/2 x 1 and 1 x 2 degree sheets, the internal tics correspond to the corners of the 7 1/2 or 15 minute quadrangles within the sheets, and are numbered as follows:

3	5	6	7	8	9	10	11	4
12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38
2	39	40	41	42	43	44	45	1

It is important to retain the history and current state of a map's projection. ALACARTE stores projection information for the map in the map directory in a file named projx.alc, where x is the number of the projection file. The information for the first projection is in proj1.alc, and that for each subsequent change in projection is stored sequentially in proj2.alc, proj3.alc, etc. The projx.alc file is obtained by ALACARTE from the project file for the ARC PROJECT command and records both input and output projections. An example of this projx.alc file for a polyconic map is:

```
INPUT
PROJECTION GEOGRAPHIC
UNITS DD
PARAMETERS
OUTPUT
PROJECTION polyconic
UNITS METERS
PARAMETERS
-120 3 45
38 00 00
0
0
END
```

TRANSFORM

The Transform function provides the means to change coordinate systems for a map by moving it from one set of registration tics into another set. Its principal use for ALACARTE maps is to move an imported scan from digitizer inches into a projected tic framework with the coordinate system in meters on the ground. This standard role for Transform is an automatic part of the transform step in the Prepare Scans sequence (see *Process and Edit Scans*, p. 155); Transform is also available from the Conversion bar (Projection pulldown), where greater control over its operation is possible.

A prerequisite for transforming a map is the presence of digital registration tics at several known locations in the map and the creation of an empty receiving map with similarly numbered tics in equivalent locations in that map. Transform uses the x,y locations of these equivalent tics in the input and receiving maps to calculate the transformation equations, and then applies these to all x,y locations in the input map to prepare the output map. The locations of the tics in the output map are the reference and do not change, regardless of how poorly the tic locations in the input map match them.

Transform Operations

Two kinds of transformation are available, affine and projective. With the affine option, a 6-parameter linear transformation of the form

$$x' = Ax + By + C$$
$$y' = Dx + Ey + F$$

is used in which the operations can involve translation from one coordinate origin to another, relative x,y stretch, and a rigid or shear rotation in which parallel map elements remain parallel. Specifying three equivalent registration tics will lead to an exact match of those tics in the output map, whereas four or more tics will be used to determine the best aggregate fit, and using only two tics will force proportional x and y scaling. A single transformation for all points is involved, and where more than three tics are used, none will be fitted precisely unless the fit is perfect.

The projective option, which is specifically intended for removing tilt from data obtained from aerial photographs, performs all the affine operations and also permits trapezoidal distortion to be made rectangular, such that parallelism of map elements is not retained . A minimum of four equivalent tics is required for calculation of the 8-parameter projective transformation

$$x' = (Ax + By + C)/(Gx + Hy +1)$$
$$y' = (Dx + Ey + F)/(Gx + Hy +1).$$

This transformation will match four tics exactly, and with more tics will determine the best aggregate fit. As with the affine transformation, a single transformation for all points is involved, and where more than four tics are used, none will be fitted precisely unless the fit is perfect.

Specifying Tics

Transform associates the tics in the input and receiving maps according to their $ID numbers and uses all equivalently numbered tics in the two maps. Control on which tics are used in a transformation is thus exerted by matching their $ID numbers. Tic numbers are assigned when the tics are created and can be changed later from the Tics bar in Edit with the Calculate function.

Transform Report

ARC/INFO presents a report of the transformation on screen during the process (run a watch file to capture this for later inspection or printing). For an affine transformation, this report includes the scaling and translation required to change coordinate systems, the RMS error of the relative tic locations (in both input and output units), and a rotation angle that may describe a rigid rotation, but is more likely to include an unreported amount of shear as well (R.K. Mark, oral commun., 1991). The tics used in the transformation are listed along with their locations in both the input and receiving (output) maps. Errors are also reported (x error, y error in output units) that represent departures of the transformed tic locations from their actual locations in the output map.

```
Transforming coordinates for coverage /CWENT/TESTMAPS/SCAN

Scale (X,Y) = (609.963,610.634)   Translation = (-6173.439,-411.649)
Rotation  (degrees) = (1.543)   RMS Error (input,output) = (0.003,1.567)
```

Tic id	input x output x	input y output y	x error	y error
1	19.214	1.196		
	5563.365	1.826	-1.561	0.129
2	0.984	0.704		
	-5563.365	1.826	1.561	-0.129
3	0.382	23.414		
	-5554.245	13873.856	-1.563	0.129
4	18.592	23.904		
	5554.245	13873.856	1.563	-0.129

The report for a projective transformation is less informative, but includes an RMS error for the tics and a list of the tics and their locations and transformation errors.

Transform Strategy

The principal decisions required in transforming an imported scan into a projected tic framework are which and how many tics to specify and which transform option to use. Under ideal circumstances the relative tic positions in the source map and calculated tic framework will be identical and a four-tic affine transformation will place the map image into the projected tics precisely with an RMS error of zero. The task is to decide how best to accommodate the inevitable departures from this ideal. Details of the procedures are described in *Map Registration (p. 115)* and *Process and Edit Scans* (p. 155).

A critical preparatory step is to assure that graphic registration marks are clear and precise in the source map before scanning and that digital registration tics are placed precisely at those marks in the imported scan (see *Map Registration*, p. 115). All subsequent positioning of map elements in the map projection is dependent on the location of these reference points.

Good transform results can be obtained from film originals and even undamaged paper maps, for which any regular x,y distortion is accommodated in the transformation process. Unless problems are anticipated, the simplest procedure is thus to proceed directly and then check the result. First add (or move) digital tics in the scanned image to the map corners and to any well located internal registration

marks and assign $ID numbers equivalent to those in the projected tic framework for the tics to be used in the transform. Then perform the transform with the affine option and check the RMS error in the Transform report. A good fit is indicated by an error of 0.003 inches or less. Larger error can cause later problems and a better transformation should be sought.

Poor transformations result from mislocated tics, which can be due to distortion in the source map, poor placement of graphic registration marks before scanning, distortion during scanning, poor placement of digital registration tics after scanning, or mismatch between projections. If no problem in tic placement can be found and the projection of the source map was used in creating the projected tic framework, try eliminating or changing the specified tics (corner or other exterior tics are preferred in transforms, but internal tics can be used if necessary). Omitting interior tics may improve the result. If there is a difference in the size of the x,y errors in the transform report, eliminate or replace the tics with the highest error.

If it is essential that all the corners fit exactly, the four corner tics can be used in a projective transformation. This will force an exact fit of the corners, but may produce unsatisfactory distortions within the map. In all transformations, and particularly in projective transformations, check the fit throughout the map by comparing unused graphic tics and registration marks, drainage and geology, or other map elements of known relation on screen and/or in a plot. As a last resort, consider rescanning.

Local improvements in registration can be made with the rubbersheeting ADJUST command (which is not automated in ALACARTE)), but the effect of such adjustments falls off rapidly with distance away from the pairs of link points used to control the distortions.

PROJECT

The Project function converts coordinates from one projection to another for either a file of locations or for a map (coverage). These functions are obtained with **Project file** and **Project coverage** on the Projection pulldown from the Conversion bar. The projection of a scanned map can be changed only after the scan has been transformed into the projection of its source.

Projecting Files

A text file of x,y coordinates is converted to another projection with **Project file**:

Project - change map projections of a file

<in file>	- name of text file of x,y locations (use full pathname if necessary).
<out file>	- name for new file of converted coordinates.
{project file}	- name of optional file with which to specify projections and parameters.

OK **HELP** **CANCEL**

The input and output projections and parameters can be specified in a text file (the project file), as described below. If you don't name a project file, ARC/INFO will ask you to specify the projections and parameters through a series of questions (examples of such questions and answers are provided in table 10, p. 112).

An example input text file of signed longitudes and latitudes (termed geographic projection in ARC) is given below, followed by the output file that would be created if the Geographic to Lambert dialog in table 10 (p. 112) were used:

Example input file of signed x,y coordinates (here longitude and latitude):

```
-122 00 00 38 00 00
-122 30 00 38 00 00
-122 30 00 38 30 00
-122 00 00 38 30 00
```

Example output file in Lambert meters:

```
87834.8581      4499891.8618
43918.0488      4499541.8939
43623.1895      4555044.5375
87245.1479      4555392.1558
```

Projecting Maps

All the x,y coordinates in a map are converted to another projection with **Project coverage,** which opens a menu similar to that for files. Specify an in- and an out-coverage (map file names) and a project file (see table 10, p. 112), or specify the projections and parameters through the interactive series of questions.

Projection File

A projection file is prepared by typing a text file using the system editor or an equivalent (you can start a screen editor from the Commands popup). Sample projection files and dialogs for map projections supported by ALACARTE are given in Table 10 (p. 112). To use a projection file, specify it as the PROJECT file in the Project File or Project Coverage menu.

Table 8. Worksheet for map projections

Name of map

Regular quadrangle? Type of quad Scale

Location of southeast corner - Lat: Long.

Map projection and parameters:

- Lambert (1st standard parallel is the one closest to the equator.)
  - Latitude of 1st standard parallel:
  - Latitude of 2nd standard parallel:
  - Longitude of central meridian:
  - Latitude of projection's origin:
- Transverse Mercator
  - Scale factor at central meridian:
  - Longitude of central meridian:
  - Latitude of projection's origin:
- Oblique Mercator
  - Latitude of projection's origin:
  - Longitude of projection's origin:
  - Scale factor at center of projection:
  - Azimuth at center of projection (degrees):
- State Plane (covers above 3 in standard form):
  - State Plane zone:
- Polyconic No parameters. (Latitude of projection's origin is set to SE corner of map)
- UTM
  - UTM zone (1 through 60):
- Albers (1st standard parallel is the one closest to the equator.)
  - Latitude of 1st standard parallel:
  - Latitude of 2nd standard parallel:
  - Longitude of central meridian:
  - Latitude of projection's origin:
- DNAG
  - Latitude of projection's origin:

X,Y shift of origin (defaults are zero; do not use in State plane projection)

- False easting in meters:
- False northing in meters:

Table 9. State Plane projection zones (NAD27)

State Plane Zone from base map and corresponding Zone number for ALACARTE-ARC/INFO
(from Table Project-4, ARC/INFO Users Guide, Volume 2, January 1989)

Alabama, East	3101	West	3126		
Alaska, Zone 1	6101	Zone 5	6201	Zone 8	6276
Zone 2	6126	Zone 6	6226	Zone 9	6301
Zone 3	6151	Zone 7	6251	Zone 10	6326
Zone 4	6176				
Arizona, East	3151	Central	3176	West	3201
Arkansas, North	3226	South	3251		
California, Zone I	3276	Zone IV	3351	Zone VI	3401
Zone II	3301	Zone V	3376	Zone VII	3426
Zone III	3326				
Colorado, North	3451	Central	3476	South	3501
Connecticut	3526				
Delaware	3551				
Florida, North	3576	East	3601	West	3626
Georgia, East	3651	West	3676		
Hawaii, Zone 1	5876	Zone 3	5926	Zone 5	5976
Zone 2	5901	Zone 4	5951		
Idaho, East	3701	Central	3726	West	3751
Illinois, East	3776	West	3801		
Indiana, East	3826	West	3851		
Iowa, North	3876	South	3901		
Kansas, North	3926	South	3951		
Kentucky, North	3976	South	4001		
Louisiana, North	4026	South	4051	Off Shore	6426
Maine, East	4076	West	4101		
Maryland	4126				
Massachusetts, Mainland		4151	Island		4176
Michigan, East (Transverse, old)		4201	West (Transverse, old)		4251
Central (Transverse, old)		4226			
Michigan, North (Lambert, current)		6351	South (Lambert, current)		6401

Central (Lambert, current)	6376				
Minnesota, North	4276	Central	4301	South	4326
Mississippi, East	4351	West	4376		
Missouri, East	4401	Central	4426	West	4451
Montana, North	4476	Central	4501	South	4526
Nebraska, North	4551	South	4576		
Nevada, East	4601	Central	4626	West	4651
New Hampshire	4676				
New Jersey	4701				
New Mexico, East	4726	Central	4751	West	4776
New York, East	4801	West	4851	Long Island	4876
New York, Central	4826				
North Carolina	4901				
North Dakota, North	4926	South	4951		
Ohio, North	4976	South	5001		
Oklahoma, North	5026	South	5051		
Oregon, North	5076	South	5101		
Pennsylvania, North	5126	Pennsylvania, South		5151	
Puerto Rico, (meters)	6026				
Rhode Island	5176				
South Carolina, North		5201	South	5226	
South Dakota, North	5251	South	5276		
St. Croix (meters)	6076				
Tennessee	5301				
Texas, North	5326	Central	5376	South	5426
North Central	5351	South Central	5401		
Utah, North	5451	Central	5476	South	5501
Vermont	5526				
Virginia, North	5551	South	5576		
Washington, North	5601	South	5626		

West Virginia, North	5651	South	5676		
Wisconsin, North	5701	Central	5726	South	5751
Wyoming, Zone I, East	5776	Wyoming, Zone III, West Central	5826		
Wyoming, Zone II, East Central	5801	Wyoming, Zone IV, West	5851		

Table 10. Sample dialogs for PROJECT

The sample PROJECT dialogs below provide examples for the projections supported by ALACARTE. PROJECT files are simply lists of the dialog responses, as shown for the first example. Prepare a PROJECT file in a screen editor or a word processor from which you can save an ASCII file. Many more options and projections are available for the PROJECT command in naked ARC/INFO than are described below (see the entry for PROJECT in the ARC/INFO Users Guide, Volume 1).

Lambert (to Albers)

Sample dialog	Sample projection file
Project: *INPUT*	*INPUT*
Project: *PROJECTION LAMBERT*	*PROJECTION LAMBERT*
Project: *UNITS METERS*	*UNITS METERS*
Project: *PARAMETERS*	*PARAMETERS*
1st standard parallel: *37 10 00*	*37 10 00*
2nd standard parallel: *37 50 00*	*37 50 00*
Central meridian: *-123 00 00*	*-123 00 00*
Latitude of projection's origin: *0 0 0*	*0 0 0*
False easting (meters): *0.0*	*0.0*
False northing (meters): *0.0*	*0.0*
Project: *OUTPUT*	*OUTPUT*
Project: *PROJECTION ALBERS*	*PROJECTION ALBERS*
Project: *UNITS METERS*	*UNITS METERS*
Project: *PARAMETERS*	*PARAMETERS*
1st standard parallel: *37 10 00*	*37 10 00*
2nd standard parallel: *37 50 00*	*37 50 00*
Central meridian: *-123 00 00*	*-123 00 00*
Latitude of projection's origin: *0 0 0*	*0 0 0*
False easting (meters): *0.0*	*0.0*
False northing (meters): *0.0*	*0.0*
Project: *END*	*END*

Transverse Mercator (to UTM)

Project: *INPUT*
Project: *PROJECTION TRANSVERSE*
Project: *UNITS METERS*
Project: *PARAMETERS*
Scale factor at central meridian: *1*
Longitude of central meridian: *-123 00 00*
Latitude of origin: *0 0 0*

False easting (meters): *0.0*
False northing (meters): *0.0*
Project: *OUTPUT*
Project: *PROJECTION UTM*
Project: *UNITS METERS*
Project: *ZONE 10*
Project: *XSHIFT 500000*
Project: *YSHIFT 4000000*
Project: *PARAMETERS*
Project: *END*

Oblique Mercator (to Geographic)

Project: *INPUT*
Project: *PROJECTION OBLIQUE_MERCATOR*
Project: *UNITS METERS*
Project: *PARAMETERS*
Enter projection type (1 or 2): *2* (Type 2 is where azimuth of central line is known)
Scale factor at center of projection: *.9999*
Longitude of projection's origin: *-133 40 00*
Latitude of projection's origin: *57 00 00*
Azimuth at center of projection: *36.87*
False easting (meters): *0.0*
False northing (meters): *0.0*
Project: *OUTPUT*
Project: *PROJECTION GEOGRAPHIC*
Project: *UNITS DD*
Project: *PARAMETERS*
Project: *END*

State Plane (to DNAG)

Project: *INPUT*
Project: *PROJECTION STATEPLANE*
Project: *UNITS METERS*
Project: *ZONE 3326*
Project: *PARAMETERS*
Project: *OUTPUT*
Project: *PROJECTION TRANSVERSE*
Project: *UNITS METERS*
Project: *PARAMETERS*
Scale factor at central meridian: *.926*
Longitude of central meridian: *-100 00 00*
Latitude of origin: *0 0 0*
False easting (meters): *0.0*
False northing (meters): *0.0*
Project: *END*

UTM (to Transverse Mercator)

1. Where UTM zone is known:

Project: *INPUT*
Project: *PROJECTION UTM*
Project: *UNITS METERS*
Project: *ZONE 10*
Project: *XSHIFT 500000*
Project: *YSHIFT 4000000*
Project: *PARAMETERS*

Project: *PROJECTION TRANSVERSE*
Project: *UNITS METERS*
Project: *PARAMETERS*
Scale factor at central meridian: *1*
Longitude of central meridian: *-123 00 00*
Latitude of origin: *0 0 0*
False easting (meters): *0.0*
False northing (meters): *0.0*
Project: *END*

2. Where UTM zone not known:

omit the zone statement

you will be asked for the location of any point in map:
Longitude: *-122 00 00*
Latitude: *38 00 00*

Albers (to State Plane)

Project: *INPUT*
Project: *PROJECTION ALBERS*
Project: *UNITS METERS*
Project: PARAMETERS
1st standard parallel: *37 10 00*
2nd standard parallel: *37 50 00*
Central meridian: *-123 00 00*
Latitude of projection's origin: *0 0 0*
False easting (meters): *0.0*
False northing (meters): *0.0*
Project: *OUTPUT*
Project: *PROJECTION STATEPLANE*
Project: *UNITS METERS*
Project: *ZONE 3326*
Project: *PARAMETERS*
Project: *END*

DNAG (to Oblique Mercator)

Project: *INPUT*
Project: *PROJECTION TRANSVERSE*
Project: *UNITS METERS*
Project: *PARAMETERS*
Scale factor at central meridian: *.926*
Longitude of central meridian: *-100 00 00*

Latitude of origin: *0 0 0*
False easting (meters): *0.0*
False northing (meters): *0.0*
Project: *OUTPUT*
Project: *PROJECTION OBLIQUE_MERCATOR*
Project: *UNITS METERS*
Project: *PARAMETERS*
Enter projection type (1 or 2): *2* (Type 2 is where azimuth of central line is known)
Scale factor at center of projection: *.9999*
Longitude of projection's origin: *-133 40 00*
Latitude of projection's origin: *57 00 00*
Azimuth at center of projection: *36.87*
False easting (meters): *0.0*
False northing (meters): *0.0*
Project: *END*

Geographic (to Lambert)

Project: *INPUT*
Project: *PROJECTION GEOGRAPHIC*
Project: *UNITS DMS*
Project: *PARAMETERS*
Project: *OUTPUT*
Project: *PROJECTION LAMBERT*
Project: *UNITS METERS*
Project: *PARAMETERS*
1st standard parallel: *37 10 00*
2nd standard parallel: *37 50 00*
Central meridian: *-123 00 00*
Latitude of projection's origin: *0 0 0*
False easting (meters): *0.0*
False northing (meters): *0.0*
Project: *END*

Map Registration

The registration of map information involves both the relative position of map elements between map layers, such as geology over a topographic base, and the assignment of absolute geographic coordinates to map elements. In work with conventional geologic maps, geologic features are located relative to features in a topographic base map and absolute geographic locations are typically determined only for selected points by measuring from the map in latitude/longitude or another coordinate system portrayed on the map.

In compiling geologic maps as digital databases, in contrast, every point and every vertex of every line is assigned an absolute location. The geographic coordinates of maps prepared in ALACARTE-ARC/INFO typically represent meters on the ground in a specified projection, although imported scans are initially in scanner dimensions, typically inches. Control on geographic registration and the registration between map layers is provided by digital registration tics (tics) that are assigned x,y addresses in a specified coordinate system. Although represented by absolute locations of high precision

in the map database, the locations of geologic features in a digital map can be no better than the accuracy and resolution of the base on which they were compiled. Attending carefully to registration issues will help maintain the accuracy of the source information.

The tics for maps started from the Setup bar in ALACARTE are assigned latitude/longitude addresses that are automatically converted to meters on the ground in the specified map projection. Maps entered from the digitizer can be registered to such a projected tic framework in the computer. Imported scans are registered geographically by placing digital tics at graphic registration marks of known location in the scanned image (typically latitude/longitude marks) and then transforming the map image into an equivalent set of projected tics (see *Projections*, p. 101).

The precision of location required to avoid perceptible misregistration between superposed map layers in high-quality plotting is about half a line width (0.003 inches on the map), which is more precise than is generally required for geographic location of the geologic features. Good registration between the geographic reference system and map images is also important if different maps are to be combined or if the map database will be used in analytic routines involving absolute or relative geographic locations.

Accomplishing good registration requires (1) precise identification of geographic references marks in the original map (the source for scanning or digitizing), (2) careful placement of digital registration tics at those registration marks in imported scans, (3) accurate registration of source maps on the digitizer, (4) preparation of subsequent layers with registration identical to the primary digital map, and (5) careful tracing, digitizing, and/or editing.

Registration and its adjustment in the computer can involve several different procedures: assigning registration according to graphic tics that are part of the map (generally latitude/longitude tics), transforming a map recorded in digitizer inches into projected tics, creating new map layers from existing maps, registering maps on the digitizer, and moving or distorting one layer relative to another.

REGISTERING IMPORTED SCANS

The best method of registering imported layers in a map is to assure that clear and precisely located graphic registration marks exist prior to import. These may be part of the original map image or, particularly for scanning, may have to be added by fine drafting or with stick-up. Each layer requires at least four outer registration marks, one near each corner, but as many internal tics should be included as possible to permit alternative use and checking of registration. This is not a matter that can be deferred until after a map has been scanned, because these graphic registration marks must be part of the scanned image.

Once a map image has been imported into ARC/INFO, the procedure is to move or place digital registration tics precisely at each of the graphic registration marks in the image and then to transform the map into a framework of projected tics. The Prepare Scan sequence of functions available from the Setup bar is designed to simplify this process.

Prepare a Projected Tic Framework

An empty framework of projected tics must be prepared to receive the transformed scan. This can be accomplished as part of the Transform step in the Prepare Scans sequence (**2. transform** on the Prep

Scans pulldown from the Setup bar), or can be done separately. The first part of the Transform step involves setting up a framework of projected tics with the same procedure used to start a new map. A location and projection are specified and a map boundary can be included (automatically tagged as map boundary), or an existing map can be specified as a template (but then a map boundary is not an automatic option). Note that this procedure requires that you have already repositioned the tics in the scan, either using the Assign Tics step or from the Tics bar. You can also prepare the tic framework by setting up a new map directly from the New Map pulldown or by preparing a new layer from an existing map from the New Layer pulldown from the Setup bar. By using these ALACARTE Setup functions, you will concurrently prepare the map database for the kinds of data the layer will contain. These procedures are described in *Start a New Map or Layer* (p. 93).

Assign and Add Tics

You can move, add, and renumber tics from the Tics bar, or can use the Assign Tics step in the Prepare Scans sequence (**1. assign tics**) if you only need to reposition the tics in the scan. To work from the Tics bar, choose the map in which you want to move the tics and, if appropriate, a background that you want to consult in the process, and then go to the Tics bar. The Assign Tics step provides forms in which to specify the edit map and any backgrounds.

Most imported maps will contain four arbitrarily located digital tics. Once the edit map is drawn on the screen, you should see these tics and their user ID numbers on the screen. (If you see no tics, be sure that the map really lacks tics by selecting All from the Tics bar and checking the size of the selected set). If there are no tics, or if you want more tics than are now displayed on the screen, you can add them from the Tics bar.

Move Tics

You will need to move the existing tics in the scan, and any that you add, so that they precisely match the location of the graphic registration marks in the scanned image. ALACARTE provides an efficient Move Tics routine that helps you reposition these tics over the graphic registration marks in the map image (**1. assign tics** on the Prep Scans pulldown from the Setup bar or **move many** on the Move pulldown from the Tics bar). The routine leads you to zoom in on and select the tics in turn, then progressively move the tic and zoom in closer until you are satisfied that you have located each as precisely as you can. You should seek to place each tic within 0.001 inch of the center of its equivalent graphic registration mark in order to avoid adding error to locations in the map.

The routine presumes that, with only the digital tics displayed, you can define a zoom box around each digital tic that will include the associated graphic registration mark. You should save any previous work before beginning, because if you miss including a digital tic in the zoom box, you will be stuck in an endless loop and will have to break out of the session.

When you move the tics, attend to the fact that the tic numbers in the scan must match the numbers of the equivalently located tics in the projected framework into which you will transform the scanned map image (see *Projections,* p. 101, for tic numbering pattern used by ALACARTE). It is easier to move the tics across the map image to their proper locations than it is to renumber them. This can be done as the first zoom box step for each tic in the Move Tics routine or by using **so** on the Tics bar to select each in turn and **move(S)** to move them near their target registration marks.

Once you have started the Move tics routine, you first define some draw parameters for the routine:

Draw arcs for initial display of entire map, <Return> = yes? - enter no; answer yes only if you must see the line work in the foreground map in order to fine the graphic tics; the time required to draw the whole map can be considerable.

Display background maps, <Return> = yes? - enter no; answer yes only if you want the arcs turned on in the background.

Set mapextent to the edit map, <Return> = yes? - enter yes; answer no only if you are prepared to enter the name of another map that should be used instead to define the map area to be displayed.

The tics will be drawn on the screen (and, if you indicated, the line work as well) and the first cycle of zoomin-and-move is started:

Now zoom in to area around first tic.
Be sure to include both the tic and the inked corner of the map.
Define the box - instruction for the Zoombox function

Follow the instructions by clicking a zoom box around both the first tic and the graphic registration mark to which you want to move the tic. Be sure to include the tic in the zoom box, as there is no way to get out of the routine gracefully if you have no tic to select in the next frame. Once the screen is redrawn, select the tic by clicking on it and then move the tic onto the registration mark:

Select the tic
Point to the feature to select - instruction for Select One
Now move the center of the tic to the map corner
Point to the coordinate to move from - instructions for Move
Point to the coordinate to move to

Now, do you want to zoom in again and place the tic more precisely? (It will generally take three or four zoomin-and-move cycles to place the tic within 0.001 inch of the registration mark on the map.) If you do, answer yes and then click a zoom box around the tic and the registration mark:

Zoom and move again? - answer *y*(es) or *n*(o)

Now zoom in closer. TIC should be within .001 inch of the corner.
(or about 0.5 meter on a 1:24,000 scale map)
Define the box - instruction for the Zoombox function

Now the routine offers the Distance function for you to measure the distance between the tic and the registration mark (click first on one, then the other); determine whether this move will place the tic within the needed precision, and close the Distance function with a *9*:

Now measure distance of tic from corner.
Press CONTROL-RIGHT_MOUSE_BUTTON to quit the distance command - enter a *9*
. . . Press any pair of Alphanumeric keys . . . (9 to quit) - prompt for the Distance function
Coordinate [coordinates of the click points]
Distance [distance between the click points]

Move the tic, repeat the cycle if necessary (usually three or four cycles will be needed) and then answer no when asked if you want to zoom and move again. There may be other tics to move, and you will then be asked:

Do again for another tic?

Answer *y*(es) and repeat the whole sequence until you have placed all the tics over their respective registration marks, then answer *n*(o) to quit the Move Tics routine.

Be sure to save your work.

Add Tics

You can add tics simply by picking **add** on the Tics bar and then clicking on the screen at the intended locations. The Add routine will use the User-ID number next in sequence above those of the tics already present in the map. To control the new tic numbers, reset the next User-ID number or change the numbers later. To reset the next User-ID number, start the Add routine, enter a *3* to obtain the prompt for a new User-ID number, and enter the number with which you want to start. When you hit <Return>, you will be returned to the Add prompt with the new number in place.

Match User-ID Numbers

Transforming a scanned image into a set of projected tics requires that the tics in equivalent positions in the input and receiving maps bear the same User ID numbers ($ID's). It is this equivalency that determines how the lines in the map image are placed in the blank projected layer. If they are not the same, change the numbers in the input layer (the scan) to match those of the projected tics in the receiving layer. Consult *Projections* for the way that ALACARTE numbers tics in the Setup routines or draw the receiving layer on the screen with Tic ID's on to determine the numbering.

Only the equivalently numbered tics will be used by the Transform function, and it is through the numbering of the tics that you determine which and how many tics will be used in the transform (see *Projections,* p. 101, for a discussion of the issues involved). You may want to use (that is, match the numbers of) only the corner tics, all the tics you have available, or some other set chosen to minimize transform error.

To change the numbers of the tics in the Edit Map, work from the Tics bar. Draw the map with Tic ID's on (set from the Draw/Back Environment menu).

Select each tic to be renumbered, one by one (**so** on the bar), and then change the number of the selected tic. Do this with **calculate** on the Database pulldown or from the keyboard at the ArcEdit command line (go there from the Commands popup):

ArcEdit: *calc $ID* = [*number*]

where *number* is the User-ID to be assigned to the selected tic.

Note that, because ARC/INFO does not tolerate duplicate tic numbers, changing the number of the selected tic to that of another tic will cause the latter to be deleted automatically. If this is a problem,

consider selecting whichever tics pose the problem and renumbering them in bulk; for example, by adding 100 to the numbers of the selected tics:

ArcEdit: *calc $ID = $ID + 100*

Change all the tic numbers as necessary and be sure to save your work.

Transform the Map

Once the tics are placed, numbered properly, and the result is saved, you are ready to transform the scan into the projected tics. Details of the transform function are described in *Projections*, which you should consult before proceeding.

You can use the Transform step in the Prepare Scans sequence, or you can use the Transform function directly (**Transform** on the Projection pulldown from the Conversion bar). The latter requires that a map with the desired projection and tics has already been prepared or can be copied from an existing map. Specify the scan as input and in one manner or other the map of projected tics as output, retain the default Affine option unless you specifically want to use the Projective option (see *Projections*, p. 101), and activate the function. If you are working outside the Prepare Scans sequence and have created a map boundary or have other map elements in the receiving map, be sure to save them separately (**Copy** on the Files pulldown from the General bar), because the Transform function will delete any preexisting elements other than digital tics in the output map. These separate elements can be added to the transformed map later (see, for example, *Add Lines*, p. 150).

REGISTER ON THE DIGITIZER

Mount your original on the digitizer. Place the map in a convenient position, but be sure that all of the map image is within the active part of the digitizer (the inactive margin can be several inches wide). Use the indicator light on the digitizing puck to determine where the active boundaries are. Start ALACARTE, specify your digitizer and tty line, and choose **digitizer** for the coordinate input device. Go to the Edit bar, choosing your map on the way. When the Snap report appears, check that the snap settings are appropriate for your purpose (see *Snapping*, p. 123).

If you are not sure how the tics in the digital map are numbered, draw the tics on the screen (turn Tic IDs on from the Draw/Back Environment menu and draw the map).

Start the Register Map routine (pick **register map** on the Map pulldown from the Edit bar), and enter the tic numbers and locations from the digitizer at the prompt:

```
Digitize a minimum of 4 tics.
Signal end of tic input with Tic-ID = 0
Tic-ID:
```

For each tic, first enter the tic number from the digitizing puck (puck indicator light must be on; tic number will appear after the Tic-ID: prompt on the screen), click *A* for enter (* will appear after the number), and then place the crosshairs precisely over the tic location on the map and click *1* from the puck to specify location. Position the crosshairs carefully before clicking the tic location, because the accurate location of the map elements that you are about to digitize will depend on the accuracy with

which you specify the registration tics. When you click the tic location, you will be prompted for another tic:

```
Tic-ID: 1*
Tic-ID:
```

Continue to enter the tics until you have specified at least four, preferably near the outer margin of the map or of the map area in which you plan to work. When you are finished, close the Tic routine by clicking *A* (enter) without first entering a tic number. The scaling factors and the RMS error resulting from this transformation between the tic locations just specified on the digitizer and those in the digital map will then be reported:

```
Scale (X,Y) = (1590.872,1583.733)  RMS Error (dig,map) = (0.002,2.577)
Hit <return> to continue:
```

It is important to keep the RMS error to 0.004 inches or less for most maps. If you get a higher error, reregister the map (pick **register map** from the Map pulldown again). If the error remains high after several tries, don't just proceed, get help if necessary and identify the problem (see discussion in *Projections*, p. 101).

EXAMINE THE REGISTRATION

Misregistration has two principal sources, mislocated tics (see *Projections*, p. 101) in the input map or disparity between bases. Other possibilities include misregistration in an earlier compilation step, operator error in numbering tics, and even use of the wrong projection. It is important to recognize that materials obtained from different base maps (and particularly from maps of different scales) are not likely to register in detail precisely. Such disparities must be addressed in compiling or comparing digital maps just as they must in conventional work.

The transform error (RMS error) provides the first test of registration, but you should also make visual checks wherever you have a basis for comparison. Work in Edit with the needed features turned on, include backgrounds as appropriate, and zoom in on available points of comparison. Distribute these throughout the map if possible, and record distance and direction of misregistration to allow later consideration of improving the registration. Compare the location of graphic registration marks and digital tics, both for tics that were used in the transformation and for tics that were not. Compare map elements of known relation between layers, such as contour crossings of drainage and the ends of contacts against water boundaries. Select one layer as the standard, if appropriate, and test other layers against it. The standard might be the layer with the smallest RMS error, the base to which everything else must be fitted, or a standard digital line graph.

Correction of misregistration can be straightforward or nearly impossible, depending on its source. As discussed in *Projections*, the location or selection of tics can be modified, or the Projective option for Transform can be used to force the four corners to fit exactly (but check the resulting fit of interior tics). The comparisons may suggest a systematic shift or rotation of the map relative to its tics that would improve registration, or improve it in a critical part of the map at the expense of less important parts. Disparities between original bases may require that material be refitted to the new base, either by hand editing or by local distortions imposed with the rubbersheeting function ADJUST.

MOVE THE MAP

Any systematic disparity in registration between two layers that involves an x,y shift or simple rotation of the map image can be corrected. Even if the disparity is only approximately systematic, the registration may be improved significantly by moving one layer relative to another.

Linear Shift

The various elements of a map can be shifted in x and y relative to the digital tics or to another layer. Work from the bar appropriate for the kind of feature involved and put the layer to be shifted in the foreground over the reference layer in the background. Note that if the map contains more than one kind of feature (lines and polygon label points, for example), each will have to be moved separately.

Select a place in the map where the shift can be precisely defined on the screen and zoom in to permit the shift to be specified by clicking *from* and *to* points on the screen. Select the whole foreground map (Select All, with Autodrawselect turned off) and then pick **move(S)** on the Copy pulldown. Specify the *from* and *to* points carefully, and the whole map will then be moved, element by element, as just prescribed (for a large map, this can take a while).

Work on a copy of your map, or save the reregistered map as a new version in case you later want to return to the unmodified version of the layer.

Rotation

The various elements of a map can be rotated in x and y relative to the digital tics or to another layer. Work from the bar appropriate for the kind of feature involved and put the layer to be rotated in the foreground over the reference layer in the background. Note that if the map contains more than one kind of feature (lines and polygon label points, for example), each will have to be moved separately.

Compute the needed angle of rotation from the size of the maximum shift and the length of the rotation bar (measure that length on screen with the map drawn at small scale using **distance** on the Options pulldown). Note that the whole map will be rotated the specified angle around the rotation point.

Set the angle (**setangle**; positive angles rotate counterclockwise), select the whole foreground map (Select All, with Autodrawselect turned off), and then rotate the map (**rotate(S)**). Specify the rotation point on the map by clicking on-screen (whole-map view or zoomed in on that spot for accuracy) or on the digitizer, and the whole map, element by element, will be rotated as just prescribed (for a large map, this can take a while).

Work on a copy of your map or save the reregistered map as a new version in case you later want to return to the unmodified version of the layer.

DISTORT THE MAP

The Rubbersheeting function in ARC/INFO (ADJUST) is not automated in ALACARTE. You will need to consult the ARC/INFO manual and/or an expert user for help with this. You will find that the Adjust function can be used effectively to distort local parts of your map, but will not distribute distortions for large distances across the map.

Snapping and Other Controls

Various snapping and processing controls and spacing parameters can be set for use during an edit session or recorded for later use with a map. These settings bear largely on lines and determine whether and how various functions operate during work on a map. Snapping is activated by such functions as digitizing or copying a line or moving a selected set. To deliberately apply the current snap settings to a selected set of lines, use **move in place** (on the Reshape pulldown from the Reshape bar).

SNAPPING

Because of the high precision with which ARC/INFO records the location of map elements and their parts, gaps and overlaps in line work and other differences in location that are too small to see at map scale can be significant for map topology. This is particularly important in working with lines that will form the boundaries of polygons, which must be precisely closed. Functions are available to automatically snap these mislocations and overlaps together. Various settings under your control determine whether they operate and over what distances the snapping will occur. Store the settings for a map in its ALACARTE setup file for automatic inclusion in each edit session and then override those settings where necessary for particular operations. A setup file is created for a map when it is started from the Setup bar (see *Start a New Map or Layer*, p. 93) or can be saved with the current settings at any time from the Edit bar.

The selection of snapping values will depend on the requirements of each map and, in some circumstances, on the particular operation being performed on the map. The snapping functions are activated only for particular operations such as digitizing new lines and moving existing ones, and can be deliberately activated by selecting the target lines and then picking **move in place** (on the Reshape pulldown form the Reshape bar).

The various snapping functions operate on a newly digitized line in the following sequence: (1) Nodesnap will try to snap the ends of the new line to any nearby nodes, (2) Arcsnap will try to snap each end of the new line to the closest existing line within the snapping distance, (3) Intersectarcs will create a new intersection if the new line crosses another and extends beyond the snapping distance, and (4) Nodesnap will try to snap such a new node to any nearby nodes.

It is also possible in ARC/INFO to snap elements in the edit map to specified features in other maps, although the functions are not automated in ALACARTE.

Intersectarcs

The Intersectarcs function determines whether a node and associated intersection will be created where one line is placed across another. It can be left OFF, limited to newly digitized lines (ADD), or applied to all lines that are digitized, moved, or otherwise manipulated in a way that requires the arc coordinates to be edited (ALL). For most work with geologic maps, the ALL option should be used.

Arcsnap

The Arcsnap function snaps nodes to nearby arcs where an end (node) of a line being digitized is placed within snapping distance of any part of an existing line. Arcsnap can be either ON or OFF

and requires a distance to be specified to indicate over how large a distance such snapping will occur. This distance is measured along the trajectory defined by the outer two vertices at each end of the new line. The function, which operates only on newly digitized lines, automatically closes small gaps and removes small overlaps by connecting the new line precisely to an existing line within the snap distance. The resulting node splits the preexisting line.

Arcsnap should be used in digitizing geologic maps to assure clean line intersections. Use a snapping distance equal to two or three line widths on the original map (typically 0.02 - 0.04 inches). Once a line exists (has been digitized or scanned and imported), Arcsnap has no application. The equivalent operations are then more complicated (see *Edit Lines*, p. 135). Note the implication for digitizing strategy: enter the crosscutting line first, then the line to be snapped to it.

Nodesnap

The Nodesnap function snaps nodes together where they are placed within snapping distance on the map. Nodesnap can snap to the first node found within the snapping distance (FIRST) or take the time to search for the closest node within the snapping distance (CLOSEST), and requires that a search distance be specified. The function operates when lines are newly digitized, when they are moved, copied, or rotated, and when nodes are moved. Note that Nodesnap will try to snap both ends of such lines; when you move a node at one end of a line, the other end may snap as well.

Use Nodesnap in digitizing and editing geologic maps to assure precise connection between lines, except where the closely spaced ends of lines should remain separate. Typically, a good snapping distance equals two or three line widths on the original map (0.02 - 0.04 inches).

Bulk activation of Nodesnap in a map can be accomplished with the Matchnode function (see *Edit Nodes*, p. 136).

Extend

The Extend function can be used to snap the ends of existing lines to nearby lines in a fashion similar to Arcsnap where the end of the line falls short and leaves a gap. (Note that Extend can lengthen a line to snap an intersection, but cannot shorten it.) Extend can be applied to a selected set or to a whole map as part of the Clean function. Extend can be applied to BOTH ends of the line(s), to the FROM or the TO end(s) only, and requires a search distance to be specified (in map units). These settings can be stored as the default for the Extend option used with the Clean function, for which a conservative distance of 0.05 inches might be appropriate. Extend can also be applied to a selected set with a specified snap distance from the Reshape (Lines) bar.

Set the Snapping

The settings for the various snapping functions can be set and stored in the setup file as part ofthe New Map and New Layer sequences and with Step 3 (**create setup file**) of the Prepare Scans sequence in Setup (see *Start a New Map or Layer*, p. 93). These settings will then be automatically established each time the map is opened in Edit. Settings can also be established (or changed) from within Edit using the Snap forms menu (**set snap** on the Snap pulldown from the Lines bar), or by copying the setup file of another map (**use setup** on the Save pulldown from the Edit bar).

Edit Tolerances Menu

This menu appears as part of the Setup sequences to allow you to store default tolerances with your map:

Set default edit tolerances for this map:

	meters or inches	
weed tolerance	*1*. *0*	- keep small (as, *0-1* meter).
intersectarcs	*ALL*	- use *ALL* for most work.
arcsnap distance	*12* . . . . . *.02*.	- typical value: 0.01-0.03 inches.
arcsnap type	*ON*	
nodesnap distance	*12* . . . . . *.02*.	- typical value: 0.01-0.03 inches.
nodesnap type	*CLOSEST*	- generally use *CLOSEST*.
extend distance	*12* . . . . . *.02*.	- as above, or set in Edit**.**
extend direction	*BOTH*	
edit distance	-1	- retain -1 here to establish the default.

ok help cancel **Map scale =** 24000

Enter the distances in meters or in inches (ALACARTE will recalculate in meters). Enter *?* or click the middle mouse button in the other blanks to pick an option from a subordinate menu.

Snap Menu

Open this menu with **Snap** on the Lines bar to view or change settings during an edit session:

Set arc and node snapping tolerances and related settings for this map:

	meters on ground	or inches on map	or with MOUSE
weed tolerance	*0*	*0*	*
intersectarcs	*ALL*		
arcsnap type	*ON*		
arcsnap distance	*12*	*0.020*	*
nodesnap type	*CLOSEST*		
nodesnap distance	*12*	*0.020*	*
grain	*30*	*0.050*	*
edit distance	*-1*	*-1*	*

set all to ALACARTE defaults for current map scale: DEFAULTS

Current map scale = 1:24000
Set current map scale: 1: *24000* **(0 = unknown)**

ok help cancel

This menu differs from the Edit Tolerances menu in permitting distances to be entered by clicking on the screen. Set those functions and parameters of interest from the menu and then establish them for the edit session with the **ok** button. Enter the distances in meters or inches (Alacarte will convert to meters) or click on the appropriate star (*****) and click the distance on the screen. Enter *?* or click the middle mouse button in the other blanks to pick an option from a subordinate menu. Pick the **DEFAULTS** button and enter a distance in inches at the prompt to set all the distances at once to the same value (except Edit Distance). Then change any entries that should be different. Once activated with **ok**, these settings will apply to the current edit session (unless changed), and can be saved in the setup file for the map with **save settings** (on the Save pulldown from the Edit bar).

Copy a Setup File

The setup file for another map can be used to set the snapping for the current edit map by picking **use setup** (on the Save pulldown from the Edit bar) and then specifying the other map. This can then be saved as a setup file for the edit map with **save settings** (on the Save pulldown from the Edit bar).

SPACING CONTROLS

Three different parameters are used to control the spacing of vertices in digitizing lines and applying the Density, Spline, and Generalize functions.

Weed Tolerance

Weedtolerance is the parameter by which you specify how closely points or vertices can be placed on the map: ARC/INFO will reject any point or vertex (other than the terminating node) that you try to place closer than the Weedtolerance to another. Weedtolerance is also the default constant used by the Generalize function in simplifying a line. To retain maximum control in digitizing geologic maps, set the Weedtolerance to a very small value (0 - 1 in map units). Such a value will be too small a distance for most applications of Generalize.

Grain

Grain is a distance parameter used to determine the spacing between vertices for the Spline and Densify functions. Set it to an intermediate value of 0.1 inches in the setup file but note that, because theses functions are quite sensitive to its value of Grain, you may want to experiment with it for specific applications.

EDIT DISTANCE

The distance from the clickpoint over which map elements are sought in such functions as Select Many and when choosing nodes to be moved (the edit distance) can be specified or be left to vary with screen magnification (zoom). A setting of -1 in the setup file will cause ARC/INFO to calculate the

edit distance from the size of the draw area (mapextent), and will thus produce an edit distance of constant screen dimension. This default setting can be overridden by assigning a constant distance in map units that will apply regardless of screen magnification. Once such a distance is assigned in an edit session, the default behavior cannot be recovered, except by reopening the map. It will thus be more satisfactory in most work with geologic maps to avoid assigning an edit distance for the setup file, to give you the option of using the default behavoir. Where required, a specific map distance can be assigned during any edit session from the Snap menu (Lines bar).

If, for any reason, the edit distance recorded in the setup file is not -1, that default setting can be restored to -1 in the Snap menu (**set snap** on the Snap pulldown) and then saved to the setup file (**save setup** on the Save pulldown from the Lines bar). You will then need to leave Edit by going back up to the Alacarte bar and, then return to Edit and reopen the map, in order to activate the default setting for Edit Distance.

PROCESSING TOLERANCES

Limits on acceptable digitizer registration can be applied automatically where appropriate and default values for parameters used by the Clean function can be stored for default use.

Precision of Registration

When a map is registered on a digitizer (see *Map Registration*, p. 115), ARC/INFO calculates the precision of fit between the tic positions that you enter from the digitizer and those recorded in the digital map. This fit is reported as an RMS error in both map units and digitizer inches (see *Projections*, p. 101). It is important that this error be kept very small, typically 0.003 inches or less, in order to maintain adequate registration. The Tic MatchTolerance, when set, will prevent use of a registered map for which the RMS error exceeds the tolerance value. This can be useful in some circumstances, but overriding this constraint is inconvenient and for most work you can avoid setting the Tic Match Tolerance and make the decision of whether or not to proceed yourself. In doing so, be sure to stop and identify the problem if the error remains too high after repeated attempts to register your map.

Fuzzy Tolerance

The fuzzy tolerance controls the resolution at which map elements are restored during operation of the Clean function. Because repeated cleaning can cause locations of elements on the map to move, the fuzzy tolerance should be kept very small. The smaller the tolerance is, however, the longer the processing of the map will take. An appropriate compromise is the input resolution of most digitizers of 0.001 inches. Do not use 0 or leave the entry blank in the menu, because the smallest value ARC/INFO will accept is 0.0001; smaller values will activate a default that may be too large (see *Clean*, p. 57).

Dangle Tolerance

The Clean function contains an option to delete all dangling lines automatically that are less than a specified length. Because most geologic maps properly contain numerous dangling lines, caution should be used in deleting dangles automatically. Set and store an appropriate dangle tolerance (in

map units) as a default. You may prefer to use 0, or a small value equal to several line widths (0.02 - 0.04 inches). this default value can be overridden when you fill out the Clean forms menu for use.

Topology Tolerance Menu

This menu appears as part of the New Map routine to allow you to store default tolerances with your map.

Set default topology tolerances for this map, in meters:

	meters	**or** **inches**	
fuzzy tolerance	. . . . .	. . . . .	- typically use 0.001 inches.
dangle tolerance	. . . . .	. . . . .	- typically use 0.
tic match tolerance	. . . . .	. . . . .	- typically leave blank.

ok help cancel **Map scale =** 24000

Enter the distances in meters or inches (ALACARTE will recalculate in meters). Enter ? or click the middle mouse button in the other blanks to pick an option from a subordinate menu.

Digitize Lines

Tracing lines by hand on a digitizer is the most direct method of entering line work. It has the advantage of producing clean line work that will require little additional editing and can be tagged during digitizing. It has the disadvantage of being a tedious and demanding process that, unless the tracing is precise, is likely to introduce small errors in line shapes and positions. Where a scanner is available, line entry by scanning and on-screen editing is an alternative that should be considered, particularly for large maps (see *Process and Edit Scans*, p. 155). Hand digitizing can also be done on screen, either by tracing a scanned image displayed in the background or by mapping directly onto a digital base in the background.

The digitizing procedure involves preparing the original, attaching it to a digitizer, registering the map from the digitizer for ARC/INFO, and tracing the lines by clicking control points (vertices) with the digitizing puck (ARC/INFO does not accept stream-mode input). Tracing a scan on screen will require an imported scan that can be properly registered. While the lines are being traced they can be assigned line types concurrently, simply by setting the current line type (such as Contact, certain). Clean connections between lines can be created automatically through effective use of the snapping functions.

If you are just beginning the map, you will need a tic framework into which to digitize the lines (see *Start a New Map or Layer*, p. 93). Attend carefully to registration between the source map on the digitizer (or as a scanned background) and the digital version (see *Map Registration*, p. 115). Set up the digital map for lines (such as **faults, contacts, units**), or otherwise assure that it has been built for lines (has an AAT) and that this has had the item LTYPE added to it (automatic for maps started in Setup for lines, otherwise use **Add ALC items** on the Files pulldown from the General bar).

For digitizer input, mount your original on the digitizer, identify the digitizer in ALACARTE and set the input device to digitizer, and register you map (see *Register on the Digitizer*, p. 120).

CHECK THE SNAPPING

You should assure that the snapping is set properly. During digitizing you want ARC/INFO to recognize line intersections automatically and to make the small snapping adjustments that will close tiny gaps and remove tiny overlaps between adjoining lines. Correcting these small but critical departures from precise junctions is more difficult later. The Setup file created when the digital map was begun from the Setup bar recorded the snap settings that you specified, and these will be reset and reported when you choose the map for editing (which includes new input as well as modification of existing map elements).

Check the Snap report to assure that you have chosen the right map and that the snapping is set properly for digitizing. You can check or change the snap settings at any time in the forms menu obtained with **set snap** (on the Snap pulldown from the Lines bar), and can check them with **show snap**. For hand digitizing, the snapping tolerances should be approximately:

Weedtolerance	very small, to give you control over tight places (0 - 0.001 inch)
Intersectarcs	ALL
Arcsnap, type	ON

Arcsnap, distance	2 or 3 line widths, 0.02 - 0.04 inches
Nodesnap, type	CLOSEST
Nodesnap, distance	2 or 3 line widths, 0.02 - 0.04 inches
Grain	select by experimentation if you plan to spline the lines.

If the snapping is not set properly, reset it, and if your map does not have a setup file, set the snapping as desired and then save those settings to a setup file (see *Snapping and Other Controls*, p. 123).

SET LINE TYPE

Before you begin entering lines, decide how you want to tag them. ALACARTE maintains a current line type with which each new line is automatically tagged as it is digitized. These line types are recorded in the map database (in the LTYPE item) and can be used later to characterize the lines for analysis or assignment of line symbols in plotting. Line types can be changed at any time, either individually or as sets, simply by selecting and retagging them.

The Digitize Lines bar provides standard geologic line types in menu form and allows any characterization to be entered from the keyboard or from custom tagging menus that have been previously prepared. The central five items on the Digitize bar (**C**, **F**, **A**, **O**, and **Mod**) open pulldowns that control the setting of the current line type:

[Dig] | dig | tag | Sel | ? | C | F | A | O | Mod | Op | Dw | Zm | ^LINES |

C: Contacts	**F**: Faults	**A**: Fold axes	**O**: Other lines	**Mod**: Modifiers
contact	**fault**	**fold axis**	**no attribute**	**certain**
	normal	**syncline**	**map boundary**	**approx. located**
	attenuation	**synform**	**water boundary**	**inferred**
	thrust	**anticline**	**glacier bndry**	**inferred ?**
	reverse	**antiform**	**scratch bndry**	**concealed**
	strike-slip	**monocline**		**concealed ?**
	" dextral			**gradational**
	" sinistral			
other contact	**other fault**	**other**	**other fold axis**	**other**
				none
			custom menu 1	**custom menu 1**
			custom menu 2	**custom menu 2**
			custom menu 3	**custom menu 3**

The default line type is Contact, certain, which is set when you first go to the Digitize Lines bar. Determine the current line type at any time by picking **?** on the bar. The line type consists of two parts, the principal line type and a modifier, which are set separately. Set the principal part first by picking the appropriate menu item, and then set the modifier. Where the standard types are not satisfactory, enter any string of characters from the keyboard (up to 35 characters) with **other**, or prepare one or more custom menus (see *Custom Tag Menus*, p. 82) and open them with **custom tag menu 1**, etc. The default modifier certain is applied automatically (except to custom types) whenever the principal type is reset. The new line type is reported after each change. Where you want to use non-standard types, it may be more efficient to use standard types initially and then change them later. This can be done by selecting by line type and then retagging the selected sets with the custom types.

ENTER LINES

With the line type set for the first suite of lines to be entered, start the Digitize Lines routine (pick **dig** on the Digitize bar). A key menu will be presented, preceded by a report of the current line type (attribute) and followed by the prompt to enter a line:

```
Adding lines with attribute: contact, certain
--------------------Options--------------------
1) Vertex          2) Node              3) Curve
4) Delete vertex   5) Delete arc        6) Spline on/off
7) Square on/off   8) Digitizing Options  9) Quit
(Line) User-ID: 1 Points 0                        - prompt for new line.
```

ARC/INFO uses the next User-ID number ($ID) in sequence for the next line (the line about to be entered), and reports the present number of vertices in that line (Points).

To enter a line, place the crosshairs of the digitizer puck over one end of the line on the digitizer and click a *2* (node), move the crosshairs along the line and click vertices (*1*'s) as appropriate to define the line, and click another *2* at the far end to complete the line. The number of points reported will increase as you click the vertices, and entering the final node will cause the line and its line type to be recorded and the line to be drawn on the screen. The prompt for entering the next line will appear automatically with the User-ID increased by 1. Enter as many lines as you choose in sequence, and then close the Digitize routine by entering *9*.

When the routine is closed, all the newly entered lines will remain selected. Be sure to make a new selection if your next step is not to apply to all these lines. Typically, however, your purpose in returning to the Digitize bar will be to change the current line type, after which you will restart the Digitize routine and enter more lines.

Remember to save your work at regular intervals.

The key menu offers several options in addition to entering nodes (*2*) and vertices (*1*) and closing the Digitize routine (*9*). You can delete the last vertex entered with a *4*, but be careful not to lose your place on the digitizer. Similarly, you can cancel the current line with a *5*. Once you have ended a line with a node, however, it can be deleted only by closing the Digitize routine and separately selecting and deleting the line. The square and curve options are not particularly useful for the basic line work of geologic maps and are not discussed. The Spline function may be used to advantage in producing smoothly curved lines, but will require experimentation for effective use (see *Reshape Lines*, p. 149).

A key menu of digitizing options can be opened from the Digitize key menu by entering an *8*:

```
-------------------------DIGITIZING OPTIONS-------------------------
1) New User-ID       2) New Symbol        3) Autoincrement OFF
4) Autoincrement ON  5) Arctype line      6) Arctype box
7) Arctype circle    8) Arctype centerline 9) Quit
---------------- Enter Option
```

The principal use of this menu with geologic maps is to reset the next User-ID number. You might want to do this where you are using that number as a record of some kind (this application of User-ID

is more common for points). Once reset, the User-ID will increase progressively from the new number as you add lines, unless you turn Autoincrement off (*3*). To reset the User-ID, open the Digitizer Options menu, enter a *1*, then enter the new number. You will be placed back at the prompt to enter a line with the new User-ID in place.

DIGITIZING TECHNIQUES

It will pay to plan ahead. Make a transparent overlay on which to plan and monitor your work. Examine the map, decide what types of lines to distinguish, and list them on the overlay. Plan to enter the long continuous lines, such as alluvium boundaries, first, and then add the connecting and cross-cutting lines. Plan to enter a series of lines of the same type before changing line type to minimize the time spent changing line types.

Overlay

Prepare a transparent overlay registered to your map on which you can write with a pencil. Make an informal explanation on this overlay of the different line symbols on the map and how you plan to tag them (such as Contact, certain for a thin, solid line). Mark on the overlay precisely where you will place the breaks to change line type (such as a change from solid to dashed fault) and where you will start and end lines that close on themselves (island polygons). This can be done all at once or progressively as you work. You will use these marks as you digitize to control where you start and end line segments.

Mark up the overlay as you work. Mark each line on the overlay after you enter it to avoid digitizing lines twice and to help assure that you digitize all the lines in the map. It can be useful to do this in color and to change the color after each save, particularly to aid recovery in the unlikely event that a malfunction causes you to lose the lines entered since your last save. Make note here of questions about the map that arise during digitizing to help you find and resolve them later. You will find that digitizing a map leads to a scrutiny of its fine detail that may exceed even that given by its author.

Sequence

The sequence in which you enter the lines can make quite a difference both in your efficiency and in the amount of later editing required to assure closed line junctions. Plan your work to enter as many lines of one type as possible before returning to the Digitize bar to change line type. You can limit the lines you digitize in one group to lines of the current line type, or digitize all the lines in an area together with that line type and then change those that should be other types later (be sure to note these on the overlay as you work).

A new line will snap to a preexisting line only if the new line is ended within snapping distance of the other. The stem of a T-shaped line junction, for example, will snap to the cross bar only if the crossbar is present when the stem is entered. It is important, therefore, to enter the long, continuous lines, such as alluvium boundaries, before entering those lines that join and terminate at the continuous lines. Lines that don’t snap together properly during digitizing can be fixed later during editing, but it is easier to organize the initial entry of lines to accomplish the snapping while digitizing.

Overlap for Snapping

Snapping of line junctions is best assured where the lines to be joined are overlapped or crossed slightly, but less than the snapping distance. Even where the snapping distance is exceeded and small tails (dangles) are created, it is easier to remove them during editing than it is to extend and join unconnected lines. Place the node that defines a line end slightly across the node or line to which it should snap. Where a line terminates at the end of another line (as for a change in line type), cross that end node onto the adjoining line about a line width; where the line ends at another line (as in a T-shaped intersection), cross to the far edge of that line with the final node.

Placing Vertices

The key to good hand digitizing is skillful placing of the vertices that define the lines. This is just as much an art as is inking or scribing lines, except that slowing the rate of entry does no damage and can greatly improve results for the unskilled operator. The goal is to place a sequence of vertices down the precise center of the original line with the spacing between the points an appropriate function of the varying curvature of the line.

Take the time to arrange that you are comfortable at the digitizer and that lighting is satisfactory. Hold the digitizing puck and attached wire to allow smooth and uninterrupted movement over the map. Assure that you can click the necessary buttons easily while moving the puck along the lines. Practice to decide whether you will vary the spacing of vertices by changing the speed of the puck or the rate of clicking points.

Because a vector line consists of a sequence of points connected by straight line segments, unless you want some part of a line to be straight, you must place one or more vertices to shape it. The more tightly curved a line, the more vertices you will need to define a smooth curve. Placing too many vertices will do no harm, whereas too few will produce an angular shape. The actual spacing that you use will be a compromise between speed and ease of input and assuring smooth line shapes, and will require a bit of experimentation. Digitize a few test lines of different curvatures and then look at them on the screen at a magnification of about twice the intended scale (use **draw to scale** on the Zoom menu).

On-Screen Display

It can be helpful to display on the screen the area of the map on which you are working, in order to see the lines you are entering. Use the Zoom Box function (Zoom menu) with the coordinate device set to digitizer to specify an area from the digitizer for display. It can also be useful to color all the previously entered lines, perhaps according to line type.

Immediate Editing

There will be occasions where you make mistakes in digitizing that should be corrected. The best time to do that may be immediately, while you know what and where the problem is. It is easy to close the Digitize routine (enter a *9*) and return to the Digitize bar, go to the Reshape bar, change the coordinate device to mouse (open the Options pulldown, pick **change coord device**, and then pick **mouse**). Save the current draw area (**save this frame** on the Zoom popup) and then zoom in on the problem

(**zoomin(box)**) and fix it (see *Edit Lines, p.* 135, for techniques). When you have finished correcting the error, **redraw saved frame** from the Zoom popup, change the coordinate device back to digitizer, and go back to the Digitize bar to continue entering lines. If the easiest way to fix the problem is to delete one or more lines and reenter them, you need not go to the Reshape bar: **select many** and **sel polygon** are available on the Select pulldown from the Digitize bar and **delete(S)** is on the Options pulldown.

Edit Lines

Various functions are available for editing lines that support both the detailed modification of line shapes and connections and the manipulation of intact lines. These functions can be used to clean up imported scans, to repair problems in hand-digitized maps, or to modify, revise, or simplify line work. Most editing is handwork carried out interactively on screen. Some bulk processes are available that are typically applied before hand editing, if at all (see *Bulk Processing*, p. 157); be sure to operate on a copy of your map and examine the results carefully for unwanted effects.

The functions for modifying lines are located largely on the Reshape bar and the subordinate Nodes bar. Work on the screen with a continuous line symbol (the default in Edit) except when editing for graphic effect. Be sure to save your work frequently. Computers and computer programs do fail occasionally, and it is far less onerous to stop and save every 45 minutes or so than it is to redo a whole morning's work.

TRACKING PROGRESS

It is easy to lose track of what has and has not been done when you are editing a map. You can work systematically around the map using the zoom functions, or make an edit plot and check off items as you work. More directly, you can color map elements according to their status in the editing sequence. If the line work is tagged, the colors can be assigned according to line type. In editing a scan, where lines are being tagged as they are edited, coloring the lines by line type will both indicate which have been edited and tagged and aid in reading the lines as a geologic map.

Color Lines

Color a line by selecting it and then assigning a session color to the selected set (pick **$Symbol(S)** from the Draw menu and then pick from the Colors popup that follows). In working on a scan, complete the editing on a group of lines, then set the current line-type appropriately and use **sel,tag,color** (on the Select pulldown from the Digitize bar) to select the lines, tag them with the current line type, and then color them by picking from the Colors popup that automatically follows.

Save and Restore Symbols

Session colors must be deliberately saved or they will be lost when you save the map or close an edit session. Similarly, they must be reassigned at the beginning of each edit session or they will be lost the next time you save with Save Symbols on. With maps for which you are saving color symbols, start each edit session with two essential steps: (1) turn Save Symbols on and (2) reassign the colors saved at the end of the last session.

Turn Save Symbols on by picking **save symbol?** on the Save pulldown from the Edit bar and entering *yes* at the prompt. Then, every time you save your work during that session, the colors will be saved and then automatically restored after the save. Reassign the saved colors before starting work in a new edit session by picking **restore save** from the bottom of any Options pulldown. Note that if, in a new edit session, you assign some new colors and then remember to restore the previously saved ones, the new assignments will be lost.

The colors are saved in the database item SYMB, which must be in the database before you can begin saving colors for the map. Include the addition of symbol and select items when you first set up the map, or add the items to an existing map (**Add save items** on the Files pulldown from the General bar).

EDIT NODES

Nodes form the ends and interconnections of lines and can be moved, snapped together, disconnected, and added to lines. They can be displayed on screen or in edit plots to aid the identification of problems that require correction. Nodes are addressed largely from the Nodes bar, which is reached by picking **N** at left center on the Reshape bar:

[Nodes] | move | Snap | Symb | Op | Dw | Zm | ^RSH |

Snap pulldown:

nodesnap first *
nodesnap first distance
nodesnap closest *
nodesnap closest distance

Symbols pulldown:

Nodecolor:
show
node
dangle
pseudo

Nodesize:
show
node
dangle
pseudo

Nodes are parts of lines, rather than independent database features, and can be selected only during the Move Nodes routine or as the end vertices of a selected line. No information can be attached to nodes in the database in version 5.0.1 of ARC/INFO.

Display Nodes

All nodes can be displayed on-screen simply by turning Nodes on from the Draw/Back Environment popup and redrawing the screen with any Draw or Zoom function. Those nodes at the unconnected ends of lines can be selectively displayed by turning Dangles on. Similarly, those nodes that connect adjacent segments in otherwise continuous lines (a connection between two line segments) can be displayed separately by turning Pseudonodes on. Pseudonodes and dangles can be displayed together with different symbols with Node Errors. Although they are not necessarily errors in geologic maps, checking pseudonodes and dangles is an effective way to find line interruptions that should, or for polygon definition must, be repaired.

It is helpful while editing to use Node Errors routinely to show where connections are broken and where lines have gaps or are split by pseudonodes. Be aware, however, that drawing maps with many lines at small scale with Node Errors on can nearly double the draw time and largely obscure the lines with node symbols.

Dangling nodes and pseudonodes can also be displayed with different symbols on edit plots (answer *yes* to the Node Error question; see *Edit Plots,* p. 193).

Node Symbols

The size and color of the symbols used to display all nodes, dangles, and pseudonodes can be controlled from the Node Symbols pulldown. Change the symbol from the default of white by picking the appropriate node type under **Nodecolor:** and then specifying a color from the subsequent Colors popup. Similarly, change the symbol size from the default of 0.1 inch by picking a node type under **Nodesize:** and then entering the desired size at the prompt (specify in inches on the screen).

Nodesnap

Nodesnap can be set (or reset) either from the Snap pulldown (Lines bar) or from the Snap pulldown from the Nodes bar. Unless Nodesnap is set, nodes will not snap together when you try to join them. When you choose maps that have setup files, Nodesnap will be set automatically to the function (Nodesnap First or Nodesnap Closest) and distance specified in the setup file. Set these properly there and you will generally not have to reset Nodesnap in Edit. The principal exception is when you need to prevent snapping of closely spaced line ends that should not be joined.

You should generally use Nodesnap Closest, in which a node will be snapped to its nearest neighbor within the snapping distance. Nodesnap First, which causes a node to snap to the first node encountered within the snapping distance, does not seem particularly useful for geologic work.

Use **distance** where you want to enter the snapping distance numerically (in map units) and use ***** where you want to click the distance on the screen. Set a distance that is small relative to the spacing of elements in the map but large enough to snap nodes moved when the map is displayed at your smallest working scale. Typically this is about 0.01 to 0.03 inches on the map at map scale.

Move Nodes

Nodes can be moved, and thus line intersections can be moved. The ends of all the lines connected to the node move with it. A node that is moved to a point within snapping distance of another while Nodesnap is on will snap to that node.

To move a node, go to the Nodes bar and pick **move** to start the Move Nodes routine. You will be instructed to:

```
Point to the node to move  <9 to Quit>
```

Click *1* on the node (at the intersection) and watch closely to be sure that the correct node blinks or becomes highlighted. The location of the selected node will be reported and then a key menu is presented:

```
Node  (9.446,14.462)  selected
1 = Select     2 = Next     3 = Who     4 = Move     9 = Quit
```

If the wrong node was selected, move the selection to the correct node by entering one or more *2*'s

until the selection moves to the target node. Once the correct node is selected, confirm with a *4*. You will be instructed to:

Point to where to move the node <4 - Restart, 9 - Quit>

Now simply click at the point to which you want the node to be moved. (Note that in contrast to the Move routines for lines, points, and annotation, no *from* point is specified when moving nodes.) The node and its connecting lines will be redrawn with the node at the new location. If a line is left behind (not redrawn), it was not connected to the node. This situation is easily recognized if dangles and pseudonodes are displayed.

You can move as many nodes as you choose in this fashion before closing the Move Nodes routine with a *9*. Be aware, however, that to remove the effect of one erroneous move with **oops** you must remove the effects of all the moves made while the routine was running. It is wise, therefore, to close the routine frequently, even if your next step is to move some more nodes.

A small group of extra lines (a clot) can be formed where you move a node across an internal vertex in a line with Intersectarcs on. These clots generally show on the screen as a slight thickening of the intersection. You can test for them by returning to the Reshape bar and clicking around the node with Select Polygon (**sp**). If any lines are selected, simply delete them (**delete(S)** on the Options pulldown). This generally leaves the intersecting lines connected, but if any dangles remain, snap the nodes together (see below).

If the nodes defining the ends of a short line are snapped together by moving one end onto the other, that line will be automatically deleted if it has no internal vertices. When you have snapped the nodes of such a line, the line will be deleted automatically and you will be warned:

WARNING Arc deleted due to size of snap distance.

If you have deliberately tried to remove such a line in this fashion, while repairing a line intersection, for example, be sure to check for this report. If it does not appear, then a clot of small lines has been formed. This can be selected and deleted, or it can be prevented in the first place by selecting and deleting the connecting line before moving the nodes.

Activate Nodesnap

Unconnected lines with dangling nodes within the snapping distance of any other node can be connected by selecting the lines and then moving them in place. To do this, select all the unconnected lines with **sm** on the Reshape bar, then use **move in place** (on the Reshape pulldown from the Reshape bar) to activate the snapping. All dangling nodes within snapping distance of each other will be snapped. Be sure to check the result by drawing again with Node Errors on, and note that you have no control over which node actually moves to the location of the other.

Matchnode

All dangling nodes in the whole map can be snapped within any specified distance using the Matchnode function. Use this where many tiny breaks are present in scanned line work, for example, but note that such bulk processing can have unpredictable results in some places. Some nodes may snap that should not be joined, and it will be uncertain whether the dangles will snap to each other or to a

nearby connected node. Dangling lines shorter than the snap distance will snap back on themselves, a circumstance that will pose problems in later editing (you can select for lines with lengths less than or equal to the intended snapping distance to test for this problem). Always specify a new output map when using Matchnode, because unsatisfactory effects imposed on your working copy cannot be removed except by hand editing.

To run Matchnode, open the Matchnode forms menu (pick **Match nodes** on the Files pulldown from the general bar):

Matchnode - match nodes within a coverage

<in coverage>	. . . . .
<out coverage>	. . . . .
<match tolerance>	. . . . .
{point coverage}	. . . . .
{NOEXTEND | EXTEND}	NOEXTEND

OK HELP CANCEL

Specify your working map as the in coverage, a new file for the out coverage, and enter the snapping distance (match tolerance) that you want to use in map units. Two options are also available. You can specify a second map containing points to which nodes within the snap distance should be snapped (this will operate on all nodes, not just dangles), and you can have all dangles extended to adjacent lines within the snap distance. Be careful in applying such functions in bulk, however, to assure that the results are constructive and that any unacceptable changes are identified and corrected.

Extend Lines

The ends of selected lines can be extended automatically to intersect adjacent lines using the Extend functions on the Extend pulldown (**E** on the Reshape bar). The functions extend each selected line along the trajectory of the last pair of vertices from either or both ends of the line and snaps that line to another that is encountered within the specified extend distance. Typically **both ends** can be used, because only one end of a line will be unattached or dangling within reach of another line. Use ***** to click the extend distance on the screen and **distance** to enter it from the keyboard. Keep the distance small enough that unexpected connections won't be made.

Disconnect Lines

Disconnecting a line from a node intersection requires that it be treated as a line. Working from the Reshape bar, select the line and then either move it bodily away from its node connection(s) or select and move the end vertex off the node (see *Edit Vertices*, p. 140). Both methods require that you either reset Nodesnap to 0 or place the line end(s) out of snapping distance of any nearby nodes.

Split and Combine Lines

Pseudonodes, which form connected breaks in otherwise continuous lines, are needed in geologic maps to permit assignment of different line types to different parts of a line (such as fault, certain and fault, inferred). They should thus be retained or added (split the line) wherever needed. Pseudonodes that are not needed, however, should be removed, both to simplify the database and to minimize

problems with cyclic line symbols in plotting. Lines must also be split where new intersections are to be made with other lines, either automatically with Intersectarcs or the Extend function or manually where fine control is needed.

Split

To split a line, select it and then split it with **split(S1)** or **split at vertex(S1)** on the Split pulldown. The Split function places a node in the selected line at the point where you click, whereas Split at Vertex highlights a vertex where you click, reports that vertex, and presents a key menu:

1 = Select 2 = Next 3 = Who 4 = Restart 9 = Quit

Once a vertex has been selected by clicking on it with a *1* or by moving the selection onto it (enter *2*), click a *1* anywhere on the screen to split the line at that vertex.

Combine

Combine line segments that are connected by pseudonodes by selecting them and picking **combine arcs(S)** (on the Split/Combine pulldown opened with **Sp** on the Reshape bar). The Combine Arcs function removes all pseudonodes in the selected set of lines, regardless of how many different combined lines result. It can be applied to any selected set of lines, including all the lines in a map (beware of removing needed pseudonodes). It is thus most efficient in editing to operate on all appropriate lines in a draw area at once, rather than combining one line at a time.

You can monitor the function by drawing the selected set first to color it. All lines that are combined will lose their drawselect color and the pseudonode symbols will disappear.

Lines can be broken and yet look continuous if, rather than a pseudonode, they are interrupted by either a tiny polygon or a short branch stub that was folded back on itself by an earlier bulk snapping operation. Recognize this circumstance by drawing with Nodes on (rather than Node Errors) or by finding that you cannot select the whole of an apparently continuous line with one mouse click. Correct it by selecting the interrupting lines (use **sp**), deleting them, and then closing any resulting gap and combining the lines.

Note that line-type attributes can be lost or changed when you combine lines where their line types are different. You have no control over which line type ARC/INFO chooses to retain for any given combined line. Either select by line type first to avoid disparate line types, or check or retag (and recolor) after combining.

EDIT VERTICES

Lines can be modified in detail by manipulating the vertices that define them. This is done for one line at a time. Work from the Reshape bar by zooming in to an adequate enlargement, selecting individual line segments (typically with **sm** or **sp**), and then using the functions on the Vertices pulldown (open with **V** on the bar):

add vertex(S1)
delete vertex(S1)

move vertex(S1)
draw vertex(S1)
in red
in other color

Display Vertices

The vertices of the selected line can be displayed for review or guidance in editing. In contrast to nodes, vertices can be displayed for only one line at a time. Draw the vertices **in red** to mark the vertices with red pluses on the yellow drawselect color, or use **in other color** to pick a different vertex color from the Colors popup that follows automatically. If the vertices are too closely spaced for convenience, zoom in farther and redraw the vertices.

Move Vertices

Move vertices on a selected line by drawing them first (if necessary) and then picking **move vertex(S1)** to start the Move Vertex routine. You will be instructed to:

```
Point at vertex to move  <9 to Quit>
```

Click on the desired vertex. A vertex will be highlighted, the identity of that vertex reported, and then a key menu is presented:

```
Vertex 22 Arc 1099  (-3071.369,21374.939) selected
1 = Select    2 = Next    3 = Who    4 = Move    9 = Quit
```

Check to be sure that the correct vertex was selected. If not, enter *2*'s until the highlight moves onto the target vertex. Then confirm with a *4* and you will be instructed to:

```
Point to where to move it
```

Now simply click at the point to which you want the vertex to be moved. (Note that, like nodes, no *from* point is specified when moving vertices.) The vertex will be placed at the clickpoint and the line changed to fit. The Move routine stays open and the prompt to point at a vertex is repeated. Move as many vertices on the selected line as you choose and then close the routine with a *9*. The new line shape is recorded and the line remains selected. Because a single **oops** will remove all the changes made while the Move routine was running, consider closing the routine frequently where many vertices are to be moved.

Note that moving the end vertices of lines is equivalent to moving nodes, and Nodesnap will operate if it is turned on.

Delete Vertices

The Delete Vertex routine works in much the same fashion as the Move routine. Select the line and start the routine by picking **delete(S1)** and you will be instructed:

```
Point at vertex to delete  <9 to Quit>
```

Click on the desired vertex. A vertex will be highlighted, the identity of that vertex reported, and then

a key menu is presented:

```
Vertex 22 Arc 1099  (-3071.369,21374.939) selected
1 = Select    2 = Next    3 = Who    4 = Delete    9 = Quit
```

Check to be sure that the correct vertex was selected. If not, enter *2*'s until the highlight moves onto the target vertex. Then confirm with a *4* and the vertex will be deleted, the line changed, and the deleted vertex reported:

```
Vertex (-2710.299,21625.816) deleted from arc 1099 User-ID:  1539
```

The Delete routine stays open and the prompt to point at a vertex is repeated. Delete as many vertices on the selected line as you choose and then close the routine with a *9*. The new line shape is recorded and the line remains selected. Backing up with **oops** will remove all changes made while the Delete routine was running.

Note that deleting the end vertices of lines is equivalent to moving nodes and, if Nodesnap is turned on, it will operate on the next vertex inward along the line.

Add Vertices

To add vertices, select the line, draw vertices if necessary, and pick **add vertex(S1)** to start the Add routine. You will be instructed:

```
Enter new vertex  <9 to quit>
```

Click in as many new vertices as you choose, one at a time, by clicking on screen where you want the vertex to be placed. After each new vertex is added, the line will snap to it on the screen and its identity will be reported:

```
Vertex (-3176.106,21523.264) added to arc 1787 User-ID:  15639
```

The Add prompt will be repeated. Add as many vertices as you choose and then close the routine with a *9*. The line will remain selected. Backing up with **oops** will remove all vertices added while the Add routine was running.

The Add routine offers a powerful way to shape a line carefully, because it allows you to add vertices in any order. If you start with a straight line pinned with vertices only at its ends, you can shape it gradually by setting the gross shape first and then going back and putting in the fine structure. The initial straight line can be added by digitizing or by stretching out an existing line by moving a vertex. You will want to experiment a bit to see how ARC/INFO decides where to fit the new vertex into the line.

Densify

The Densify functions (on the Reshape pulldown from the Reshape bar) add vertices to selected lines (not limited to one selected line) at a specified spacing. No change in shape is involved. The principal use for Densify in ALACARTE is to provide vertex control on straight lines before their projection is changed. Use **densify default(S)** to apply vertices at a spacing equal to the current value of Grain, **densify *(S)** to click the spacing on the screen, and **densify distance(S)** to enter the spacing from the keyboard in map units.

Align Vertices

Irregularly positioned vertices within a given search distance on one or more lines can all be moved onto a specified linear alignment using the Align function on the Align/Rotate pulldown (from the Reshape bar). This can be used effectively to straighten lines or parts of lines, but can also create complications where parts of several lines are all brought together. Align does not require selection of lines or vertices, it operates on all vertices within the rectangle defined by the center line specified for alignment and the perpendicular search distance on either side of that line. You will want to experiment a bit to decide whether and how to use the function.

Align requires that you specify the perpendicular search distance and then the alignment to which vertices (including nodes) are to be moved. Use **align *** to click the search distance anywhere on the screen and **align distance** to enter a distance in map units from the keyboard . Once the distance has been specified, you will be asked to:

> Enter 2 points defining the line segment to align features along
> 1 = Enter points 2 = Show line 9 = Quit

Enter the two ends of a line to which you want the vertices to be moved. If you click *1* at both ends, the function will be activated for the specified line. If you use a *2* for the second click, a tentative line will be shown that you can change with another *2*. When you are ready, click *1* at the desired point and the function will be activated.

MANIPULATE LINES

Entire lines, or selected sets of lines, can be moved, copied, enlarged (or reduced), and rotated. Nodes will snap within the snapping distance when their lines are operated on. Lines can thus be manipulated within the map relative to adjacent lines or the rest of the map, or the whole map can be manipulated relative to its tics or a reference background. Work from the Reshape bar.

Copy and Move

One or more lines can be copied or moved as a selected set using functions on the Copy/Move pulldown. Move the line(s) to a new position on the map with **move(S)** and, at the prompts, click a *from* and a *to* point. The line(s) will be moved parallel to themselves in the direction and distance specified by the clicks. The line(s) will remain selected.

Make one copy of a line (or lines) in the same fashion, using **copy(S)**. The copy will become the selected set. Make several copies of the same line(s) with **copy many(S)**. A prompt for a *from* point will begin the sequence, but thereafter the *from* point for the next copy will be the *to* point of the last copy. Close the sequence with a *9*; the last copy made will remain selected.

Enlarge

The Parallel options in Copy and Move (on the Copy/Move pulldown) can be used to change the size of one or more lines while retaining their relative positions and proportions. This is not a zoom function; the lines are made longer or shorter relative to the rest of the map. Each straight component

(vertex to vertex segment) of a line is moved (copied) parallel to itself and lengthened (or shortened) appropriately. Some modification of line shape and number of vertices may take place. You will want to experiment with this function to determine whether and how you can use it.

Specify the distance the line(s) should be moved (or copied to) on screen with ***(S1)** (one arc only) by clicking at the appropriate perpendicular distance from the line. Use **distance(S)** to enter the distance in map units from the keyboard for one or more arcs (positive values move line(s) to the left, negative to the right, relative to line direction).

Rotate

Lines can be rotated a given angle around a specified rotation point on the map using functions on the Align/Rotate pulldown. This function can be applied to a single line or a larger selected set, including the whole map.

With the line(s) selected, pick **rotate(S)**. You will be asked first to Point to the pivot point, which you should do with a mouse click. The next step depends on the current angle. If it is 0 (the default), a circle will appear on the screen around the pivot point with a *from* radius pointing north, and you are instructed to Point to the coordinate defining the angle. Do this by clicking a *to* point on the circle to define the rotation angle (you are defining an angle, not an orientation). The line will be rotated about the pivot point by the specified angle and the angle and pivot point will be reported:

1 arc rotated 263.157 degrees around (5278.220,13217.724)

You can also specify the rotation angle from the keyboard by picking **setangle** and entering the angle at the prompt (positive values rotate counterclockwise). This current angle will be used by the Rotate function until you change it. Use **setangle 0** to reset it to 0. Where you have rotated a line in the wrong direction, use **oops** to restore it, and reset the angle with the opposite sign with **setangle last** (which multiplies the last angle used by -1). Check the current angle settings by entering *status misc* at the Arcedit prompt.

DELETE UNWANTED LINES

Imported scans are likely to contain unwanted lines. For scans of existing geologic maps, these are likely to include lines representing structural symbols, numbers, unit labels and leaders, line ornaments (such as thrust teeth), and text. In addition, some scanners place lines around incompletely thinned parts of the original line work (particularly common at intersections). A first step in converting a scan into a lines layer in a map database is thus to select and delete the unwanted material either throughout the map or in each part of the map as it is addressed. Hand-digitized maps may contain dangles needing removal, or the goal may be to modify an existing lines layer for a new purpose by selectively removing lines. Be sure to retain an unmodified version of the scan or other map for use later as a background layer for comparison during hand editing.

Select by Attribute

It is faster to select the lines for deletion in bulk rather than by hand, if new problems won't result. This would apply, for example, where lines can be selected according to LTYPE (as, all faults), or where length and/or a dangling end is the criterion. Some scans have a myriad of tiny lines that may

best be removed before hand editing begins (but check some test areas on the map first). You may want to color and examine a decreasing progression of line lengths in the map before choosing a length criterion for deletion.

Another class of lines that can be deleted in bulk is dangles. You can leave small dangles untouched during hand editing and then select and remove them all at once, or use the dangle option in the Clean function to delete them when you clean the lines map for polygons. This will delete all dangling lines less than the dangle length that you specify in the Clean forms menu.

Select by Hand

Most deletion of extraneous lines must be done by hand. This is sufficiently time consuming that it pays to remove as much of the extraneous material from the original as possible before scanning, or to make a tracing of the source map for scanning.

To select unwanted lines, work from the Reshape bar using whichever selection function is most appropriate (see *Selecting Map Elements*, p. 73); Select Polygon (**sp** on the Reshape bar) is particularly useful for many situations. Try to capture a large group of lines in each selection step, check the lines that redraw in yellow (default color) to be sure that no wanted lines are included, and delete the selected set (**delete(S)** on the Options pulldown). It can be useful to draw with Nodes on in order to see and avoid selecting parts of broken lines that should be retained. Where the representation of wanted lines is complex because of ornaments or interference with other material, it may be easiest to delete the lines and then replace them by tracing on screen over an unmodified version of the scan.

Duplicate Arcs

Some circumstances can leave duplicate arcs where one line is intended, including hand digitizing the same line twice and automatic insertion of boundaries around incompletely thinned lines in scans. Duplicate arcs are pairs of lines that share common end nodes and therefore form closed polygons (of any shape). One of each pair can be deleted by selecting the lines, picking **no duplicate arcs** on the Options pulldown from the Digitize Lines bar, and then activating the Duplicate Arcs function with **move in place** on the Reshape pulldown.

Draw the map with Nodes on to be sure you can see which wanted lines may also be duplicates. Then select the candidate lines, move them in place, and one of each duplicate pair will be automatically deleted. Select all the lines in a work area that are candidates, avoiding only those wanted lines that may be duplicates. The function operates on the whole selected set and has no effect on non-duplicate lines. Be sure to turn Duplicate Arcs back on (**duplicate arcs ok**) if you plan to move other lines or do any digitizing during the session.

REPAIR LINE INTERSECTIONS

Most intersections in imported scans will be deformed in varying degree as a result of the raster line thinning that precedes conversion to vectors. The need for correction will depend on your application and perhaps a test plot to determine their graphic effect, but at least the more extreme examples may have to be fixed. Intersections in hand-digitized line work will pose far fewer problems, but may require some attention because of digitizing error, snapping effects, or other causes. Fitting the geol-

ogy to a base or simplifying the line work may require moving or changing intersections, as may editing for graphic appearance in plots.

Distorted Intersections

The most common problem with intersections in imported scans is mislocation of the node that joins the intersecting lines as a result of the line thinning that must be applied to the raster scan before it is converted to vectors. In that process, pixels are stripped off the outer boundaries of the lines until only one pixel remains or the procedure is terminated. The junctions and resulting nodes at low-angle intersections are moved toward the acute angle of the intersection by thinning of the wedge-shaped junction of the two lines. At T-shaped intersections, the junctions are moved down the stem of the T by asymmetric thinning that views the intersection from above the crossbar as a very wide line. The size of the distortions is small, typically 0.005 to 0.05 inches, but the more severe distortions can greatly exceed a line width and be quite evident on plots.

Move the Node

Most of these distortions can be corrected simply by moving the common node. Its proper location can generally be determined by eye directly on the screen without consulting the original map. Pull the node at a blunted intersection out to straighten the joining lines. Move the node at a T-shaped intersection out to straighten the cross bar. If you move a node across a vertex in one of the connecting lines, you will create one or more tiny lines and polygons around the new intersection that must be removed.

The distortion at X-shaped intersections can involve separation of the top and bottom of the X into two opposed V's connected by a short line. Combine the two nodes by moving the node in one V onto the other node (be sure that Nodesnap is on), and then move the combined node to its correct position. Watch for the report that an arc has been deleted to assure that the connecting line actually was deleted or, if internal vertices are evident, delete the connector first. If a clot does form, select and delete it and then check that the remaining lines are properly connected.

The most efficient method of moving nodes at distorted intersections is to zoom in on one or more intersections, move them, go to the Reshape bar to check for and delete clots if necessary, and then return to the larger draw area with Node Errors on, check for and correct any unconnected lines, and then zoom in on the next group of nodes to be moved. Beware the temptation to fix inconsequential distortions that are exaggerated at high magnification.

Unconnected Intersections

One or more lines at an intersection may be unconnected, or an X-shaped intersection may be represented by two opposed V's without a connecting line. Most unconnected lines will be revealed by their dangling ends (draw with Node Errors on), and opposed, unconnected V's will probably be marked by pseudonodes. These pseudonodes must be joined, regardless of the size of the distortion, if the lines are to serve later as polygon boundaries.

Connect the V's

Join the opposed V's by moving nodes, as described above. If the V apex is not marked by a node, select the line and split it to add a node there.

Connect Lines

Unconnected lines at an intended intersection can be connected by selecting them and then activating the Nodesnap function by moving them in place or by moving nodes at low magnification. If details of the connection are important, zoom in and move each dangling node separately. Work from the Nodes bar, and be sure that Nodesnap is on. If necessary, split a line to create a pseudonode to which to join the dangling end(s).

CLOSE BROKEN LINES

Maps being edited, particularly imported scans, may have numerous gaps that must be closed. Many geologic maps contain dashed lines that produce lines with regular gaps when scanned, and the line work in some scans may contain many irregular gaps. Several techniques are available to meet the particular circumstances, including bulk processes and detailed hand operations.

Dash-to-Solid Conversion

Incomplete lines that contain gaps shorter than the line segments can be closed using the Dash-to-Solid routine. This ALACARTE function lets you temporarily reset the Nodesnap distance to the maximum gap length and select the lines to be snapped. It then snaps the lines and offers the option of deleting the resulting pseudonodes (combining the selected segments). Dash-to-Solid works well on regularly dashed lines and lines with various small gaps, but will not be satisfactory for dotted lines or lines with ornaments (such as thrust teeth). Nearby extraneous material that might divert the snapping should be deleted first, and nearby lines with superfluous pseudonodes should be combined.

To use the function, work at moderate magnification from the Reshape bar. Draw with Nodes on to let you recognize any complicating factors. Start the routine (pick **dash to solid** from the Reshape pulldown) and you will be instructed to reset the Nodesnap distance:

Click on two points on the screen which are slightly farther apart than
the longest space between dashes - ALACARTE instruction.
Enter 2 points defining the distance - ARC/INFO prompt.

Click a distance representing the longest gap that you want closed along the broken line, but keep it short enough to avoid snapping to other nearby nodes. Then use the Select Polygon (Within) function to specify the lines to be joined:

Select the lines (dashes) to connect by drawing a polygon around them
Click the 1 key to define the polygon vertices, click the 9 key to end
A line must be entirely inside the polygon to be selected.
Define the polygon - ARC/INFO prompt.

Click a polygon on the screen around the dashes or the line segments that you want to have snapped.

When you close the selection with a *9*, the selected lines will be drawn in yellow and the gaps will be closed as the nodes snap across the gaps. When the snapping is completed, ALACARTE will instruct:

> Now may remove pseudo-nodes in order to merge snapped line segments. . .
> Remove pseudo-nodes, <Return> = yes?

Check the result on the screen, and if everything has gone as intended, hit <return> and the selected line segments will be converted to a single line. If you see problems or are uncertain, enter *n* and combine the segments separately. ALACARTE will reset the nodesnap distance to its previous value before returning control to the bar.

Check to see that the line is now continuous. The simplest way is to select the line with one click (**sm**) to see if the whole line redraws. If it does not, or if other errors were introduced, you will want to redraw the screen to clear away remnants of deleted node symbols and examine the situation.

Problems can sometimes arise with the Dash-to-Solid routine. Some nodes may remain on the line where relations are complex. Any line segments (arcs) shorter than the gap length you have defined will either be deleted (no internal vertices) or folded back on themselves. If a node on some nearby feature is closer than the intended end of the next dash, the snapping will diverge from the dashed line. Fix these problems individually (Save the frame and zoom in on each one), or start over by backing up through the routine with **oops** (on the Options pulldown) 2 or 3 times, depending on whether or not you deleted pseudonodes). Where dashes snapped to nodes off the line, pick them up (as end vertices) and put them back where you want them to be. Sometimes you can use Dash-to-Solid sequentially to snap and combine short dashes with a small gap length first and then reapply the routine to close larger gaps.

Bulk Snapping of Nodes

The dangling ends of any set of lines can be snapped by selecting the lines, setting Nodesnap to the appropriate distance, and moving the lines in place. Where possible, use the Dash-to-Solid function, which allows you to do exactly this. In some cases it may be more convenient to perform the steps separately by hand.

For some maps, an early editing step may be to use Matchnode to snap dangling nodes in the whole map (see *Matchnode*, p. 138). In doing this, consider working progressively, snapping first with a relatively small snap distance, then examining the result before increasing the snap distance and running Matchnode again. It may be important, before rerunning Matchnode, to apply the Combine Arcs function (on the Split/Combine pulldown from the Reshape bar) to the whole map (select all the lines first) to avoid folding lines shorter than the new snap distance back on themselves.

Individual Treatment

Some interrupted lines may be simple enough or, conversely, so complex, that moving nodes individually is the best solution. This approach may also be preferable where you are already working from the Nodes bar for other reasons. Be sure that you have Nodesnap set properly.

Another approach is to enter short line segments from the Digitize bar to fill gaps, particularly where they are relatively large, and then combine the resulting connected line segments. If the lines are tagged, be sure to check the resulting line type or simply retag.

Where nodes are moved or snapped across a relatively large distance, it may be desirable to go back and add some vertices to smooth the line. One good place to add a vertex is at the original position of the moved node. If you combine the line segments first, you will be able to work with the whole line at once.

RESHAPE LINES

Lines may need to be reshaped to correct scanning artifacts, to improve appearance or fit the the base, to simplify, or to incorporate changes (where major changes are involved, consider adding new lines). Such reshaping can be done by hand, either by editing vertices or drawing a new shape, or by applying the Spline or Generalize function to a selected set of lines.

Reshape by Hand

Most scanning artifacts that are large enough to matter, as well as various misplaced vertices in hand-work, can be corrected by moving or deleting vertices, although some lines may be improved by adding vertices as well. Where lines have many fine irregularities, Spline or Generalize may be useful, but experiment first.

Larger changes in the shape of line segments can be made by using Add Vertex to shape a skeleton line prepared by deleting preexisting vertices or moving vertices. Or, use the Reshape function, which permits you to redraw part of an existing line segment.

To apply the Reshape function, select the line and then pick **reshape(S1)** from the Reshape pulldown. You will be instructed to:

Enter the new segment <3 - Curve, 9 - Quit)

You then can enter a new shape or addition for the line by clicking vertices with *1*'s, being sure to cross the selected line either at the beginning or end of an addition or at both ends of a new shape (the dangles will not be retained). Close the routine with a *9* and the line will be redrawn with the new shape incorporated. If you cross the selected line twice the new shape will replace the old between the intersections. If you cross only once, the new line will be a composite of the longest parts of both the original line and the addition. Remember that you are not digitizing a new line, you are modifying the selected line, and must attach the change to that line by crossing it.

Spline

The Spline function can be applied to a selected set of lines either to smooth the lines or to simplify them. The difference depends on the relative size of the Grain parameter and the spacing between vertices on the lines. The Spline function places or removes vertices on the selected lines to the grain interval but, in contrast to Densify, it can build curves at the angles in the line. Use it to add curves to an angular line by using a Grain value smaller than the existing vertex spacing. Where the Grain value is larger, the vertices will be weeded to the Grain spacing and the remaining vertices will define the line. This method of simplifying a line can distort its original shape (but see *Generalize*, p. 150).

To use Spline, select the line(s), set Grain, and then apply the function. Set Grain from the Reshape pulldown either with **grain *** (click the distance on the screen) or with **grain distance** (enter the value from the keyboard in map units). Then pick **spline(S)** (also from the Reshape pulldown) to apply the function to the selected set of lines. Be sure to check the result. Be cautious about applying Spine to large parts of your map, as some line relations will be distorted. Check particularly at intersections, tight bends, and abrupt steps in the lines. If you do operate on large areas, work on a copy of your map.

Generalize

Generalize, like Spline applied with a relatively large Grain value, weeds vertices, but it does so with some attention to the shape of the line (using the Douglas-Peucker algorithm). Although the new line will be a simplified version of the old, there will be shape changes and the result should be checked carefully. Like Spline, a spacing parameter should be set to control the function. In contrast to Spline, the final spacing of vertices will be much larger than that parameter. The function is sensitive to small changes in the control parameter and satisfactory results will require experimentation.

To use Generalize, select the line(s) and apply the function from the Reshape pulldown. Pick **gen *(S)** to click a distance for the control parameter on screen and **gen distance(S)** to enter it in map units from the keyboard (**gen default(S)** uses the current Weedtolerance value, which is typically set automatically from the setup file for the map). Be sure to check the result. Be cautious in applying Generalize to large parts of your map without first testing its effect, and be sure to work on a copy.

ADD LINES

Most maps will require the addition of various lines during editing, including lines that were overlooked during original input or were deleted during earlier editing. A scratch boundary may need to be added around the mapped area to close polygons, or a map boundary may be needed if not included in the original setup of the map.

Hand Digitize

Some lines may have been overlooked during the initial digitizing or tracing, may not have been effectively captured in scanning, or may have been deleted during editing as too complex to repair. To replace them, simply digitize them by hand from the original registered on a digitizer or over a scan displayed in the background on screen. Be sure that the lines have snapped properly to existing lines, that they are properly located in the map, and that they are tagged properly.

Map and Scratch Boundaries

A boundary is needed around the map area to close the open sides of polygons left by dangling faults and contacts. This can be the latitude/longitude boundary of a regular quadrangle or a scratch boundary around an irregular map area.

A scratch boundary can be digitized on screen or from a digitizer and concurrently snapped to the ends of dangling lines. Register your original on the digitizer or zoom to the part of the map in which you want to add the boundary on screen. Set Nodesnap to a value that will let you place nodes within

snapping distance of the dangling line ends. Then, from the Digitize bar, set the line type to scratch boundary, start the digitize routine, and enter the line. Place a node at the end of each dangling line to cause the scratch boundary to snap to the dangling nodes. Once the line has been entered, draw with Node Errors on to be sure that all the appropriate snapping did occur and that you have not created new dangles outside the boundary by intersecting some of the dangling lines.

The best way to obtain a projected map boundary is to include it when you start the map or transform a scan from the Setup bar (see *Start a New Map or Layer*, p. 93). Adding a regular map boundary to an existing map is a bit more complicated. To make a map boundary for an existing map, go to the Setup bar and make a new layer for your map (any kind of lines) and include creation of a map boundary. A boundary will be created, snapped to the corner tics, densified, and projected into your map projection.

Next, move the boundary from the new layer into your working map layer with the Get function. Go back to Edit, rechoose your working map (otherwise the new layer will be the edit map) and go down to the Reshape (Lines) bar. Pick **get** from the Options pulldown and then specify the new layer from the map names popup. The boundary will be added to your working map and will be the selected set. While it is still selected, assign it a session color (**set $symbol(S)** on the Draw popup) to allow you to see and select it later in the session if necessary (Select For Expression *$symbol* = [*color number*]) and/or tag the line as map boundary.

The remaining step is to attach connecting line work to the boundary. From the Reshape bar with Intersectarcs on, move the boundary in place to create intersections with any overlapping lines and then draw with Node Errors on. It will be difficult to distinguish unattached lines within the map from small dangles at the ends of intersected lines. Go systematically around the map boundary and use Select Polygon to find and delete small dangles and use the Extend function to lengthen the other lines to attach them to the boundary.

Get and Put

The Get function allows you to copy all the lines from one map layer into the current edit map. Put, in contrast, allows you to copy selected lines from the edit map into another layer. In both cases, all ALACARTE attributes (such as LTYPE) will be lost unless the structures of the lines databases (AAT) in the two layers are identical. Be sure, if you don't want the current snap settings to operate, that you change them before proceeding. Addition of lines with Get is an edit change that must be saved.

Get lines from another layer by opening the forms menu with **get** (on the Options pulldown from the Reshape bar) and entering (or picking) the name of the map containing the lines. All the lines in the specified map will be added to the edit map, any in the current draw area will appear on the screen, and the newly added lines will form the selected set. You may want to assign these lines a session color while they are selected. If it is important that the line types or other attributes are copied as well, you will need to attend to correspondence between the two lines databases.

Put selected lines from the edit map into another layer from the Put bar, which is reached with **PUT** on the Options pulldown from the Reshape bar. Select the target lines with the various select (**so**, **sm**, **sp**) and aselect (**aso**, **asm**, **asp**) functions on the bar. Open the forms menu with **put** on the bar: enter (or pick) the name of the map into which the lines should be put, and click the **ok** button. If the

specified layer does not exist, it will be created by copying the tic framework and database format of the Edit Map and the selected lines copied into it. If the receiving layer already exists, ARC/INFO will interrupt to ask:

```
Coverage  [pathname of specified layer]
  already exists.  Do you want to append  <Y/N>  :
```

Confirm with a *Y*, and the line(s) will be added to that layer. In contrast to Get, the addition is to the permanent file of the receiving map unless you are displaying that map in the background, in which case you may need to save it. If you are putting numerous lines into another layer, you may want to color or delete them from the edit map in order to keep track of which lines you have already put.

TAG LINES

Existing lines can be selected and assigned line types (tagged) in bulk or by hand from the Digitize bar. The most efficient technique will depend on the specific problem. ALACARTE maintains a current line type that you can set as desired (see *Digitize Lines*, p. 129). In addition to tagging lines as they are digitized, that line type can be used to tag any selected set of lines or to select lines already tagged with that line type.

In the basic tagging operation, a selected set is tagged with the current line type by picking **tag** on the Digitize bar. That line type will be recorded in the LTYPE database item for each of the selected lines and the operation will be reported:

```
12 lines tagged with LINETYPE:  contact,  LINEMODIFIER:  certain
```

While the lines are still selected, you may want to use **$Symbol(S)** on the Draw menu to assign them a session color.

This sequence is combined in the ALACARTE function **sel,tag,color** on the Select pulldown (**Sel**) from the Digitize bar. This starts Select Many, with which you can select the desired lines. When you close the selection (enter *9*), the selected lines are redrawn in the drawselect color and you are asked in the dialog area if you want to continue. If the line selection is good, hit <Return> to tag them, if not, enter *n* to cancel the process. Once the lines have been tagged with the current line type, the Colors popup is presented for you to assign a session color to the lines.

You can tag lines one-by-one as you edit, or wait to finish the lines in a work area on the map and then tag and color all the lines appropriately. Selecting finished lines by clicking with Select Many will help you find overlooked editing problems and avoid tagging any tiny lines not evident at normal screen magnifications. That absence of tags can be used to find these lines later.

Tag lines only with their proper line types, or, where more convenient, tag an easily selected group, even though some are wrong, and then change the incorrect ones later.

At any time, the line tags can be checked by selecting the lines by line type, coloring each type differently, and checking visually on the screen. Ultimately, you will want to make a test plot using proper line symbols. Check that plot particularly for misoriented asymmetric symbols. Correct them by reversing the line direction.

LINE DIRECTION

All lines in ARC/INFO have a direction that is recorded in terms of the *from* and *to* nodes in the database. Line direction is of principal interest here because of its influence on asymmetric line symbols. The direction that thrust teeth, queries, and other asymmetric elements face is a function of line direction. If you find that such elements face the wrong way, simply reverse the line direction.

To display line direction on the screen, turn Arrows on in the Draw Environment and redraw. To reverse the direction of lines, select them and pick **flip line dir'n(S)** (on the Options pulldown from the Digitize and Reshape bars).

Process and Edit Scans

Maps that have been scanned and converted to vectors can be imported into ARC/INFO for conversion into the line work of a map database. The scanning and vector conversion can introduce a variety of defects and artifacts in the lines and their intersections, many of which must be corrected before the lines can serve as the database line work and polygon boundaries.

Once the vector file has been converted into an ARC/INFO map, that map is transformed into its projection, prepared as an ALACARTE map, and then edited and tagged. Editing involves removal of extraneous material, repair of line continuity, shape, and intersections, and replacement of lines lost in scanning or deleted during earlier editing. This work is done largely by hand on screen. Boundaries of open water and a map or scratch boundary around the map area are incorporated into the map as appropriate. The lines are tagged and the map searched for small untagged lines that signal minor problems that are best corrected before polygons are built.

Once any bulk operations are completed, it is most efficient in hand editing to work systematically over the map. Start in one corner at an appropriate zoom magnification, do all the editing and tagging needed in that work area, and then shift the work area and edit and tag progressively through the map. Coloring lines as they are completed (edited and tagged) will help you find remaining problems and keep track of progress. You will want to take full advantage of the various Zoom functions as you work (see *Zoom Controls*, p. 69).

PROCESS THE SCAN

Prepare and scan your original to obtain the cleanest line work possible. Take the time to prepare the original to eliminate as much extraneous material as possible. For many originals, it may be more efficient to prepare a tracing in non-smear pencil specifically designed for scanning (that is, all lines continuous and without teeth or other ornaments). Be sure to include precise registration marks (see *Map Registration*, p. 115). At least four graphic marks should be located near the outer corners of the map at known positions and where other line work will not distort them in the scanning. It will also be more efficient to take the time to set the scanner up carefully than to edit unnecessarily severe scanning artifacts later.

Import from Vector Source

With your map scanned and converted to vectors in an acceptable file format, load the file onto your ARC/INFO system (consult a colleague or your system administrator and, on Unix systems, avoid capital letters in the file name). Convert this into an ARC/INFO map (coverage) using the appropriate ARC routine. Name the converted map something like [quad name].scn.

IGES - for files in IGES format, go to the Arc prompt and use the IGESARC command:

Arc: *igesarc* [*input iges file*] [*output map name*] {*out error log file*}

The option is available to name an error file, which will then record any unrecognized characters in the input IGES file.

DXF - for files in DXF format, go to the Arc prompt and use the DXFARC command:

Arc: *dxfarc* [*input dxf file*] [*output map name*]

There are text-width and attribute-width options for this command that have no significance for scans.

SCITEX - for files in SCITEX format, open the Scitexline forms menu (pick **Scitexline** on the Scitex pulldown from the Conversion bar) and specify the Scitex file name and the output map name.

Transform into Projection

The dimensions and locations of map elements in the imported scan will be in scanner inches. You can edit the line work in this form but, particularly if you will be using a digital base, it is better to get the map into the proper projection first. This procedure is described under *Map Registration* 9p. 115). Be sure to include a map boundary in the Transform step if one will ever be needed, and call the projected scan something like [quad name].pr.

Prepare the Lines Layer

Make a copy of the projected scan ([quad name].pr) to be prepared as the lines layer, either by saving the projected scan as a new file from Edit or using **Copy** on the Files pulldown from the General bar. Call the copy something like [quad name].ln. You will want to preserve the unmodified projected scan for use as a background during editing.

Prepare this lines layer for work with lines. Working from the Prepare Scans pulldown from the Setup bar, use **3. create setup file** to record the map scale and the snapping and other values that you will want to use while editing (see *Snapping and Other Controls*, p. 123). The resultant Setup file, which can be changed at any time, will then accompany the map and any derivatives as long as you work within ALACARTE. Then use **4. Prep database**, specifying a map layer of *contacts_faults,* to prepare the database for lines. This routine will build the map for lines and add an LTYPE item to the database in which to store the line types. You should also include addition of the SYMB and SEL items for saving session colors and a selected set. (Be consistent in the items that you include when you start layers to allow Get and Put transfer of lines to include database information.) When these steps are completed, the layer is ready for editing and tagging lines.

REMOVE EXTRANEOUS MATERIAL

Most scanned maps will contain various amounts of extraneous material. A typical first step in editing a scan for lines is to remove this material by selecting and deleting it on screen (see *Delete Unwanted Lines*, p. 144). You can do this as a first step in working on each part of the map, or you can clear out the whole map before beginning to edit the lines. Editing on large maps will be speeded considerably if all extraneous lines are removed from the database first (reduces database search times), and any bulk processing will require it.

Use of Test Plots

A plot of the line work, although not necessary, can help you judge which scanning artifacts are significant. Edit plots, which can include symbols for Node Errors (see *Edit Nodes*, p. 136), will show

where dangling ends and pseudonode breaks in lines are located. The most useful times to make edit plots are after the extraneous material is cleared away, in order to examine the effects of scanning artifacts, and then after most of the editing is completed, to help find any remaining broken lines.

Edit plots are prepared in a routine started from the Edit Plot forms menu (see *Edit Plots*, p. 193). For the first plot, specify a scale denominator that will plot the map at scale, use a window only if the full map is too big for the plotter, and answer *yes* to only the Plot tics? and Plot arcs? questions. Make a hard-copy plot on a pen plotter, or on a high-resolution electrostatic plotter with all the lines assigned a very fine line symbol, such as contact weight in the ALACARTE lineset (ALCWRG.LIN, line symbol 25).

In the second edit plot, be sure to include node errors. Neither plot will contain any polygon information, because polygons have yet to be built and recognized in the map.

EDIT AND TAG LINES

The principal task in editing a scan is to clean up the lines: to repair line intersections, close broken lines, and reshape distorted lines. The techniques involved are described in *Edit Lines*. Consider starting with bulk procedures to delete tiny lines, snap dangling nodes, and smooth the lines, as appropriate, and then work through the map systematically by hand to fix all the lines. Tag the lines as you finish them, or as you finish all the lines in each work area, and color them to show that they are finished. Be sure to save these session colors and restore them at the beginning of each edit session.

Bulk Processing

It may be useful to apply some operations to the whole map before proceeding to hand editing. The principal criterion is whether the operations will increase or decrease the difficulty of later editing. Thus, if there are many short gaps in the lines, or many exceedingly short lines, or some fine-scale irregularity in line shape, bulk processing may be profitably applied. Be sure that the extraneous material has been removed first.

Delete Short Lines

Consider selecting and deleting all the lines shorter than a line width or so (0.01 inches, for example). You can test the effect by selecting and coloring all the lines less than such a value (expressed in map units) -- or, better, by selecting and coloring a sequence of progressively shorter lines -- and then inspecting the map in several places at high magnification to see what the effect of deleting a set of short lines would be. The principal damage that this can do is to remove tiny connecting lines produced by the line thinning at crossed-line intersections. These situations can be flagged with Node Errors as long as you do not combine arcs in bulk.

Snap Dangling Nodes

It may be useful to snap together all closely spaced dangling nodes to simplify later editing. Draw various parts of the map at intermediate magnification with Node Errors on to see whether this will do more harm or good. One useful procedure where such snapping looks promising is to snap all dangling nodes at some very short distance, examine the result, combine arcs in the whole map, and then

progressively increase the snap distance and repeat the process until damage starts to appear. Make a new copy of the map for each stage to allow later selection of the best version.

Nodes can be snapped on screen by setting Nodesnap to the desired distance, selecting the lines (individually or, for example, by the screenful), and then activating the snapping with **move in place** (on the Reshape pulldown from the Reshape bar). If you want to operate on the whole may, use Matchnode (see p. 138).

Smooth the Lines

Some scans may contain systematic fine-scale distortion of the lines that can be effectively removed by smoothing the lines with the Generalize or Spline functions (see p. 149-150. Try out some representative lines first, and be sure to check the effect on intersections and tight bends in the lines.

Hand Editing

Once the extraneous material has been removed and any bulk processing has been applied, the remaining lines will probably require hand editing. Check the snapping, turn Node Errors on, and proceed systematically through the map. Adjust those intersections that are distorted beyond the limits of map resolution, close broken lines and unconnected intersections, and fix misshapen lines. Add any lines missed by the scanner or deleted during earlier editing, either from the digitizer or by tracing from the unmodified, projected scan.

Tag and color the lines by line type as you finish them to record your progress and help you read the map on the screen. Test line integrity while tagging by selecting with Select Many to help check for remaining problems. Beware the temptation to fix artifacts that are too small to be significant at map scale. Test line type assignments occasionally by selecting and coloring by line type, rather than just restoring the colors saved in the last edit session.

Your goals are to produce line work that properly represents the lines in the original map and that can serve as polygon boundaries in the polygon layer. If appropriate, work with a digital base map in the background to assure that the lines are properly fitted to the base.

Map, Scratch, and Water Boundaries

If the map is a regular quadrangle , you probably included a projected map boundary when you prepared the scan from the Setup bar. If you did not, and now want such a boundary, prepare it separately by starting a new map in the same projection (see *Start a New Map or Layer*, p. 93). Get the map boundary from its separate map layer and add it to the lines layer you are working on. You will want to tag it to distinguish it from the other lines, and will need to attach to it all those lines that reach the boundary in the original. If the map area is irregular, add a scratch boundary to bound the mapped area and attach it to the dangling lines in the map. Similarly, if there are open bodies of water that should be distinguished from the geologic map units on the map, add their boundaries to the map, and then tag the boundaries and connect other lines to them as appropriate. These water boundaries can be traced on a digitizer from a base map or selected in a digital base and added to the lines layer with the Put function.

REMAINING PROBLEMS

When you think you are finished with the lines, there will almost certainly be more problems to correct. Check the map by selecting and coloring the lines by Line type and then drawing its various sections on the screen with Node Errors on to check for mistagged lines, unnecessary pseudonodes, and unwanted gaps in lines. Make a second edit plot to check particularly for breaks in lines that are to serve as polygon boundaries. Any that are not corrected now, however, will become clearly evident later.

You can find and correct untagged lines by selecting them (Select for Expression: *LTYPE = ' '*), listing them, and recording their $ID numbers. Then select each of the lines, one by one (Select for expression: *$ID* = [*number*]), draw the area of the selected features to find it on the screen, and delete, tag, or otherwise correct the problem that it represents.

Tag and Edit Areas

The various units in a geologic map are represented by polygons whose boundaries are composed of the contacts, faults, and other kinds of lines in the map. The polygons are organized by ARC/INFO in a topologic processing step (the Clean and Build functions) that organizes valid polygons and lists them in the areas database (the PAT). Prepare a polygon layer from the completed lines layer of the map. You then can specify the identity of each polygon by placing a label point in it (by hand or in bulk process) and tagging the label point according to map unit. Subsequent editing will probably be needed to find and correct breaks in some of the intended polygon boundaries and any errors in labeling and tagging.

Digitizing and editing the identifying label points is done principally from the Digitize (Areas) bar and repair of broken polygon boundaries is done from the Reshape (Lines) bar. The symbols representing the label points can be colored or changed on screen, polygons of given identities can be filled with color to aid editing, and missing and multiple label points can be listed.

PREPARE THE POLYGON LAYER

Process the lines layer to build polygon topology for a new polygon layer (name it something like [map name].py1). The procedure for this depends on how you have processed the map to this point:

Edited Scan - a lines layer that has been processed for contacts and faults with Step 4 from the Prepare Scans pulldown will not yet have an areas database (PAT). Such layers should now be processed at Step 4 again for units: pick **4. prep database** (on the Prepare Scans pulldown from the Setup bar) and specify *units* for layer type. Generally you will want to include the SYMB and SEL items for the PAT as well.

New Map or Layer - a lines layer that was started from the New Map or New Layer pulldowns for contacts, faults, and units will already have a PAT and probably will have SYMB and SEL items in the PAT as well. Do not use the Prepare Scans procedure here. Instead, simply clean the map for polygons (**Clean** on the Topology pulldown from the General bar).

Non-Standard Map - any ARC/INFO map, regardless of its history, can be prepared for work with polygons in ALACARTE as long as it does not contain point information (in ARC/INFO 5.0.1, points and polygons are incompatible because they use the same PAT database). First, clean the map for polygons (**Clean** on the Topology pulldown from the General bar; and see *Topology*, p. 56). Then add the PTYPE, SYMB, and SEL items to the PAT database with **Add ALC items** (on the Files pulldown from the General bar). The remaining step is to add a Setup file. This can be done with Step 3 in the Prepare Scans sequence or by establishing settings in Edit and then saving them (see *Snapping and Other Controls*, p. 123).

Completion of this step for any ALACARTE map should produce a database prepared both for lines (AAT) and polygons (PAT) that probably contains SYMB and SEL items for each feature type. The structure of the database for a map can always be checked by describing the map (**describe map** on the Map pulldown from the Edit bar) and/or going to the Lines and Areas bars and listing the items in the database for each type of feature (**items** on the Database pulldowns).

TAG POLYGONS

The principal task in preparing the polygon layer for a map is to place an identifying label point that is tagged by map unit in each polygon. This is done from the Digitize (Areas) bar which, like the Digitize (Lines) bar, supports digitizing, tagging, and selection by area type:

[Dig] | dig | tag | Sel | ? | key | m1 | m2 | m3 | Op | Dw | Zm | ^AREAS |

A current area type is maintained at the bar for use in tagging label points automatically as they are digitized, in tagging a selected set of label points, and in selecting label points according to their tags (PTYPE). Pick **?** to report the current area type, and reset it either by entering from the keyboard (pick **key** and enter at the prompt) or by picking from a user-prepared custom menu opened with **m1**, **m2**, or **m3** (see *Custom Tag Menus*, p. 82). In contrast to lines, there are no standard area types and no modifiers for area types. Labels and arcs will be turned on in the Draw Environment automatically when you go to the Digitize bar.

To digitize label points, pick **dig** on the bar - a key menu is presented, preceded by a report of the current area type that will be assigned to the PTYPE item for the point and followed by the prompt to enter a label:

```
Adding polygons labels with attribute:  Qal

-------------------------Options----------------------------
1)  Add Label                5)  Delete last label
8)  Digitizing options       9)  Quit
(Label)  User-ID: 20
```

Click *1* on the screen or digitizer to enter a point; the coordinates of the clickpoint will be reported and the point displayed on the screen:

```
(Label)  User-ID: 20  Coordinate = -3181.966,6025.430
```

The simplest way to identify polygons on a map is to digitize label points and tag them concurrently. Do this from the screen or, particularly for complex maps, from a full-scale colored map or annotated map or edit plot registered on a digitizer. An alternative method is to create untagged label points for all valid polygons automatically and then to find, select, and tag each of these points, working either on screen or from the digitizer with an edit plot on which all polygons and their label points are shown.

Digitize and Tag

Labelling polygons by hand from the digitizer or on screen mimics the familiar labeling of an inked map and provides the greatest control over the location of the labels in the map. If you place more than one label point in a polygon, however, or any polygon boundaries are incomplete, then some PTYPEs may be changed when you build the map and later editing will be required.

Work on screen with one section of the map at a time, tagging the larger polygons first and then the smaller ones progressively. Set the area type for the first unit to be tagged, start the digitize routine, and enter the label points, one to each polygon (position the crosshairs and click *1* to digitize a point). The label points will be tagged automatically with the current area type. Tag as many polygons of that area type as is convenient, then change to the next area type and proceed. Save the current frame and

zoom in on small polygons as necessary to assure that the label points are actually placed within the polygon boundaries.

The label points will draw on the screen as you enter them. You can include display of the PTYPE tags at the label points to help you read the map (see *Display Tags On Screen*, p. 163). As you progress, build the map and color the remaining unlabeled polygons on screen to help guide the work.

Working from the digitizer, in contrast, and particularly with a full-scale, colored original, allows you to digitize tagged label points for many polygons of the same map unit throughout the map before the area type has to be changed. Start by registering your map on the digitizer, and keep track of your progress by checking off the digitized points on a transparent overlay as you go. Display the map on the screen in the fashion described above to help keep track of the work. If you have difficulty placing labels within small polygons or finding remaining untagged polygons, move your work to the screen.

It can be useful, particularly as you begin to run out of unlabeled polygons, to highlight the remaining ones by coloring them on screen. There will be a number that you have overlooked, particularly small ones, and perhaps some that result from line problems that should be fixed. Alternatively, you may want to color labeled polygons of specified PTYPEs to aid work on screen. Such on-screen coloring may make it easier, even where the initial polygon tagging is done from a digitizer, to finish the job on screen. Build the map first, and then specify the kind of polygon from the Color Units menu opened with **color units in backgnd** (see *Color Selected Polygons*, p. 169).

Determine that you have labeled all the polygons by building the map and running Labelerrors (see *List Label Errors*, p. 167). Or, if you are coloring unlabeled polygons, check the report in the dialog area that indicates the number of polygons that have been selected for coloring. A report of 1 polygon selected (the background polygon) indicates that there are no unlabeled polygons in the map.

If any unlabeled polygons are particularly resistant to being found, use the Createlabels function to add labels to them (see *Create and Tag*, p. 164). These untagged labels can then be selected directly (see *Find Untagged Label Points*, p. 166).

Display Tags On Screen

You can display on screen the tags associated with each label point as you digitize or tag it, or as a means of checking the tags of existing labels. This is useful at relatively large draw scales, but will illegibly clutter the screen at small scales.

Turn the display of PTYPE attributes on with **post attribute: on** (on the Options pulldown from the Digitize bar). Now, each time that you digitize or tag a label, the tag (PTYPE) will be displayed next to the label point. The tags will be displayed for all existing label points whenever you draw or zoom, although the text does not scale with zoom and it cannot be manipulated as annotation.

Turn off the display of tags with **post attribute: off** (on the Options pulldown).

Create and Tag

You can automatically assign untagged label points to the centroid of every valid polygon in a map and then select and tag them. This approach avoids the multiple-label problem of hand digitizing, but requires that you find and select the label points before you can tag them. Editing will still be required to correct incomplete polygon boundaries and remove labels and lines for unintended polygons.

Assign the label points with the Createlabels function. It can be applied to add label points to all the polygons in a new polygon layer, if you prefer to select and tag existing label points. It can also be used after hand digitizing to add untagged label points to the remaining unlabeled polygons. Once the labels have been created, you then select and tag them.

Run Createlabels

Createlabels is run from a forms menu opened with **Create labels** (on the Files pulldown from the General bar). Build the map for polygons first if it has been edited (**Build** on the Topology pulldown from the General bar), open the Createlabels forms menu, and enter the map name.

If you use the default user-id base (#, which here represents 0), new labels will be created in every valid polygon in the map. If the map already contains label points, those points will all be replaced by new ones placed at the polygon centroids. PTYPE attributes of those existing labels will be assigned to the equivalent new labels, **but you must build the map again for polygons to assure that the user-ID numbers are reset properly**.

This procedure will cause multiple labels to be replaced by single labels, which will leave you unable to find those places where building with multiple labels has reassigned erroneous PTYPEs across incomplete polygon boundaries To avoid changing existing labels, limit the procedure to unlabeled polygons by specifying a new user-id base that exceeds the highest user-ID number for the existing labels. Determine the next higher user ID in a map by starting the digitize routine; the next higher number will be posted as the user ID at the prompt.

Tag Existing Labels

Tag existing label points on screen or from an edit plot of the map on which you have included tics (for registration on the digitizer) and all arcs and label points. Set the area type for the first unit to be tagged, select all the label points of that type within reach, and tag them. The selection, tagging, and on-screen coloring of the label points are combined in the ALACARTE function **sel,tag,color** (on the Select pulldown from the Digitize bar). This begins with Select Many, with which you select the labels to be tagged. When you close the Select routine, the selected set is redrawn with the drawselect symbol. Check that the redrawn points are correct, confirm with <Return> (or cancel with *n*(o)), and the selected set will be tagged automatically with the current area type. The Color popup will then appear, from which you can assign a symbol to the newly tagged label points in order to distinguish them. You can also post the tags on the screen as you go (see *Display Tags On Screen*, p. 163). To find polygons with untagged label points, select them directly or color the polygons (see *Find Untagged Label Points*, p. 166).

If you are working on a digitizer, keep track of progress by checking off the label points as you go.

CHECK LABELS

It is important, once you have labeled the polygons in a map, to check them. At least some of the following kinds of error are almost certain in all but the simplest maps. Polygons may have:

1. No labels:
   a. polygons missed during hand labeling, most common with very small polygons;
   b. polygon not recognized by Createlabels because of an incomplete boundary;
2. Untagged label points: points from Createlabels missed during tagging;
3. Multiple labels:
   a. more than one label placed by hand in a single polygon, most common with intricate polygons such as alluvium;
   b. label points placed by hand in separate polygons, but a break in line work caused ARC/INFO to consider them a single (composite) polygon with more than one label.
3. Wrong PTYPE:
   a. polygon tagged incorrectly;
   b. PTYPEs of multiple labels reassigned during a build.

Correcting these errors is straightforward, but first they must be identified and located on the map. There are several ways to do this. Polygons with multiple or missing labels can be listed or can be plotted in map form. The errors can be located on the map using hard-copy plots or by on-screen selection of erroneous label points or coloring of unlabeled polygons. Mistags can be identified through scrutiny of hard-copy or on-screen plots in which the tags for each label are distinguished or the polygons are colored according to PTYPE.

You can work on-screen work or from hard-copy edit plots registered on a digitizer. Complex maps may warrant repetition of some of the steps more than once. Your choice of method and sequence will depend on convenience, the abilities of your system, and the size and complexity of the map.

Checking Procedure

Build the Map - The first step in checking a polygon layer for errors is to assure full polygon topology by building the map (**Build** on the Topology pulldown from the General bar; and see *Topology*, p. 56).

Tag or Label Remaining Polygons - If you have entered label points by hand, test for unlabeled polygons. Do this by checking the selection report when you color unlabeled polygons (see *Color Selected Polygons*, p. 169) or by listing errors (see *List Label Errors*, p. 167). If some remain unlabeled, find and label them. To find unlabeled polygons, color them on screen (see *Color Selected Polygons*, p. 169), post their centroids on an edit plot (see *Plot the Errors*, p. 168), or add untagged label points and select them (see *Create and Tag*, p. 164). If you have used Createlabels, check for untagged label points (see *Find Untagged Label Points*, p. 166) and tag any that you find.

Fix and Label Incomplete Polygons - If you have used Createlabels, check that there are no intended polygons without labels (due to incomplete polygon boundaries) by inspection of the map on screen or on an edit plot (see *Plot the Errors*, p. 168), fix the boundaries, and tag.

Correct Multiple Labels - If you have done any hand labeling, list label errors (see *List Label Errors*, p. 167) and record the list of any multiple label points, or make an edit plot to display multiple label points and node errors (see *Plot the Errors*, p. 168). Find the multiple labels by polygon, determine whether the problem is a broken boundary or multiple labeling, and fix the boundary or delete excess labels (see *Edit Polygons*, p. 171). Building with broken boundaries will have reset the PTYPE tags of the multiple labels. While they are at hand, find and correct the erroneous tag(s).

Check Tags - Once all the label errors are corrected in a map, it is wise to check that all the polygons are tagged correctly. This can be done on screen by including the tags when you draw (see *Display Tags On Screen*, p. 163) or by coloring the label points or the polygons. Label points can be colored by PTYPE (see *Distinguish Label Points*, p. 168). Map units can be colored throughout the map one by one on screen (see *Color Selected Polygons*, p. 169), or numerous units can be colored at once (see *Custom Colorfill*, p. 170). Check the tags throughout the map and correct erroneous tags. Ultimately, you will want to make a full-color plot to check the whole map.

Find Unlabeled Polygons

Unlabeled polygons can be listed (see *List Label Errors*, p. 167), but that list provides no basis for finding the polygons on the map. To find them you can either color the unlabeled polygons on the screen (see *Color Selected Polygons*, p. 169) or make an edit plot showing polygons with label errors (see *Plot the Errors*, p. 168). If you include tics in the edit plot, you can register it on a digitizer and either tag the polygons directly or, particularly for tight areas, zoom in from the digitizer and then work on screen.

Find Untagged Label Points

Label points added to a polygon layer with the Createlabels function will need to be selected and tagged. If all the labels in a map are untagged, draw from the Digitize (Areas) bar and select and tag the labels. Or, make an edit plot showing all arcs, label points, and tics (see *Edit Plots*, p. 193), register the plot on a digitizer, and select and tag the label points. When working on the screen, you can color those polygons that have untagged label points to help guide the work (see *Color Selected Polygons*, p. 169).

Where only a few label points are untagged, select them with Select For Expression (Select popup):

selection expression: *PTYPE = ''* - two single quotes.

Then color the labels (**$symbol(S)**) and draw the area of the selected features. If the distribution of the labels draws too large a part of the map, you may have to list their User-ID numbers (**show sel'd features** on an Options pulldown), record those numbers, and then select them one by one:

selection expression: *$ID* = [*ID number*]

Once a single label is selected, draw the area of the selected feature. If you need to enlarge the draw area, first use **zoomin(box)** to reset a finite draw area and then zoom out.

List Label Errors

The Labelerrors function will list all the valid polygons in a map that have no labels or that have multiple labels. The list of unlabeled polygons serves to indicate their presence, but other means must be used to find them on the map. The multiple labels, in contrast, are listed by User-ID number for each polygon, and this number can be used to select the label points.

Run Labelerrors from the General bar. Pick **Labelerrors** on the Topology pulldown, specify the map, and activate the function. Use **ok** unless you want to send the resulting list to the system printer, in which case use **print**. You can also run a watch file to record the list and print that separately. To do this, go to the Devices bar (pick the bar name to open the Commands menu, then pick **DEVICES**), and pick **watch on** from the Watch pulldown. Enter a name for the watch file at the prompt (such as *erlist.1*) and then go back and start Labelerrors. Be sure to turn the watch file off again afterwards (**watch off**). This watch file can then be displayed on the screen (**page list** on the Commands menu) or sent to a printer.

If you are working from a terminal, you may want to reset the screen dialog to full screen (**fullscreen dialog** on a Commands popup) in order to preserve as much of the list as possible on the screen.

If there are no errors in the polygon labels on the map, the list will simply report the background polygon, which surrounds your map and needs no label:

```
Polygon        1  has          0  label points
```

Otherwise, a list of errors will be reported in the following form:

```
Polygon        1  has          0  label points
Polygon        3  has          2  label points
Label User ID:                 5                - one label in polygon 3.
Label User ID:                 6                - another label in polygon 3.
Polygon        4  has          2  label points
Label User ID:                 4
Label User ID:                 8
Polygon        7  has          0  label points
```

This list of label errors indicates the presence of unlabeled polygons and specifies the User-ID numbers of the label points in each polygon that has multiple labels. Use these ID numbers to select the label points (see *Locate Multiple Labels*, below).

Locate Multiple Labels

The Labelerrors function lists multiple labels according to their enclosing polygon, and you should locate them on the map in the same polygon groups to facilitate correction. Select the labels using Select Many from an edit plot on a digitizer or by user ID-numbers on screen. To select a group of labels by user ID, use Select For Expression on the Select popup and enter the User ID (call it $ID) for each label in the group, separating each with *or* :

```
select expression:  $ID = 3 or $ID = 4 or $ID = 5
```

This example would select the three label points that have User ID numbers 3, 4, and 5. The first time you do this in a session, ARC/INFO will warn you:

```
WARNING  User-IDs between LAB and PAT do not agree.
Exit and re-build the coverage
```

Do not rebuild. The disagreements in the database that produce this warning result from the errors that you are working to correct.

With the labels selected, draw the area of **selected features(S)** from the Zoom popup to see the selected label points on the screen. Draw the selected labels or, better, assign them a session color to distinguish them (**$symbol(S)**). Zoom out if necessary to see whether the problem is more than one label in a single polygon or a broken boundary that has produced a composite polygon. To check this, you will probably want to draw the whole perimeter of the enclosing polygon. You can do this by zooming out several times. It may be faster to go to the Reshape bar (which you must do anyway to repair a boundary), select the polygon boundary with Select Outline on the Select popup, and then draw the area of the selected feature from the Zoom menu. The selecting mouseclick should lie just inside the polygon at the boundary.

Plot the Errors

Two complementary kinds of edit plots can be made that will help to identify and find errors for correction (see instructions in *Edit Plots*, p. 193). A plot of polygon errors will show the information in the error list graphically (multiple labels and polygons without labels). A plot of line-work errors will aid in finding broken polygon boundaries by showing the line work and marking all pseudonodes and dangling nodes . If tics are included in the plot, the error plots can be registered on a digitizer and used directly. Complex parts of these plots will be difficult to read clearly. Plot these areas at an expanded scale or reserve them for on-screen work.

Make a polygon error plot by limiting the edit plot to polygons with label errors (include tics to register the plot on a digitizer). This will mark the centroids of unlabeled polygons with a star, indicate multiple label points and their User-ID numbers, and show the boundaries of those polygons that have label errors. Make a line work error plot by including all arcs and node errors (and tics for registering the plot). This will show all the arcs and then superimpose (with pen 2) small rectangles for dangling nodes and diamonds for pseudonodes.

ON-SCREEN COLORING

Coloring the label points of tagged polygons or filling polygons with color on screen can be very useful in viewing and editing your work. Some coloring operations are automated in ALACARTE, whereas others require the preparation of simple text files that are then run as ArcPlot programs whenever the screen is redrawn with any Draw or Zoom function.

Distinguish Label Points

The polygon tags can be displayed on the screen at their label points (see *Display Tags On Screen*, p. 163) or the label points can be assigned session colors or symbols according to polygon type. These label colors can be saved between edit sessions.

Select the label points by area type from the Digitize bar and assign each type a session color (**$symbol(S)** on the Draw popup). Save these symbols, if desired, by assuring that the needed items have been added to the database (SEL and SYMB in the PAT) and turning Save Symbols on from the Save pulldown from the Edit bar.

Session colors 1-15 on the Colors popup will assign a small rectangular spot of the specified color to the label point. Because only five or six screen colors are really distinguishable on screen for such small symbols, such coloring must be done in groups of five or six map units at a time. Larger symbols can also be assigned in the same range of colors by picking **other** from the Colors popup and entering a number at the prompt: 17-31: rectangles: 33-47: pluses; 49-63: rectangles containing an X; 65-79: rectangles contain a plus; and 81-95: diamonds.

Color Selected Polygons

You can color any single kind of polygon in the edit map with the Color Unit function (**color units in backgnd** on the Options pulldown from the Digitize bar). This is particularly useful in finding untagged polygons or label points, but can also be used to color polygons of any PTYPE. You specify the type of polygon and the color, and then every time you draw or zoom the polygons are selected and colored. The routine that colors the polygons consults the permanent file of the edit map and requires that no editing has been saved since it was last built for polygons.

Color unlabeled polygons, or those with any single specified tag (including untagged label points) with **color units in backgnd**, which opens a forms menu:

1. **Specify shadeset**
   local shadeset: /ARCEXE50/SYMBOLS/COLOR.SHD
   OR
   arc shadeset: /ARCEXE50/SYMBOLS/COLOR.SHD
2. **Unit to be colored** **selected geologic unit:** Qal
   OR
   color unlabeled polygons
3. **select color for unit** **selected color number:** 7

Accept the default shadeset or specify another (*?* or middle mouse click to list options from your local directory or the ARC symbols directory). Use the PTYPE of existing label points to specify the polygons to color by picking the **Unit to be colored** button and then choosing from the resulting list of unit labels in the map (Qal in the example; pick ***none*** from that list to color polygons with untagged label points). Color polygons with no label point by picking the **color unlabeled polygons** button. Specify the color to be used by opening the Colors menu with the **select color** button and picking a color. Numbers greater than 16 will produce various patterns in white, red, green, and blue (pick **other** and enter number from the keyboard). Activate the routine with **ok**, and then every time you draw or zoom, the specified kind of polygon will be colored on screen.

Change the unit or color assignments by repeating the process. Accumulate colors on the screen for different units by changing the settings and drawing sequentially without clearing the screen (use **draw(noclear)** on the Draw menu).

Turn the coloring routine off with **color unit: off** on the Options pulldown. Be sure to do this before leaving the Areas bar to work on lines or points or errors will result on every zoom and draw.

This function operates on the permanent file of the current edit map. You can color from a different version of the map, or color several units at once, by using a custom colorfill program (see *Custom Colorfill*, below).

Custom Colorfill

A colorfill program can be written that will color one or more map units on screen as part of the Draw and Zoom functions in ALACARTE. This works in the same fashion as the routine used to color selected polygons from the Color Unit menu, except that you invoke it from the Arcedit command line. You must have built the map for polygons since last saving any editing. The limit on the number of units that can be colored concurrently is the number of distinctive colors and patterns available on your system. For large maps this routine may exceed available memory in your terminal unless only part of the map is drawn at a time.

Prepare the Program

Go to the directory that contains your map and start a screen editor from the system prompt or the Commands menu. Use a short file name of the form *c*.[*mapname*].*ap*. (Or use the extension *.alc*, which will inform ALCARTE to copy the coloring file when you save to a new file name.)

Enter the program in the screen editor:

/ explanatory heading for the program*	(optional)
shadeset color.shd	(specify the shadeset for the program*)*

Repeat the following four lines for each unit to be colored:

resel [*map name*] *poly mapextent*	(save time by limiting to draw area)
resel [*map name*] *poly PTYPE = 'Qal'*	(single quotes around entry)
polygonshades [*map name*] 7	(7 is yellow)
Clearselect	(clear this selection)

In this form the program is specific for a particular map file. Save the program as a file in the current directory for the map.

This basic form can be modified to color unlabeled polygons (those lacking label points) and post the polygon numbers on screen (those reported by Labelerrors):

shadeset color.shd	
resel [*map name*] *poly mapextent*	(save time by limiting to draw area)
resel [*map name*] *poly PTYPE = ''*	(two single quotes, no space between)
polygonshades [*map name*] 7	(7 is yellow, 13 is magenta)
textcolor 13	(specify a color for polygon numbers)
polygontext [*map name*] [*map name*]#	(post polygon numbers)

To make the general program apply to the current edit map, regardless of its name, change the file name references:

```
/* explanatory heading for the program
shadeset  color.shd

resel  %.alc$cover%  poly  mapextent
resel  %.alc$cover%  poly  PTYPE  =  'Qal'
polygonshades %.alc$cover%  7
Clearselect
```

To post the polygon number for the selected polygons (as for unlabeled polygons), insert the following into the program just before *Clearselect*:

```
&s apcover  [entryname %.alc$cover%]      (generalize map name for other directories)
textcolor 13                              (color the text magenta)
polygontext  %.alc$cover%  %apcover%#     (post the poygon number)
```

Run the Program

Activate the colorfill program by going out to the ArcEdit prompt (pick **give one ARC/EDIT command** from a Commands popup in Edit) and entering *ap* [*name of colorfill program*]:

```
Arcedit:  ap  colormap.alc
```

Now, every time that you draw or zoom in ALACARTE, the colorfill program will color the polygons on the screen. Turn the colorfill routine off by picking **color units: off** (on the Options pulldown from the Digitize bar). To restart the colorfill routine, go out to the Arcedit prompt and activate it again.

EDIT POLYGONS

Polygons can be edited by repairing or modifying their boundaries or by adding, deleting, moving, or tagging their label points. Work with the label points from the Digitize and Move (Areas) bars and change polygons boundaries from the Reshape (Lines) bar. Any changes in boundaries or in the presence or location of label points will require that the map be rebuilt for polygons to assure complete polygon topology. Be sure to save any changes before leaving Edit, and then rebuild the map to incorporate the edit changes into the polygon topology.

Once problems in a polygon layer have been identified (see *Check Label*s, p. 165), the principal issue is to locate them on the map in order to correct them. Some problems are located as they are identified, as with coloring unlabeled polygons or noting problems on an edit plot, whereas others must be located once they have been identified. This applies particularly to multiple labels listed with Labelerrors.

Most polygon editing will be facilitated by drawing with Node Dangles on and displaying the tags at their label points (see *Display Tags On screen*, p. 163).

Move Labels

There are occasions, particularly with very small polygons, in which you may have placed a label on the wrong side of a boundary. This leads to one polygon with no label and an adjacent one with two. If, in checking labels, you recognize that this has happened, simply select one of the labels and move it across the boundary (work from the Move bar). You will then need to check (and correct) the tags of both labels, because the previous build will have reassigned them in common.

Delete Extraneous Labels

Some errors in polygon labels may be multiple labels in individual polygons. This is most likely in large or intricate polygons that you labelled more than once in different places. Multiple labels within discrete polygons can be found on a polygon error plot, except where the plot is illegible in tight or complex areas. They can also be found on screen through the selection of groups of multiple label points or by inspection of a screen plot showing lines and label points (draw from the Areas bar).

Select and delete the extraneous label points and then check the tag of the remaining label and correct it if necessary.

Change Tags

The tag recorded for a label point (PTYPE) may be wrong either because you entered it incorrectly or because it was reset during a build where the polygon contained multiple labels. Change a tag either by retagging or by correcting it in the database form.

To retag, set the correct area type at the Digitize bar, select the label, and tag it.

To check or correct the tag from the database form, select the label, open the form (**forms(S)** on the Database pulldown from the Areas bar) and, if necessary, enter the correct tag in the PTYPE blank. Or, open the form with no label selected and then select from within the form (click on **SELECT** in the form and then click on the label on the map).

To change the PTYPE entry for a set of labels (for example, to change numerous entries from `Tv` to `Ta`), set the current area type to the current entry (`Tv`), select by current area type, reset the area type (`Ta`), and tag the selected set. Be sure to save your work.

Broken Boundaries

Some polygons with multiple labels may actually be composite polygons made of adjacent, labeled polygons for which the common boundary is not closed. These composite polygons can be found either by on-screen inspection of the line work surrounding the multiple label points or by comparison of a polygon error plot and a line work error plot.

Work from the Reshape (Lines) bar and be sure that the snapping functions are set properly. Examine the map and determine the source of the error. If gaps in a polygon boundary are tiny, you may need to zoom in on the various junctions to find where the continuity is broken (use **save this frame** before zooming in to permit easy return to your view of the whole polygon). In extreme cases you can use Select Outline on the Select popup to check the integrity of a polygon boundary. Once you have

located the break, fix it (typically by moving and snapping nodes).

The tags of multiple label points within each polygon will have been reassigned in common during the preceding build. Thus you will also want to check and correct the tags while the affected labels are identified. Select the mistagged label and correct it (see *Change Tags*, p. 172).

Points and Point Data

Geologic maps can contain a variety of kinds of information assigned to particular points in the map, including field or sample localities, fossil localities, wells, and earthquake epicenters. (Structural data and such oriented elements as strike-slip arrows and bar-and-ball on faults are also recorded at points, but are separately treated under *Oriented Data and Symbols*.) Point data in a digital map can be much more extensive than on a single cartographic presentation, because the digital map is a database. Different kinds of points can be distinguished by different primary tags (PTTYPE in a standard ALACARTE map) or can be separated in different map layers.

Points and point data are entered by hand or by import of tabular files; scans can only provide locations for on-screen tracing. Imported files that contain location of the points can be used to generate point maps automatically; those without locations can be be used to assign information to existing points carrying equivalent identifications. All the information about a point can be recorded in the primary INFO database, or an entry in that database can be used to relate the point location and identity with additional information in another database containing additional information (such as fossil lists, major-element chemistry, or field notes).

Different kinds of point information are supported by different digitize bars in ALACARTE. Work with information that requires a point location but has no azmuthal content from the Digitize (Points) bar (pick **POINT** from the Digitize/Tag pulldown from the Points bar).

BASIC POINTS BAR

The points bar (reached with **PTS** on the ALACARTE bar) provides basic functions about points and a Digitize/Tag pulldown from which you proceed to the digitize bars for the different kinds of points:

[Points] | Dig/tag | MOVE | SYMB | Db | Sel | Op | Dw | Zm | ^EDIT |

POINT
PLANAR
LINEAR
MAP SYMBOLS
no attribute

Use the items on the Digitize/Tag pulldown to go to the digitize bar appropriate for the kind of point data with which you want to work. Move or copy points from the Move bar. Change markerset or lookup table for the symbols displayed on the screen from the Symbols bar (pick **SYMB**). The Database pulldown contains a number of functions for working with the database, including the Database forms menu from which you can view and change database entries.

Points Item

The database item that ALACARTE uses to record the point type and to select by type is the PTTYPE field by default, but this can be changed for more specialized applications from any of the points digitizing bars. If you have established an additional character item in the database for some purpose (with **Additem** on the Files pulldown from the General bar), you can reset it as the points item that

ALACARTE will use in tagging and selecting. Pick **set points item** (on the Database pulldown from the Points bar), which causes the report:

Current points item is PTTYPE. Select a new character item.

and opens a menu of available character items in the points database of the current edit map from which you can pick an alternative to PTTYPE. ALACARTE will report the new points item, which will be maintained throughout the various points bars until you change it or start a new work session.

PREPARE A POINTS LAYER

Start a Points map from the Setup bar as a new map or a layer for an existing map by picking **sample localities** from the appropriate pulldown (see *Start a New Map or Layer*, p. 93). Use this menu item regardless of whether the intended points will actually be sample localities or some other kind of point. ALACARTE will prepare the map for points and add items (database fields) called PTTYPE and SAMPNO, which are addressed automatically in some of the ALACARTE points functions. You will probably want to include the save items SYMB and SEL as well. If you will need additional database items, add them from the General bar: **add item** on the Files pulldown (see *Database Items*, p. 55).

DIGITIZE POINTS

Digitizing points can be as simple as setting the PTTYPE, positioning the crosshairs or digitizing puck, and clicking on the location. An option is available to follow the entry of each point with a prompt at which to enter an identifying number or name for the point from the keyboard (generically called Sample Number in ALACARTE). To begin, go to the Digitize Points bar (click **POINT** on the Digitize/Tag pulldown from the Points bar):

[Dig] | dig | Tag | Sel | ? | Point Tags | SYMB | Op | Dw | Zm | ^POINTS |

point tag	**key-in**
sample nbr tag	
point & samp tag	**Custom tag menu 1**
	Custom tag menu 2
	Custom tag menu 3
	Sample nbr:
	help
	set field
	on
	off

A current point type is maintained at the bar for use in tagging points automatically as they are digitized, in tagging a selected set of points, and in selecting points according to their tags (point item of PTTYPE, unless changed). Pick **?** to determine the current point type and reset it either by entering from the keyboard (pick **key** and enter at the prompt) or by picking from a user-prepared custom menu opened with **Custom tag menu 1** (or **2** or **3**) on the Point Tags pulldown (see Custom Tag Menus, p. 82). There are no standard types for these simple points and no modifiers.

The process of digitizing points is identical to that of digitizing label points for polygons. Pick **dig** on the bar - a key menu is presented, preceded by a report of the current point type that will be assigned to the PTYPE item for the point, and followed by the prompt to enter a label (in this case meaning a point):

```
Adding points with attribute:  bedding

-------------------------Options--------------------------
1)  Add Label              5)  Delete last label
8)  Digitizing options     9)  Quit
(Label)  User-ID: 20
```

Click *1* on the screen or digitizer to enter a point; the coordinates of the clickpoint will be reported and the point will be displayed on the screen:

```
(Label)  User-ID: 20  Coordinate = -3181.966,6025.430
```

Unique Point Identifier

The point type will probably be used to identity a class of points, such as sample localities or wells. Two options are available for assigning unique identifiers to the points as they are entered, the User-ID number and/or the Sample Number.

User-ID Number

The simplest way to assign a unique identifier is to control the User-ID number that is automatically assigned to each point when it is digitized. This number, typically referred to as the $ID, is recorded in the [map name]-ID item in the points database (PAT). Use the number that ARC/INFO assigns (posted at the prompt when you digitize), or reset that number as you wish. ARC/INFO will start a new round of digitizing with a $ID number one greater than the highest number already in the database, and will automatically increase the count as you digitize (this Autoincrement can be turned off from the Digitzing Options key menu if you wish). The User-ID item is a numeric field, which will permit selection of ranges of numbers with Select For Expression on the Select menu.

Reset the base from which the $ID number is counted from the Digitizing Options key menu. This menu can only be reached from the Points bar: pick **no attributes** on the Digitize/Tag pulldown and then, at the digitizing prompt, enter an *8* to obtain the Digitize Options key menu:

```
----------------------------------------Digitizing Options-----------------------------------
1)  New User-ID          2)  New Symbol    3)  Autoincrement  OFF
4)  Autoincrement  ON    5)  New Angle     6)  New Scale
9)  Quit
-------------------Enter Option
```

To reset the User-ID, enter a *1* here, then enter the new number. You will be placed back at the prompt to enter a new point with the new user ID-in place. Even if you want to work from the Digitize (Points) bar, you must digitize one point here to implement the new User-ID number (you can always delete it later, if necessary). The number will progressively increase from this new base as you enter

more points. You can post the $ID numbers adjacent to their points on the screen to provide a means of checking the numbers as you proceed (see *Display Point Attributes On Screen*, p. 179).

Sample Number

A number or other unique identifier (any sequence of alphanumeric characters) can be recorded for each point at a prompt that appears after each point is entered. This is in addition to recording the current point type in the PTTYPE item and is placed in a separate character field in the database. Controls for this option are on the Point Tags pulldown (see p. 176). Use **set field** to change the database item in which the identifier will be recorded from the default of SAMPNO to any other character field that is available. Include the Sample Number prompt in the digitizing sequence with **on** and remove it with **off**. After each point that you enter with the prompt turned on, you will be asked to:

enter a sample number on keyboard:

Do so and upon your <Return>) the prompt to digitize another point will appear. You can post these entries with the points on the screen to provide a means of checking them as you proceed (see *Display Point Attributes On Screen*, p. 179).

Changing Points Attributes

The point tag and/or the sample number can be reassigned or changed from the Tag pulldown (see p. 176). Use **point tag** to assign the current point type to the selected set. Use **sample nbr tag** to obtain the sample number prompt from which to enter a different sample number. (The function **point & samp tag** to do both steps together is not implemented in version 1.0; use the separate items instead.) If more than one point is selected, the retagging will be done on the whole set together, but the sample number prompt will cycle through the set, one point at a time.

When you pick **sample nbr tag** with a set of four points selected, for example, a report will indicate

Tagging 4 points with individual sample number	
1 element (s) now selected	- selected the first point in the set.
Existing sample number for point 1 of selected set	
(ID = 22) is: 444	- reports the current entry in SAMPNO.
Enter new sample number on keyboard or	
<Return> = No Change, Q to Quit: *1*	- *1* entered as new sample number.
Point 1 of 4 tagged with SAMPLE NUMBER: 1	- reports change in sample number.

The routine cycles through the whole selected set in this fashion, and then asks

Reset selected set, <Return> = yes?

Hit <Return> to have ALACARTE reestablish the original selected set before returning control to the bar, or enter *n*(o) to leave only the last point in the list selected.

Display Point Attributes On Screen

You can display on screen next to the point symbol any of the attributes associated with the point as you digitize, tag, or draw. This is useful at relatively large draw scales, but will illegibly clutter the screen at small scales. Go out to the Arcedit prompt (pick **give one ARC/EDIT command** from the Commands menu) and enter:

Arcedit: *textitem label* [*item name*]

where *item name* is the item (database field) in which the attribute is located (PTTYPE, $ID, SAMPNO, or others). Then, each time you digitize or tag a label, the attribute will be displayed next to the point. The attribute will be displayed for all existing points whenever you draw or zoom, although the text does not scale with zoom and it cannot be manipulated as annotation.

Turn off the display of attributes by going out to the Arcedit prompt and entering:

Arcedit: *textitem label none*

Oriented Symbols and Data

Oriented symbols are used on geologic maps to represent such information as bedding attitudes, lineations, and strike-slip arrows on a fault. In an ALACARTE map, the type of feature and orientation information are recorded in the database and the symbols representing that data are posted on the map in the proper orientation at the time of plotting or on-screen display. The data are associated with a specific location in the map and database and are posted at that point. Such data are recorded by ALACARTE as points with associated attributes in a map layer devoted to structural information. Different kinds of orientation data are distinguished by different primary tags (PTTYPE) assigned to the points, with the strike or bearing stored in the STRIKE item and the dip or plunge in DIP.

Oriented point data are typically entered by hand from the digitizer or on screen with the strikes (or bearings) specified graphically or from the keyboard and the dips (or plunges) entered from the keyboard. Data in tabular files can be imported and associated with existing points or, if x,y locations are included, can be used to generate a map automatically. Scans can be useful as backgrounds from which to trace orientations on screen.

The basic Points bar is described in *Points and Point Data* (p. 175). Work with all orientation data from the appropriate digitize bar - the Planar bar for features such as bedding and joints, the Linear bar for features such as lineations and the axes of minor folds, or the Map Symbols bar for features such as strike-slip arrows on a fault (the Map Symbols bar is not implemented in version 1.0 of ALACARTE).

PREPARE A STRUCTURE LAYER

Start a structure layer from the Setup bar as a new map or a layer for an existing map by picking **geologic structures** from the appropriate pulldown menu (see *Start a New Map or Layer*, p. 93). ALACARTE will prepare the map for points and attributed lines (such as fold axes or structural contours) with the items LTYPE, PTTYPE, STRIKE, and DIP in the appropriate attribute tables. You will probably want to include the save items SYMB and SEL for both lines and points as well.

PLANAR AND LINEAR ELEMENTS

Although different bars are used because of the different point types and digitizing routines, the procedures related to planar and linear features are essentially the same and data for planar and linear elements are normally stored in the same structure layer. Start by specifying the markerset to be used for posting symbols, and set the point type, which identifies the kind of structural feature (bedding, vertical joint, minor anticline). For each graphic entry, click the ends of the strike line or lineation on the screen or digitizer and enter the dip or plunge from the keyboard. ALACARTE calculates the azimuth and records it in the STRIKE item, places the point at the midpoint of the strike line or the origin of the lineation, records the dip or plunge value in the DIP item, and posts the value as annotation an appropriate distance from the end of the symbol as a function of map scale. (Keyboard entry of direction, either by azimuth or by quadrant, is not supported in version 1.0 of ALACARTE.)

To begin, go to the appropriate bar from the Digitize/Tag pulldown from the Points bar by picking **PLANAR** for planar structural elements and **LINEAR** for linear structural elements; the only difference in the appearance of the bars will be the bar name:

[Planar] | dig | Chg | Sel | ? | Pt Tags | Set | Op | Dw | Zm | ^PTS |
[Linear] " " " " " " " " " "

ALACARTE will automatically select the existing points in the layer, assign symbols from the standard map-scale symbol set, and draw the map.

SET THE SYMBOL ENVIRONMENT

Before you work with oriented structural symbols on the screen, you will probably need to define some of the settings that control the method of entering data and the way that symbols are selected and drawn on the screen. In particular, this involves changing to the lookup table for double-sized symbols if desired, and setting the draw scale to permit you to read symbols and dip or plunge values in proportion to the other map features. The draw scale is important because, although the spatial relations of map elements and the dip and plunge numbers all scale when you zoom in or out, the size of the structural symbols themselves does not.

Most of these factors are set from the Set Symbols pulldown, which is identical for both planar and linear features (except for dip/plunge):

draw first time w/ current
show current settings

Choose markerset
Choose lookup table
Select db items

set dip numeral height
or **" plunge " "**
set attitude entry format

Set the Symbols

Check the Settings - List the current settings for symbols by picking **show current settings**.

Markerset - The standard structural symbols that are drawn on the screen in ALACARTE are contained in a markerset called ALCGEOL.ALC, which is located in the ARC Symbols directory. This is specified automatically by ALACARTE, but can be changed for specialized work. To specify a markerset, pick **Choose markerset**, list the options from the Symbols directory or the local directory (*?* or middle mouseclick in the blank), and pick one.

Lookup Table - Two standard lookup tables for structural symbols were attached to the structure layer when you started it from the Setup bar. One of these, called [map name].LUT, assigns symbols of a size appropriate for geologic maps and is automatically selected by ALACARTE. The other ([map name].LUT2X), assigns symbols twice as large. Because these symbols do not change size as you zoom in and out on the map, you will want to select the proper lookup table for your on-screen work. For most digitizing and editing, you will probably want to use the double-size symbols (the 2X lookup table). To specify a lookup table, pick **Choose lookup table**, list the options (*?* or middle mouseclick in the blank), and pick one.

Size of Numbers - The dip and plunge numbers are placed as annotation in the structural layer with a default height of 0.05 inches on the map. The height is actually specified in map units (meters on the ground) by automatically converting as a function of recorded map scale. Change from this default height by picking **set dip numeral height** and entering a height in map units from the keyboard. This height will apply only to dip or plunge values entered while it is in effect. The height of existing numbers was established when they were entered. Change that from the Change Annotation bar with **annosize(S)** after selecting the numbers (see *Edit Annotation*, p. 190).

Set the Draw Scale

The structural symbols have a fixed size on the screen, regardless of the scale at which you draw the map, whereas the dip and plunge values and the spatial relations of map elements rescale as you zoom in and out. If you want to see the symbols, numbers, and other map elements in the same proportion as on a plot at map scale, you will want to establish the appropriate draw scale. Use **draw to scale** on the Zoom menu, and specify a scale chosen to match the lookup table (1X or 2X map scale) and the relation of your graphic screen to the standard screen width of 9.25 inches used by ALACARTE:

draw scale = (map scale or map scale / 2) X (width of your screen / 9.25)

To retain this scale on the screen, avoid using Zoombox and keep track of any temporary scale changes imposed with Zoomin and Zoomout, or rescale the display after changing scale or location.

Change Database Items

The default items in the database that are used to record the point type, strike or bearing, and dip or plunge can be changed from the default settings (PTTYPE, STRIKE, and DIP) for specialized work. Pick **Select db items**, then list the available character fields (*?* or middle mouseclick in the blank) and choose an item for each data type.

Set the Entry Format

Three different methods of entering strike or bearing are offered on the Entry Methods menu: Quadrant, Azimuth (left hand), and Digitize (the only entry format available in version 1.0 of ALACARTE is Digitize). Change from the default Digitize method by picking **set attitude entry format** and then picking the desired method from the popup menu:

Quadrant - digitize the location of the data point on screen or from the digitizer and then enter both strike and dip (or bearing and plunge) from the keyboard, with the direction in quadrant format (such as N30E45SE). (Not included in Version 1.0.)

Azimuth - digitize the location of the data point on screen or from the digitizer and then enter both strike and dip (or bearing and plunge) from the keyboard, with the direction in azimuth format. For planar features the down-dip direction will be the left hand side of a viewer looking along the azimuth direction (180° dips E, 360° dips W). (Not included in Version 1.0.)

Digitize - Digitize the direction and location concurrently by clicking on each end of the strike or bearing line, then enter the dip or plunge from keyboard. For planar features, the location will be the calculated midpoint of the line specified, the azimuth will be the direction from the second toward the first clickpoint, and the dip direction will be to the right hand side of the azimuth. For linear features, the origin will be the first clickpoint and the azimuth from the first toward the second clickpoint.

SET THE POINT TYPE

Specify the kind of structural feature that a point represents with the PTTYPE, in which ALACARTE records the current point type when a point is digitized. A current point type is maintained at the Planar and Linear bars. Set this by picking from the standard types listed in the Point Tags menus (open with **Pt Tags** on the bar):

Planar Features:

bedding
approx bedding
ot bedding
bedding w/ tops
ot bedding w/ tops
flat bedding
vert bedding
vert bedding w/ tops
crumpled bedding
foliation
foliation and bedding
vert foliation and bedding
horz foliation
inclined cleavage
inclined cleavage w/ tops
joint
horz joint
vert joint

Linear Features:

lineations:
inclined
" at attitude
horizontal
vertical

slickenside:
inclined, normal
inclined, reverse
inclined, unknown
bd-clvg inters. lin.

minor anticline
minor syncline
minor f.a., inclined
minor f.a., horiz.

paleocurrent

joint unmineralized	**dip of fault sfc**
air photo attitude	
key-in	**key-in**
Custom tag menu 1	**Custom tag menu 1**
Custom tag menu 2	**Custom tag menu 2**
Custom tag menu 3	**Custom tag menu 3**

You can also enter a point type from the keyboard (pick **key-in**) or pick from a user-defined custom menu (open with **Custom tag menu 1** or **2** or **3**). Note that only the standard types on the Point Tags menus will correlate properly with the standard lookup tables and markerset; use of custom types will therefore require a custom markerset and lookup table.

ENTER STRUCTURAL DATA

Draw the map area on the screen at an appropriate scale and set the point type for the kind of structural feature to be digitized. If you are working from a digitizer, register your source map (see *Map Registration*, p. 115). Start the digitizing routine by picking **dig** on the bar. The procedure then depends on the entry format that you have chosen. Follow the instructions in the dialog area after checking the point type that is reported.

Graphic Entry (Digitize)

When you start the digitize routine, the point type is reported. (Note that the raw form of linear types is reported, rather than that indicated on the Tag Menu. The correlation between the two will be clear if you set two or three types and check the report for each by starting the digitize routine.)

You are instructed to click on one end of the strike or bearing line (click *1*). For strikes, this first click should be to the left of an observer looking down dip at the attitude, which is the end of the line farthest from an observer looking along strike with the down dip direction on the right. For bearings, Click-point 1 should be at the data point marked by the origin of the linear feature.

> Click on endpoint 1 of attitude template using CURSOR, or press 9 to exit

> Click on origin of linear symbol using CURSOR, or press 9 to exit

The template for attitudes is an oversized strike-and-dip symbol (3-4 inches long) that you can prepare and use to increase the precision of strikes entered from the digitizer. Alternatively, click on the ends of a drafted symbol or a scanned equivalent displayed on the screen. Remember that ALACARTE will calculate the midpoint of the strike line to determine its location.

The second click (also a *1*) marks the other end of the strike or bearing line; the second click for a bearing is used simply to specify direction (no length is involved):

> Click on endpoint 2 of attitude template using CURSOR

> Click on end of linear symbol (arrow) using CURSOR

The symbol will be drawn on the screen at the point in the specified orientation, the calculated azimuth

of the strike or bearing will be reported, and you will be asked to enter the dip or plunge from the keyboard:

```
strike  =  313
Enter dip value (0  to  90) on keyboard:  45
Bearing  =  82
Enter Plunge value (0  to  90) on keyboard:  45
```

The examples show values of 45 degrees entered. When you <Return> after typing the value, ALACARTE records the data and starts the instruction sequence over again. Enter another data point, or terminate the digitize routine with a *9* and return control to the menu bar.

Note that, once begun, the entry sequence cannot be interrupted. If you make an error, carry on through the sequence and then correct the problem. Do this by deleting an entry (see below) or, if the error is in the last point entered, by backing up with **oops**. Repeat the **oops** seven times to back up through one entry cycle (watch on the screen and in the dialog area to see the steps that ALACARTE uses to enter an oriented symbol and dip number).

EDIT STRUCTURAL DATA

The database for oriented structural data cannot be edited with the same ease as for other kinds of map features. Correcting an azimuth is not as simple as changing the recorded azimuth, because the orientation of the symbol on the map is controlled by a separate angle that is calculated from the azimuth at the time of digitizing and is stored in an internal ARC/INFO file. Similarly, the dip is not only recorded in the DIP item in the database, but is posted as annotation as well.

The recorded PTTYPE and resultant kind of symbol can be changed directly, by selecting the attitude, setting the point type, and picking **current point type(S)** on the Change pulldown. The other items on the Change pulldown are not implemented in version 1.0 of ALACARTE.

If either the strike (bearing) or dip (plunge) of an entry must be changed, the present procedure is to delete the entry and reenter it. Select the symbol as a point and delete it, then go to the Annotation bar and select the dip (plunge) value and delete that. Then return to Points and redigitize with the correct information.

SELECT STRUCTURAL DATA

Oriented structural entries can be selected by all the standard techniques for selecting points that are available on the Select popup menu and with the Select-By-Current-Point-Type items on the Select pulldown. The Select pulldown also supports selection by strike (bearing) and dip (plunge) values as well. Pick the appropriate menu item, click on a button to specify the kind of relation desired, and enter a value in the blank (**gt** = greater than, **ge** = greater than or equal, **eq** = equals, **le** = less than or equal, **lt** = less than, and **ne** = not equal to).

DISPLAY SYMBOLS IN BACKGROUND

The oriented symbols and dip/plunge numbers in a structure layer can be displayed in the background behind any map layer for reference. This is not done in the usual way by choosing a background and

turning on the points (labels), but is done instead from the Symbols bar. Go to the Symbols bar from any feature bar (Lines, Points, Areas, or Annotation) by picking **SYMB**:

[SYMB] | Lines | Pts | Areas | Anno | Dw | Zm | ^PREV |

Points (**Pts**):

Oriented symbols:
markerset
lookup table
draw cov in back
draw in back off

Non-oriented:
markerset
reset symbols
lookup table

The Points pulldown from this bar offers items with which to set the markerset and lookup table for oriented symbols (see *Set the Symbol Environment*, p. 180), and then to turn the background on (**draw cov in back**) and off (**draw in back off**). When turned on, the oriented symbols will draw in the background in white with every draw and zoom.

Add and Edit Annotation

Annotation can be added to any map layer, but for geologic maps it may be better to create a separate map layer for unit labels and other text. Such an annotation layer is strictly for graphic purposes, as database information must be assigned to valid map elements (individual lines, points, or polygon label points). Annotation can be added to any map layer from the digitizer or on screen, can be generated automatically from any database entry, and existing annotation can be selected, deleted, moved, rotated and otherwise modified (Change bar).

PREPARE THE LAYER

Start an annotation layer at the New Layer pulldown from the Setup bar by making a layer into which you can enter annotation and leaders (pick **annotation + leaders**, and call the layer something like [map name].an). This layer will be prepared to receive tagged leaders and other lines as well as text. Then, consider adding to it the unit labels recorded by PTYPE in the polygon layer of your map (see *Copy Annotation from Database*, p. 98). These can be placed automatically as annotation at their label-point locations in a specified map layer with **add unit text labels** (New Layer pulldown from the Setup bar). Although not directly satisfactory for graphic unit labels (too few in large and too many in small polygons), they will provide an excellent starting point for editing.

DIGITIZING CONTROLS

The Annotation Environment forms menu provides control on several factors involved in digitizing annotation: (1) the level in which the annotation is recorded, (2) the size and style used for the alphanumeric characters added to the map, (3) the method by which the text is specified, and (4) the method by which the text string is placed on the map. This menu appears automatically when you first go to the Annotation bar in an edit session and can be called at any time from the Digitize bar (**Anno-environment** on the Add Options pulldown):

Annotation Environment

Annolevel:	*1*	
Annosize:	*0.000*	
Annosymbol:	*1*	
Annooffset:	*0.000*	
Annofit:	*OFF*	**ON OFF**
Annoposition:	*LL*	**LL LC LR CL CC CR UL UC UR**
Annotype:	*POINT1*	**POINT1 POINT2 LINE AUTO**
Annoitem:	*KEYBOARD*	**POLY POINT LINE KEYBOARD**
{item]:		
{AUTO}:	*OFF*	**ON OFF**

OK HELP CANCEL DEFAULT

The settings in this menu control subsequent digitizing of annotation:

Annolevel - ALACARTE typically uses level 1 for all annotation in a map, although any of the 10 levels (1-10) supported by ARC/INFO for a map layer can be specified here. Use the default

level of 1 for standard ALACARTE maps. Separation of annotation into different levels permits independent manipulation of the separate levels, such as selective inclusion in plots or change in size or symbol (font, etc.). The control of annotation by ALACARTE in the Draw and Back Environments turns all levels on and off together. Annotation can be selected by level (see *Select Annotation*, p. 190) and selected annotation can be assigned session symbols. The level of selected annotation can be changed from the Change bar.

Annosize - defines the height of the alphanumeric characters that are entered. Two modes are available. Where Annosize is left at the default value of 0, characters are entered with a screen height of 0.1 inch, regardless of the zoom magnification of the display, and are then rescaled as the zoom is changed. Text entered at different screen magnifications will therefore have different sizes on the map. Specify a height in map units (numerically in the forms menu or by clicking on screen from **Annosize *** on the Add Options pulldown) where you want the text to be entered with that constant map height. The size of existing annotation can be changed from the Change bar.

Annosymbol - a positive integer that designates a suite of alphanumeric characters in the current textset that has a particular combination of font, color, slant, and character spacing (the default textset is PLOTTER.TXT, which contains 100 symbol suites; see *Appendix* B, *Font*s, in *ARC/INFO Symbols* of th*e ARC/INFO Users Guid*e). Because many types of symbols draw slowly on the screen, it is more efficient to use the default symbol (1) for most on screen work, and then change to the desired symbol for final editing and plotting (and see *Draw Selected Annotation*, p. 191). The Annosymbol of existing annotation can be changed from the Change bar or as part of preparing a plot file.

Annooffset - distance in map units by which text is offset from its associated line when placed on the map using Annotype AUTO. The default distance is 0.

Annofit - use ON when you want to place text by stretching it between two clickpoints. This overrides the character spacing inherent in the Annotation symbol. The default is OFF.

Annoposition - specifies which part of an annotation string is placed at the positioning clickpoint: considering the text string as an elongate rectangle, the Annoposition can be at the lower left of the rectangle (LL), the lower center (LC), lower right (LR), center left (CL), center center (CC), center right (CR), upper left (UL), upper center (UC), or upper right (UR). The default is lower left, which is the point from which a string of annotation is selected (regardless of the Annoposition setting.

Annotype - specifies the method by which a text string is placed on the map. Place it horizontally with one click using Point1 and at any angle by specifying an orientation with a second click using Point2. Specify a curved alignment with 3 or 4 clickpoints using LINE, and align it with an existing line in the map using AUTO.

Annoitem - enter the text string from the KEYBOARD, or extract it from the database item of a specified kind of map feature (POLY, POINT, LINE) that will be selected during the Digitize routine.

item - the database item from which the text string will be extracted with Annoitem set to a map feature.

AUTO - places the text automatically along the same line from which the text is extracted where Annotype is set to a map feature; uses the identifying clickpoint as the position point.

ENTER AND PLACE ANNOTATION

The basic procedure used to add text to a map uses Annotype = Point1. Start the Add routine (pick **add** from the Digitize bar) and enter the text string at the prompt::

Text: [*this is an example text string*]

Hit <Return> when the text has been typed and you will be instructed to:

Enter position (1)

Click once on the screen (indicated by the 1 in the prompt) to place the text on your map. The current Annoposition setting will be used (default of lower left). The text will be plotted horizontally on the screen (in the current Annosize and Annosymbol) and you will be prompted for another text entry. Close the Add routine with a <Return> at the Text: prompt.

Specify an orientation for the text line with two mouseclicks by setting the Annotype to Point2 and then, at the position prompt (Enter position (2)), click twice on the screen to define a direction. The first click positions the text and the direction to the second click defines the orientation of the text. Stretch the text between two such clicks by turning Annofit on as well.

Place the text along a curved line smoothed automatically between 3 or 4 clickpoints by setting the Annotype to Line. The prompt then becomes:

Enter position (Up to 4, 9 to stop)

Click 3 or 4 points to define a line along which the text is to be placed (if only 3, close with a *9*). The actual line used will be a splined version of the angular line that you enter. You can also make the Annotype Line function work like Point1 (close after one click) or like Point2 (close after two clicks), although Annofit will not operate here as it does with Point2.

Place the text along an existing arc in the map by setting the Annotype to AUTO. The position prompt then becomes:

Point to the arc to receive annotation
1 = Select 2 = Next 3 = Keep 9 = Quit

Use a single mouseclick to accomplish three steps at once: to select the line used for orientation, specify a position, and indicate on which side of the line the text should go. The text will be placed along the line with its base toward the side of the line indicated (for positive offset values). Offset the text from the selected line by specifying a distance in map units for Annooffset (positive values place text above the line, negative below).

Create stacked lines in a single entry by separating the lines with \, as:

Text: *this is the first line and\this is the second and\this is the third*.

Determine how the digitizing controls are currently set either by opening the Annotation Environment

menu or by picking **status - add** from the Add Options pulldown to obtain a report:

```
Annotation  Level   1    Symbol  1   Size  158.000
Annotation  Fit  OFF    Position  UR   Type ONE POINT
Annotation  Offset  -100.000     Item  KEYBOARD

Hit <return> when finished viewing
```

EDIT ANNOTATION

Annotation can be modified from the Change bar. The changes can involve modifying the entries themselves, such as size or symbol, or manipulating a text string as a whole, such as moving or rotating it. Before annotation can be changed, it must be selected.

Show Characteristics

Show the characteristics of individual text strings with **show(S1)** on either the Add Options pulldown (Digitize bar) or the Change pulldown (Change bar). This produces a report about the selected entry:

Shows characteristics of a selected annotation string.

Arrow1:	
Arrow2:	
Arrow3:	
Gap:	-100
Level:	1
Narrows:	0
Nchars:	12
Npts:	1
Point1:	2493.932387835,21305.80971419
Point2:	
Point3:	
Point4:	
Size:	124.8238980423
Text:	Example Text
Status:	ADDED
Symbol:	1

OK HELP

Select Annotation

Select individual entries using Select One or Select Many by clicking at lower left (regardless of where Annoposition was at the time of digitizing) or using Select Polygon to surround the lower left corner. Select multiple entries with Select Many or Select Polygon. Note that all levels of annotation in a map are active at once, regardless of what is actually drawn on the screen.

Select all the annotation in a particular level with Select For Expression (Select popup), by entering the level at the prompt:

selection expression: *$level* = [*numbe*r]

Select all the entries with a particular text string using **select $text =** on the Change pulldown. At the prompt, enter the text string to be used in the search:

Enter annotation string to be selected: [*text to be used in search*]

All annotation entries in the map (in all levels) that precisely match the search string will be selected.

Draw Selected Annotation

Text symbol 1 is a clear type that draw quickly on the screen in white, but the standard Drawselect symbol of 7 uses slightly larger characters in green. This leads to changes in apparent size when you select and the annotation redraws, and prevents complete removal of the green when the string redraws again in white. If this poses a problem, change to another Annosymbol and set the Drawselect color appropriately as well. For example, Annosymbol 9 (Drawselect symbol 11) is a simple type, but is smaller than 1; Annosymbols 21, 41, 49, and 85 (and their respective Drawselect symbols 23, 43, 51, and 87) are similar in size to 1, but all require more than single strokes to draw them.

Modify Entries

Several of the characteristics of annotation established at the time it is digitized can be changed later from the Change pulldown. Some of these changes can be applied to many entries at once, whereas others require working with one entry at a time. Any changes are made in the temporary file and must be saved.

Change Annolevel - Select the entries for which the level is to be changed, pick **annolevel(S)**, and enter the new level in the resulting forms menu.

Change Annosize - Select the entries for which the size is to be changed, pick **annosize(S)**, and enter the new size in map units into the resulting forms menu.

Change Annosymbol - Select the entries for which the symbol is to be changed, pick **annosymbol(S),** and enter the new symbol number into the resulting forms menu.

Change Text String - Change the selected text string(s) in one of four ways. Pick **change(S) $text**, to open the Change Options menu:

Change options - Please select an editing method:

APPEND CHANGE OVERLAY REPLACE

HELP CANCEL

Pick one of the change options and provide the needed information:

APPEND - enter a new string to be added to the end of the existing string(s).

CHANGE - change part of existing string(s) by entering the partial string to be changed, the new string with which the old should be replaced, and under **Globally**, indicate whether the replacement should YES apply to all repeats of the search string in each selected string, or NO apply only to the first encountered from the left.

OVERLAY - enter a new string that will be overlaid (characters and spaces) on the existing string(s), starting from the left.

REPLACE - enter a new string to be substituted for the existing string(s).

Replace Text String - pick **replace text string** from the Change pulldown and enter a new text string to be substituted for the selected string(s). This function is identical with the Replace option in the Change Text String function, except it cannot be canceled once started. Remove unintended effects with **oops**.

Manipulate Text Strings

The location, orientation, or method of placement of annotation on the map can be manipulated for existing text strings.

Copy and Move Text

One or more text entries can be copied or moved as a selected set using functions on the Move/Copy pulldown. Select and move the text string(s) to a new position on the map with **move(S)** by clicking a *from* and *to* point at the prompts. The string(s) will be moved parallel to itself in the direction and distance specified by the clicks. The string(s) will remain selected. Use **select and move** to select and move several string(s) in sequence by selecting (Select One) and clicking *from* and *to* points for each one. Close the routine with a *9;* the last string moved will remain selected.

Make one copy of a text string (or strings) in the same fashion, using **copy(S)**. The copy will become the selected string(s). Make several copies of the same string(s) with **copy many(S)**. A prompt for a *from* point will begin the sequence, but thereafter the *from* point for the next copy will be the *to* point of the last copy. Close the sequence with a *9*; the last copy made will remain selected.

Reposition Text

Reposition one selected text string according to the current Annotype setting. Select the entry, set the Annotype if necessary, pick **reposition(S1)** on the Move pulldown, and then follow the instructions as if placing a new string.

Dragging and Rotating Text from Terminals

Individual text strings can be selected and dragged to a new position and/or rotated easily using **smartanno(Tek)** and **position(Tek)**. As implied by their names, these functions will work only from Tektronix terminals, which contain the needed segment memory required by the functions. Turn Smartanno on and off with **smartanno(Tek)** (pick **ON** or **OFF** from the resulting menu). With Smartanno on, you can select and drag annotation with **move(S)** by holding the left mouse button down. Similarly, drag and rotate selected annotation with **position(Tek)**: drag with the left mouse

button and rotate in increments of the current Setangle by entering 1's from the keyboard (see the Rotate pulldown; uses 5 degrees if Setangle is 0).

Rotate Text

Text strings can be rotated a specified angle around a specified rotation point on the map using functions on the Rotate pulldown. This function can be applied to a single string or to a larger selected set, including the whole map.

With the string(s) selected, pick **rotate(S)**. You will be asked first to Point to the pivot point, which you should do with a mouseclick. The next step depends on the current angle. If it is 0 (the default), a circle will appear on the screen around the pivot point with a *from* radius pointing north, and you are instructed to Point to the coordinate defining the angle. Do this by clicking a *to* point on the circle to define the rotation angle (you are defining an angle, not an orientation). The text string will be rotated about the pivot point by the specified angle and the angle and pivot point will be reported:

1 annotation rotated 263.157 degrees around (5278.220,13217.724)

You can also specify the rotation angle from the keyboard by picking **setangle** and entering the angle at the prompt (positive values rotate counterclockwise). This current angle will be used by the Rotate function until you change it. Use **setangle 0** to reset it to 0. Where you have rotated a string in the wrong direction, use **oops** to restore it, and reset the angle with the opposite sign with **setangle last** (which multiplies the last angle used by -1). Check the current angle settings by entering *status misc* at the Arcedit prompt.

Plots

Making plots of digital map files is important as a means of checking the digital compilations and to obtain hard copy for use in revision, continued field work, display, and study and analysis. Various kind of plots can be made that range from simple pen plots and page-sized line drawings to page-sized and large-format color plots. High-quality color plots that rival published maps in appearance can be made with large-format color electrostatic plotters.

There are two distinct steps in making a plot: (1) preparing the plot file from the digital map files, lookup tables, and various symbol sets, and then (2) loading that plot file into a plotter to obtain output. Version 1.0 of ALACARTE supports preparation of plot files for simple edit plots and for full-color maps that are in standard ALACARTE format, and the on-screen display of such plot files. Separate expertise will be needed, however, both in preparing the lookup tables for the color plots and in making hard-copy plots.

EDIT PLOTS

Hard-copy line plots can be prepared easily to help find errors in line work, polygons, and polygon labels. A plot file is first created according to your specifications and then this file is plotted (a pen plotter is sufficient). Edit plots are useful to gain a first look at line work and to identify and find dangling nodes and pseudonodes and errors in polygon labeling that result from missing or multiple label points or incomplete polygon boundaries.

To make an Edit plot file:

If you want to include polygon features, be sure that the map has been cleaned or built for polygons since it was last edited. Use **describe map** (on the Map pulldown from the Edit bar) to determine this.

Open the Editplot forms menu (pick **Make edit plot** on the Plotfiles pulldown from the Plot bar menu:

Editplot - create error plot of coverage

<coverage> . . . . . .
<plot file> . . . . . .
<scale denominator> 1

OK HELP CANCEL

Fill in the blanks in the form with the map name, a name for the plot file (such as *[map name].ep*), and a plot scale (called *scale denominator*). This scale parameter is defined as the number of map units equal to 1 inch on the plot:

scale denominator = (denominator of map scale) / (inches per map unit)

or, for a map with map units in meters (typical for ALACARTE maps) to be plotted at 1:24,000 :

scale denominator = (24000) / 39.37) = 609.6

A series of questions is then posed on screen, the answers to which (largely *Y*(es) or *N*(o)) specify the content of the plot.

Window plot?

- Y - use to limit the plot to a specified rectangular part of the map. Prompts will then ask for the x,y coordinates of the lower left and upper right corners of the rectangle. This is useful particularly to plot a map in page-sized pieces or to enlarge complex parts of the map.
- N - the outer map boundary will be used to define the limits of the plot.

Enter legend Text:

<Return> - use the default text: EDIT PLOT of [map name].
Key-in - specify a text line of up to 70 characters to describe the plot.

Plot Tics?

- Y - tics will be shown by a plus enclosed by a square, together with the Tic-ID number.
- N - omits tics.

Plot ONLY Polygons with label errors?

- Y - limits plot to polygons with label errors and their boundaries (shows multiple label points and their User-ID numbers and marks unlabeled polygons at their centroids with a star). Question sequence is terminated.
- N - continues the questions.

Plot arcs?

Y - all arcs in the map will be shown.
N - no arcs will be shown.

Plot arc IDs?

Y - places the User-ID number of each arc at its center.
N - no arc IDs will be shown.

Plot label points?

Y - the label point and its User-ID number will be plotted at the centroid of each polygon; prompt follows to specify the size of the plus symbol in inches.
N - no label points will be shown.

Plot Node Errors?

Y - shows dangling nodes with squares and pseudonodes with diamonds.
N - nodes will not be shown.

Once the questions are answered, the plot file is automatically created and placed in the current directory. Check the plot file by displaying it on screen (see *Screen Plots*, below).

SCREEN PLOTS

Plot files can be drawn on the screen using the Draw Plotfile menu (pick **Draw plotfile to screen** on the Plotfiles pulldown from the Plot bar):

Draw - display an ARC/INFO plot file on the screen

<plot file name> . . . . . .

OK HELP CANCEL

Enter the name of the plot file (use ? or middle mouseclick in blank to list, then pick). When you pick the **OK** button, the plot will be drawn on the screen and it will be reported:

Plotting [name of plot file]
Hit <CR> to continue:

The ALACARTE menus will not reappear until after the <Return> and thus the ALACARTE zoom functions are not accessible while the plot is on the screen; use machine zoom and pan instead on terminals and emulators to examine the plot.

FULL-COLOR PLOTS

A plot file for a single, full-color map can be prepared with the Standard Plot routine, once the necessary parts have been prepared or determined. These parts are:

1. Geologic map - polygon layer, with
   - lines attributed in LTYPE (required)
   - polygons attributed in PTYPE (required)
   - a geologic lookup table (optional)
2. Map units for all layers in meters (required)
3. Input scale to specify (required)
4. Structural attitudes (structural layer - optional)
5. fold axes (can be a separate layer - optional)
6. Base map (optional) with line symbols (color) assigned from CCA.LIN
   - index contours
   - intermediate contours
   - culture layer
   - drainage layer (hydro)

Open the Standard Plot menu with **Make standard plot** on the Plotfiles pulldown from the Plot bar):

Makes a plot file of a geologic map constructed with Alacarte

<geologic map> . . . . . .
{geologic lookup table} . . . . . .
<scale> . . . . . .
{keyfile} . . . . . .

{structural attitudes} . . . . . .
{fold axes} . . . . . .

Color	**Base Layer**	. . . . .
. . . . .	**{index contours}**	. . . . .
. . . . .	**{intermediate contours}**	. . . . .
. . . . .	**{culture layer}**	. . . . .
. . . . .	**{hydro}**	. . . . .

OK HELP CANCEL

Enter the name of the completed polygon layer as the geologic map. This must not have been edited after last being built for polygons, and the attributes must be in ALACARTE format.

Specify a lookup table in which the attribute fields are defined:

PTYPE 35 35 C
SYMBOL 3 3 I

If no lookup table is specified, the program will not attempt to color polygons.

The program assumes that you want standard geologic symbols assigned to the lines and uses the line symbol set ALCWRG.LIN. This cannot be changed.

Enter a scale denominator for the plot (no commas).

The keyfile is an optional ASCII system file that is used to produce an explanation of the map units down the right hand side of the plot: The file specifies in sequence the color for filling the box (in shadeset CCA.SHD, which is located in the arcexe50 symbols directory) and the unit label to be placed in the box. For example:

.16	(color number)
Qal	(unit label)
.24	
Qls	

Specify the structural layer for oriented structural symbols. This must have attributes recorded in the PTTYPE, STRIKE, and DIP fields. The program uses the lookup table CCPTPL.LUT (located in the ALACARTE symbols directory), which is formulated for Calcomp pen color 3 (black), and uses the ALCGEOL.MRK structural symbol set (located in the arcexe50 symbols directory). If no structural layer is specified, the program does not plot oriented symbols.

Specify the structural layer for fold axes. Line attributes must be recorded in the LTYPE field. The program uses the lookup table CCSTRUCTURE.LUT to plot anticline and syncline symbols on the fold axes. This entry can be the same as that for oriented symbols.

Enter colors and layer names for the base layers. The program uses line symbols from CCA.LIN and the color numbers to plot the base layers. All are optional and any combination will work, including a composite base specified in any one of the blanks.

The program creates a plot file and names it by appending .PLT to the input geologic name (plot file for LP.GEOL thus is named LP.GEOL.PLT). A box is drawn around the map with a 3-inch margin in the x dimension and a 5-inch margin in the y dimension. The name of the geologic map, the map scale, and the date and time are placed in the lower left corner of the plot.

Note that the program changes annotation in structural attitudes to symbol 21 for plotting, and then changes it back to symbol 1. If the symbol in the original was not 1 to start with, it will be 1 on completion of the program.

SYMBOLS

Symbols are used in ARC/INFO to portray the various elements in a map to aid editing, composition, and interpretation, and to support cartographic output. They are assigned to map elements as a function of the attributes stored in the database and can be flexibly applied both to on-screen displays and hardcopy plots. Examples of symbols include contact- and fault-weight lines, thrust-fault symbols for faults, oriented dip-and-strike symbols for bedding attitudes, a light yellow shade for aluvium (Qal), and an appropriate font for map-face text. Symbols are displayed during editing on screen in both the

edit map and background layers (ARCEDIT) and are specified for inclusion in plot files and on-screen display and query in ARCPLOT.

Several standard symbol sets are provided in ARC/INFO and symbol editors are available for modifying symbol sets and creating new ones. ALACARTE adds custom symbol sets for geologic lines and points and implements a subset of the ARC/INFO symbolization capabilities.

Symbol Sets

The symbol sets store pattern definitions for symbols. The four types of symbol sets correspond to the four principal feature types: markersets for labels (points and polygon label points), linesets for arcs, shadesets for area-fill of polygons, and textsets for annotation. Some symbol sets are device-specific. Shadesets for pen plotters, for instance, are designed for stroked color fill, whereas shadesets for electrostatic plotters specify solid color fill. Standard ARC/INFO symbol sets are stored in the ARC symbols directory and are accessible to all users. Custom symbol sets can reside in map workspaces or can be copied to the ARC symbols directory for general use. Some details about text sets are described in *Annotation* (p. 55).

A group of symbol sets - one each for points, lines, areas, and text - can be combined as a SYMBOLSET. SYMBOLSET PLOTTER, for example, consists of PLOTTER.MRK, PLOTTER.LIN, PLOTTER.SHD, and PLOTTER.TXT. The standard ARC SYMBOLSETS are:

PLOTTER	- for 4-color pen plotters (see Appendix C, Default symbols, in the ARC/INFO Symbols Users Guide)
COLOR	- a 16-color symbolset optimized for fast hardware drawing speed
BW	- for monochrome monitors

The default symbol sets in Arcedit are PLOTTER.TXT, COLOR.LIN, and COLOR.MRK; because Arcedit does not manipulate polygons, it does not support shadesets (except as backgrounds, see below). The default SYMBOLSET in Arcplot is PLOTTER. ARC/INFO provides several additional special symbol sets (described in the ARC/INFO Symbols Users Guide, Appendix D, Special Symbols) that are designed for 4-pen plotters:

MINERAL.MRK	- USGS mineral locality symbols.
MUNICIPAL.MRK	- point symbols for municipal mapping.
OILGAS.MRK	- standard oil and gas well symbols.
USGS.MRK	- subset of USGS topographic map symbols.
WATER.MRK	- subset of USGS geohydrologic point symbols.
OILGAS.LIN	- lines for subsurface structures.
CARTO.LIN	- a variety of dashed and dotted lines.
CARTO.TXT	- several styles of text.
CARTO.SHD	- useful stroked area fill patterns.

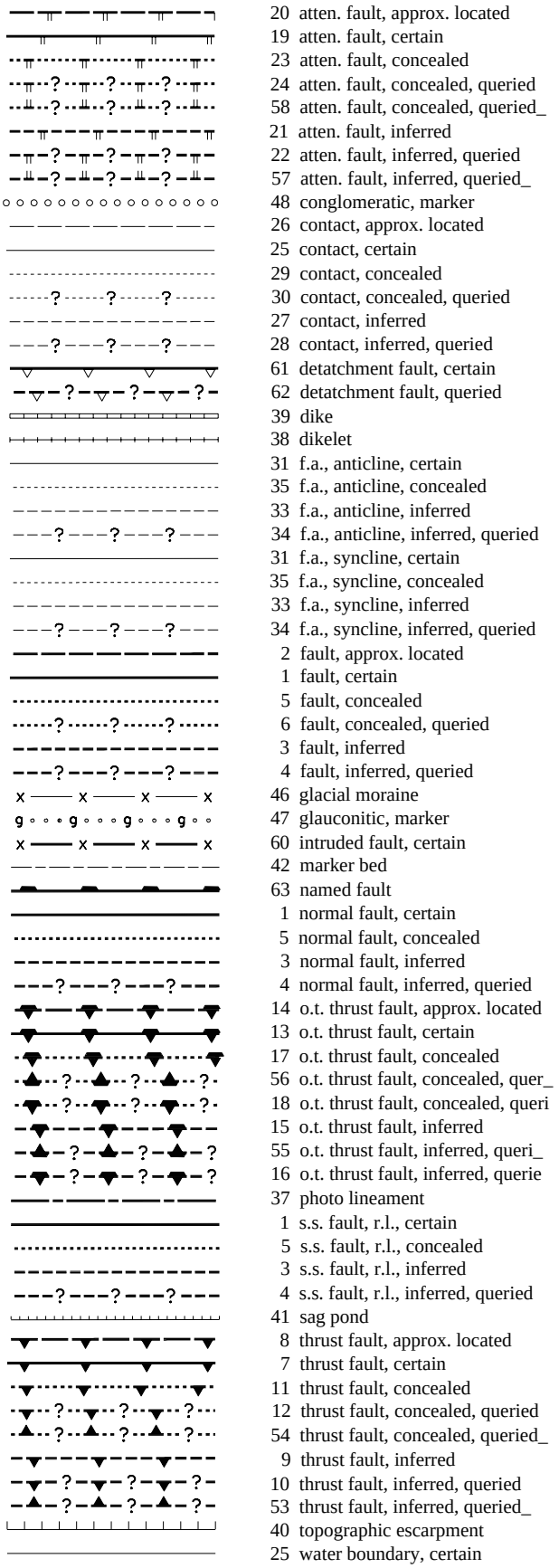


Figure 2. Line symbols in line set ALCWRG.LIN (symbol, symbol number, and standard line type).

ALACARTE provides several additional symbol sets:

ALCWRG.LIN	-	geologic lines (see fig. 2).
ALCGEOL.MRK	-	oriented geologic structural symbols (see fig. 3).
CCA.SHD	-	shadeset for Calcomp electrostatic plotters, hardware shades 1 through 999.
CCB.SHD	-	shadeset for Calcomp electrostatic plotters, hardware shades 1000 through 1024.
CCA.LIN	-	lineset for Calcomp electrostatic plotters, hardware lines 1 through 999.
CCB.LIN	-	lineset for Calcomp electrostatic plotters, hardware lines 1000 through 1024.

Under normal ALACARTE installation procedures, these will be located in the ARC/INFO symbols directory, where they are available to all users.

Using Symbols

Simple, distinctive symbols are automatically assigned to the various kinds of map features (lines, points, nodes, etc.) for on-screen editing in ARCEDIT, but these can be changed as desired in one of three ways. The simplest way to control symbol assignments in ALACARTE is by selecting one or more features and setting their symbol number to the desired symbol with **set $symbol(S)** on the Draw popup. In this way, for example, you can color lines as a function of line type or editing status and can mark newly added label points in polygons with a distinctive symbol.

A second method involves using a lookup table to assign symbols systematically as a function of database attributes. ALACARTE provides standard lookup tables in the ALACARTE symbols directory with which to assign standard geologic symbols for lines, points, and oriented structural symbols. Lookup table ALCLINE.LUT assigns line symbols from lineset ALCWRG.LIN as a function of standard LTYPEs picked from the linetype menus (Digitize Lines bar), and PTPL.LUT assigns point and oriented symbols from markerset ALCGEOL.MRK as a function of PTTYPEs picked from the point type menus (Digitize Planar and Linear Points bars).

When a structure layer is prepared in ALACARTE from the Setup bar, two copies of PTPL.LUT are attached to it that will assign symbols of two different sizes (see *Set the Symbol Environment*, p. 180). These lookup tables, which are directed particularly at oriented symbols, are named [map name].LUT and [map name].LUT2X, where [map name] is the name of the map.

Specific assignment of custom symbols for lines, polygon labels, and non-oriented point is less automated in ALACARTE and requires use of the lookup command from the Database pulldown (**Db**) on the Points, Lines, and Areas bars.

Finally, map elements can be symbolized as AP (ARCPLOT) backgrounds to ARCEDIT edit maps. ALACARTE supports the coloring of selected polygons in the background with **color units in backgrnd** on the Options pulldown from the Digitize Areas bar. Oriented structural symbols can be displayed in the background by selecting the **draw cov in back** item on the Points pulldown from the Symbols bar. AP backgrounds are separate from normal ARCEDIT backgrounds (backcoverages) and the backenvironment. Refer to the ARCEDIT Users Guide, Chapter 6, Drawing Coverage Features, for more information on symbolization.

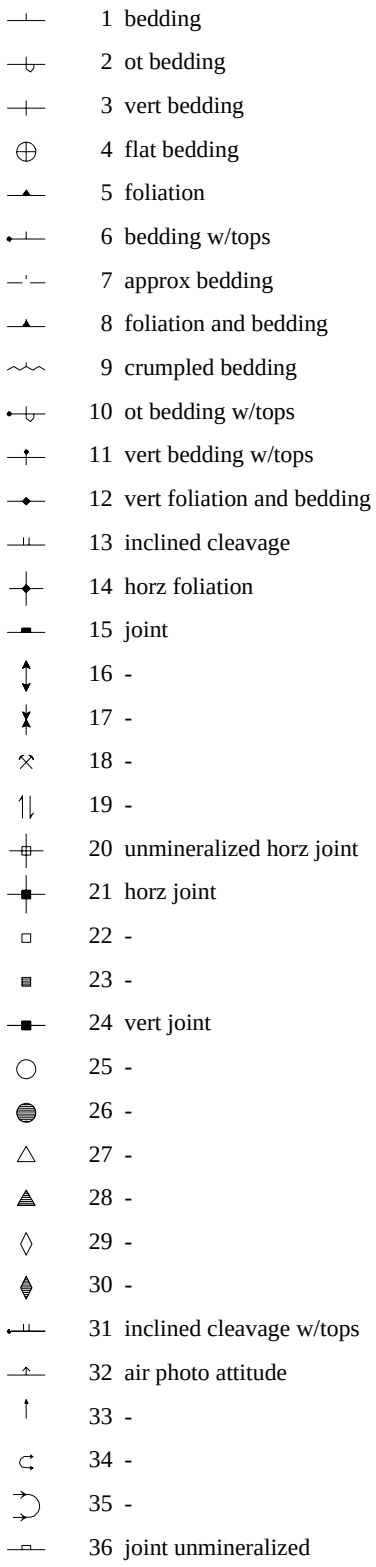


Figure 3. Point symbols in marker set ALCGEOL.MRK (symbol, symbol number, and standard point type).

ARCPLOT has a rich set of commands for symbolizing and drawing features. The simplest procedure draws all features with a single symbol. A symbolset is specified, then the symbol to be used, then a command that draws the features from a specified map layer. Symbolizing features based on attributes requires a different drawing command that takes a lookup table as one argument. ALACARTE implements a basic plotting capability with **Make standard plot** (on the Plotfiles pulldown from the Plot bar). Otherwise, the ARCPLOT command line must be used to prepare plotfiles. Refer to Chapter 3, Specifying Symbols, in the ARCPLOT Users Guide for more information.

Creating and Modifying Symbolsets

Symbol sets can be modified and new symbol sets created using the ARC/INFO symbol editors. The four symbol editors markeredit, lineedit, shadeedit, and textedit, are opened in ALACARTE with **marker editor**, **line editor**, **shade editor**, and **text editor**, respectively (on the Symbol Editors pulldown from the General bar). Individual pattern elements for markers, text, and certain lines (for example, teeth on thrust faults) are created in ARCEDIT and grouped as fonts. Instructions for using the symbol editors and creating fonts can be found in the ARC/INFO Symbols Users Guide.

STRUCTURE AND FUNCTIONS

This section of the manual shows how the menu items in ALACARTE are organized into a hierarchical structure of bar menus and subordinate pulldown, popup, and forms menus and briefly describes the function of each menu item on the bars and pulldowns (the individual popup menus are described as part of the discussion of their use in *ALACARTE Basics* and *Procedures*). The menus are shown much as they appear on the screen, except that pulldown menus are listed near the left margin under their bars rather than being aligned beneath their call symbols on the bar. The different kinds of menus are described in *Using the Menus* (p. 59) and the application of the various ALACARTE functions in working with maps is described in *ALACARTE Basics* and *Procedures*.

Although not necessary for normal use of ALACARTE, further information about the ARC/INFO commands employed by the various ALACARTE functions can be obtained from the ALACARTE Installation and System Manual and directly from the AML and MENU routines in ALACARTE, and description of the ARC/INFO commands themselves can be obtained from on-line ARC/INFO help and the ARC/INFO manuals.

ALACARTE is divided into six principal sections that support different kinds of activities with maps:

Setup - begin new maps and adjust imported maps to ALACARTE.
Edit - enter and modify digital map elements and data.
Plot - make plot files and on-screen and hard-copy plots.
Analysis - query, manipulate, and analyze maps.
Conversion - import, export, and convert formats and projections of maps.
General - various whole-map operations and housekeeping functions.

The main framework of the ALACARTE menu structure is the hierarchical series of bar menus (fig. 4, p. 205), in which each bar supports a different set of related functions. The six bars just below the Alacarte bar at the top of the menu tree represent the six principal sections of ALACARTE. These higher level bars provide routes down to bars lower in the menu structure. Working-level bars offer standard popup menus, direct access to frequently used functions, and various pulldown and forms menus tailored to the purpose of each bar. Procedures initiated from a particular bar return the user to that bar, which serves as home base until it is deliberately changed. Your choice of a bar menu from which to work thus determines which suite of ALACARTE functions is directly available.

Alacarte Bar Menu

The Alacarte bar menu appears automatically once the startup phase of ALACARTE is completed. It serves principally as the switch place between the six major subdivisions of ALACARTE, which are called from the six central items on the Alacarte bar. As on all of the bar menus, the bar name on the left (here, **[Alacarte]**) is used to gain access to the command lines and other system functions from the

Commands popup menu, and the right-most item (here, **QUIT**) is used to move up and out of the menu structure. The Devices and Show bar menus are accessible from this and all other Commands menus.

[Alacarte] | SETUP | EDIT | PLOT | ANALYSIS | CONVERSION | GENERAL | QUIT |

[Alacarte]	- name of bar menu; open commands menu.
SETUP	- go to Setup bar menu.
EDIT	- go to Edit bar menu.
PLOT	- go to Plot bar menu.
ANALYSIS	- go to Analysis bar menu.
CONVERSION	- go to Conversion bar menu.
GENERAL	- go to General bar menu.
QUIT	- close ALACARTE-ARC/INFO and return to the system prompt**.**

COMMANDS POPUP MENU

A Commands popup menu can be opened from any of the bar menus in ALACARTE (click on the bar name, at the left end of the bar) except the Devices and Show bars (which are themselves reached from the Commands menus). The Commands menus provide various basic controls, particularly access to the Devices bar and to the command lines of the host computer and ARC/INFO. The Commands menus called from within the Edit section also provide access to the Arcedit command line (see *Edit Section*, p. 210).

[Cmds]

alacarte info	- display the information panel, which provides an update summary.
alacarte demo	- start the automated demonstration of ALACARTE-ARC/INFO.
arcshell	- start Arcshell.
	Go out to a command line and then return to current ALACARTE bar:
give one system command	- enter one command and return automatically to the current bar.
give system commands	- enter commands; enter *quit* or *exit* to return to current bar.
list dir	- list files in current directory.
give one ARC/INFO command	- enter one command and return automatically to the current bar.
give ARC/INFO commands	- enter commands; when done, enter *quit* to return to the current bar.
change workspace	- enter name of map directory (full pathname where not subordinate).
show workspace	- report the current map directory.
run my aml or menu	- run custom AML or menu program (pick from list or give pathname).
screen editor	- select a file or name a new file and start the screen editor**.**
page list	- select file from current directory popup and list it, page by page.
default dialog	- limit dialog to the bottom 8 lines of the screen (terminals only).
fullscreen dialog	- use whole screen for dialog (terminals only).
DEVICES	- go to the Devices bar menu.
SHOW	- go to the Show bar menu.
<Cancel>	- return to the current bar menu.

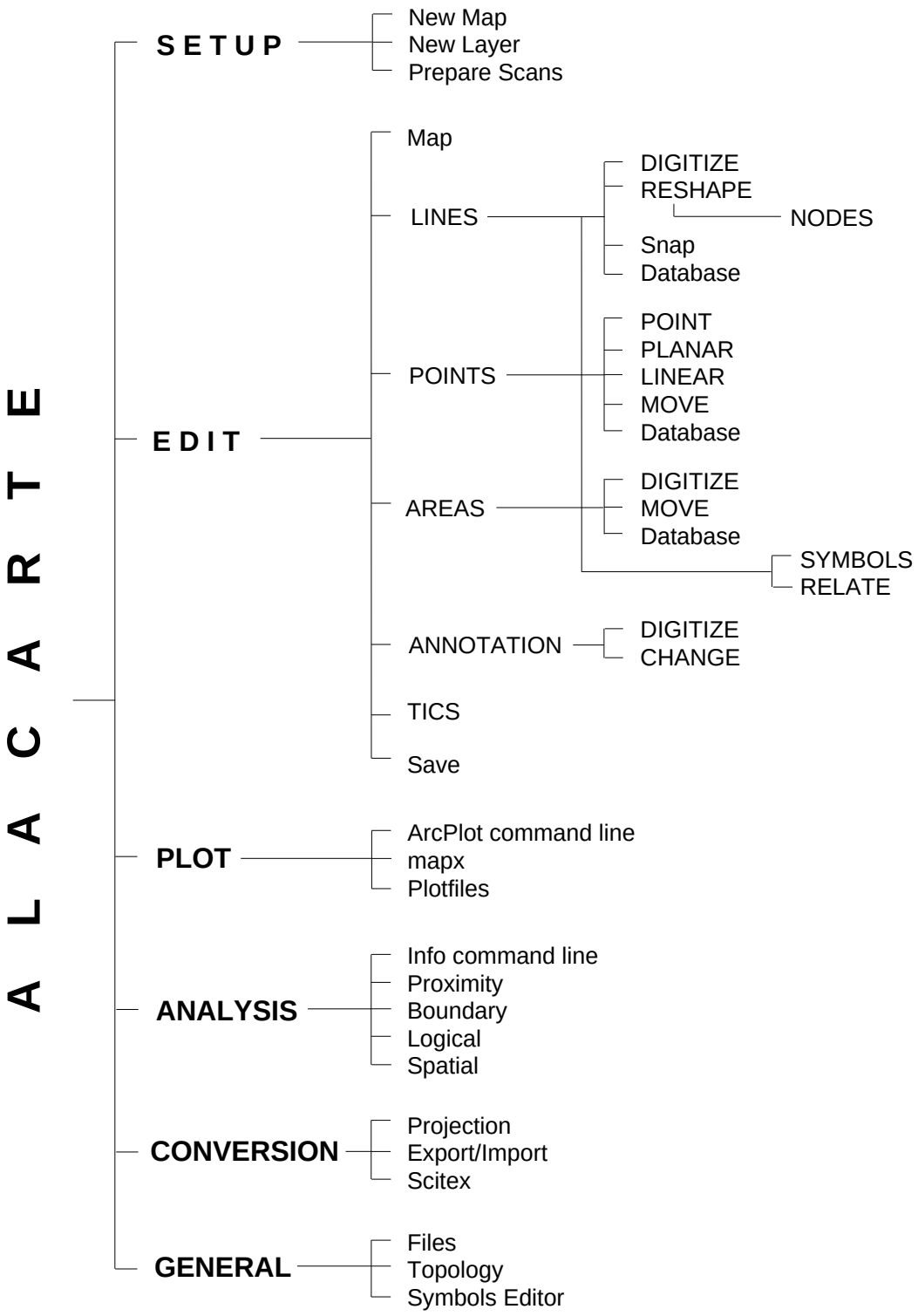


Figure 4. The hierarchical framework of menus in ALACARTE. Bar menus are shown in capital letters and selected pulldown menus and access to command lines are shown with initial capitals. Every bar provides access to the Devices bar, to the system and ARC command lines and, in Edit, to the Arcedit command line as well.

Devices Bar Menu

The Devices menu lets you reset and save device settings, increase the responsiveness of screen crosshairs to mouse movement (terminals only), change the content and location of messages reported on screen, and start and stop watch files, which record all map operations for later scrutiny.

[DEVICES] | Devices | Settings | Watch | ^PREV |

[Devices]	- name of bar menu; no Commands menu available here**.**
Devices	- open the Devices pulldown menu.
Settings	- open the Settings pulldown menu.
Watch	- open the Watch pulldown menu**.**
^PREV	- return to the previous bar menu.

Devices pulldown:

[DEVICES] | **Devices** | Settings | Watch | ^PREV |

show devices	- list the current device settings.
station	- reset devices to those previously saved as a station file**.**
save station	- save current device settings as a station file in current directory.
terminal	- specify a terminal type and method of picking menu items.
display:	
set to term	- set display device to match the presently specified terminal.
other display	- specify a display device name and a display option if desired.
digitizer	- specify digitizer from popup menu (or enter from **other**).
coord device	- pick method of entering map coordinates from popup menu**.**
fastmouse	- make crosshairs more responsive to mouse movements (terminals only).
fastdisk	- make crosshairs more responsive to joydisk movements (terminals only).
help "	- explain **fastmouse** and **fastdisk** functions**.**
close menu	- close Devices pulldown menu and return to Devices bar menu.

Settings pulldown:

[DEVICES] | Devices | **Settings** | Watch | ^PREV |

messages on	- all messages on and printed in dialog area (the ALACARTE default).
messages popup	- all messages on and displayed in popups (rather than in dialog area).
messages info off	- limit messages to errors and ALACARTE prompts; printed in dialog area.
messages all off	- no messages except from operating system**.**
current setting	- show current setting for messages.
echo on	- list all ALACARTE program statements as they are executed.
echo off	- program statements not listed (the ALACARTE default)**.**
current setting	- show current setting for echo.
default dialog	- limit dialog to the bottom 8 lines of the screen (terminals only).
fullscreen dialog	- use whole screen for dialog (terminals only)**.**
set dialog lines	- specify number of dialog lines at bottom of screen (terminals only)**.**

show dialog lines - show present number of dialog lines being displayed**.**
help - dialog - describe dialog settings.

close menu - close Settings pulldown menu and return to Devices bar menu.

Watch pulldown:

[DEVICES] | Devices | Settings | Watch | ^PREV |

watch on - start a watch file to record ARC/INFO commands as they are executed.
watch append - start adding to an existing watch file**.**
watch off - close the running watch file.
display file - report the name of the running watch file**.**
help - watch - describe watch file.

close menu - close Watch pulldown menu and return to Devices bar menu.

Show Bar Menu

The functions on this bar are used largely in debugging and related work on the ALACARTE AML code itself. The Help pulldown in Edit includes help for Arcedit as well as ARC/INFO commands.

[Show] | Show | List | Help | time | ^PREV |

[Show] - name of bar menu: no Commands menu available here.
Show - open Show pulldown menu.
List - open List pulldown menu.
Help - open Help pulldown menu.
time - report time and date.
^PREV - return to the previous bar menu.

Show pulldown:

[Show] | Show | List | Help | time | ^PREV |

show - enter show topic at prompt.
&show - enter &show topic at prompt.

close menu - close Show pulldown menu and return to Show bar menu.

List pulldown:

[Show] | Show | List | Help | time | ^PREV |

list all vars - report values of all AML variables in ALACARTE.
list one var - report value of a specified variable in ALACARTE.
set variable - set the value of an ALACARTE variable.

list files - list open user files.
trace back - show AML program sequence from the Alacarte bar to present location.

close menu - close List pulldown menu and return to Show bar menu.

Help pulldown:

[Show] | Show | status | List | Help | time | ^PREV |

help ARCEDIT cmds	- enter help subject at prompt or list help topics with <Return> (Edit only).
list ARCEDIT cmds	- list ARCEDIT commands page by page (only in the Edit section).
help ARC/INFO cmds	- enter help subject at prompt or list help topics with <Return>.
list ARC/INFO cmds	- list ARC/INFO commands page by page.
help AML commands	- enter name of AML directive or function at prompt for help.
list AML commands	- list AML commands page by page.
show aml usage	- enter name of AML directive or function at prompt.
close menu	- close Help pulldown menu and return to Show bar menu.

Setup Section

The Setup section supports starting a new map or or map layer or preparing an imported scan for use in ALACARTE. A map that is started here will automatically be provided with the database structure and items (fields) required for the specified kinds of map features in ALACARTE. A Setup file is created in which basic information about the map is stored, including the tolerances used by ALACARTE to set the snapping functions each time the map is opened.

SETUP BAR MENU

The Setup bar provides access to suites of functions to start various kinds of new maps, to start various kinds of new layers from an existing map, and to carry out the several steps involved in preparing an imported scan for use in ALACARTE. The Setup bar is reached from the Alacarte bar (click **SETUP**).

[Setup] | New Map | New Layer | Prep scans | Options | ^ALC |

[Setup]	- name of bar menu; open Commands popup menu.
New Map	- open New Map pulldown menu.
New Layer	- open New Layer pulldown menu.
Prep scans	- open Prepare Scans pulldown menu.
Options	- open Options pulldown menu.
^ALC	- return to Alacarte bar menu.

New Map pulldown:

[Setup] | New Map | New Layer | Prep scans | Options | ^ALC |

Make new map:

faults, contacts, units	- start new map to contain faults, contacts, and units.
unit boundaries only	- start new map to contain only unit boundaries.
geologic structures	- start new map to contain oriented structural data and fold axes.
sample localities	- start new map to contain sample localities or other points.

annotation + leaders - start new map to contain annotation and leaders.

help - display help for New Map menu.
Close menu - Close New Map pulldown menu and return to Setup bar menu.

New Layer pulldown:

[Setup] | New Map | **New Layer** | Prep scans | Options | ^ALC |

Make new layer:

faults, contacts, units - start new layer to contain faults, contacts, and units.
unit boundaries only - start new layer to contain unit boundaries.
geologic structures - start new layer to contain oriented structural data and fold axes.
sample localities - start new layer to contain sample localities or other points.

annotation + leaders - start new layer to contain annotation and leaders.
create unit annotation - create annotation from entries in a database item.

help - display help for New Layer menu.
Close menu - close New Layer pulldown menu and return to Setup bar menu.

Prepare Scans pulldown :

[Setup] | New Map | New Layer | **Prep scans** | Options | ^ALC |

faults, contacts, units:

1. **assign tics** - move digital tics to graphic registration points in scan.
2. **transform** - convert scan to projected dimensions on the ground.
3. **create setup file** - store tolerances, scale, etc. in a setup file for the map.
4. **prep database** - prepare map database for desired kinds of map features.
5. **create tagging menus** - enter items for custom menu(s) from which tag types can be set.

help - display help for Prepare Scans menu.
Close menu - close Prepare Scans pulldown menu and return to Setup bar menu.

Setup Options pulldown :

[Setup] | New Map | New Layer | Prep scans | **Options** | ^ALC |

create map - create a new, empty map; can copy tics from an existing map.

setup file present? - check for the presence of a setup file for a specified map.
show or change setup - examine setup for specified map, change as desired, and save.
copy setup file - copy setup file from one map to another.

view projection file - view the projection file for a specified map.

change workspace - enter name of map directory (full pathname where not subordinate).
show workspace - report current map directory.

help - display help for Setup Options menu.
Close menu - Close Options pulldown menu and return to Setup bar menu.

Edit Section

The Edit section supports compilation of maps, including entering digital elements into a map (lines, points, the identity of areas, and map-face annotation), tagging or identifying those features, editing (modifying) them, and entering and modifying database information. Before the Edit menu can be reached from the Alacarte bar menu, a map must be chosen on which to work. This chosen map becomes the edit map (foreground) for the working session and is the map layer that can be modified and queried. Once in Edit, background maps can be chosen for display as underlays on the screen.

CHOOSE MAP MENU

The Choose Map menu pops up automatically the first time in an edit session that you go to the Edit bar from the Alacarte bar (click **EDIT**):

You must choose a map to enter the EDIT menu

help	- display help for menu.
Choose map	- pick edit map from popup list of maps in the current directory.
change to new map dir	- enter name of map directory (full pathname where not subordinate).
create new map	- make empty map layer; can copy tics and projection from existing map.
^ALC	- return to the ALACARTE bar menu.

EDIT BAR MENU

Once an edit map is chosen, the Edit bar menu appears. This bar is the switch point between the four bar menus that support work with the different graphic elements of a map (lines, points, areas, and text annotation) and the Tics bar for work with digital registration tics:

[Edit] | Map | LINES | PTS | AREAS | ANNO | TICS | Save | Dw | Zm | ^ALC |

[Edit]	- name of bar; open the Commands popup menu.
Map	- open Map pulldown menu.
LINES	- go to the Lines bar menu.
PTS	- go to the Points bar menu.
AREAS	- go to the Areas bar menu.
ANNO	- go to the Annotation bar menu.
TICS	- go to the Tics bar menu.
Save	- open the Save pulldown menu.
Dw	- open the Draw popup menu.
Zm	- open the Zoom popup menu.
^ALC	- return to the Alacarte bar.

Commands popup (Edit):

The Commands popup menu available in Edit does not provide access to the ALACARTE demonstration or to Arcshell, but does provide access to the ARCEDIT command line and to the Audit Trail bar menu. The menu can be opened from any of the bar menus in the Edit section (click on the bar

name, at the left end of the bar) except the Devices, Audit Trail, and Show bars (which are themselves reached from the Commands menus). The Help pulldown from the Show bar here in Edit includes help for Arcedit as well as ARC/INFO commands.

[Cmds]

	Go out to a command line and then return to current ALACARTE bar.
give one system command	- enter one command and return automatically to current bar.
give system commands	- enter commands; *enter quit* or *exit* to return to current bar.
list dir	- list files in current directory.
give one ARC/INFO command	- enter one command and return automatically to the current bar.
give ARC/INFO commands	- enter commands; enter *quit* to return to current bar.
give one ARC/EDIT command	- enter one command and return automatically to the current bar.
give ARC/EDIT commands	- enter commands; enter *&return* to return to the current bar.
change workspace	- enter name of map directory (full pathname where not subordinate).
show workspace	- report current map directory.
run my aml or menu	- run custom AML or menu program (pick from list or give pathname).
screen editor	- select a file or name a new file and start the screen editor**.**
page list	- select file from current directory popup and list it, page by page.
default dialog	- limit dialog to the bottom 8 lines of the screen (terminals only).
fullscreen dialog	- use whole screen for dialog (terminals only).
DEVICES	- go to the Devices bar menu.
AUDIT TRAIL	- go to the Audit Trail bar menu.
SHOW	- go to the Show bar menu.
<Cancel>	- return to the current bar menu.

Map pulldown:

[Edit] | Map | LINES | PTS | AREAS | ANNO | TICS | Save | Dw | Zm | ^ALC |

choose edit map	- choose new edit map (foreground) by picking from popup menu.
show current edit map	- report the identity of the current edit map.
show all open edit maps	- list the current edit map and any other open maps.
remove edit map(s)	- pick map to remove from popup menu of open maps.
create new map	- make empty map layer; can copy tics and projection from existing map.
choose background	- choose background layer and color from popup menus.
show current backgrnds	- list current background layer(s).
remove background	- remove one background layer by picking from popup menu.
remove all backgnds	- remove all background layers.
change workspace	- enter name of map directory (full pathname where not subordinate).
show workspace	- report the current map directory.
list dir	- list the contents of the current map directory.
register map	- register map on digitizer by specifying tic numbers and locations.
describe map	- list data about content and state of current edit map.
record mapscale	- enter map scale for edit map from popup menu and record in setup file.

record mapunits - enter map units (meters or inches) from popup menu and record.
show scale, units - report scale and map units for the edit map that are recorded in setup file.
change coord device - pick coordinate device from popup menu.

close menu - close the Map pulldown menu and return to the Edit bar menu.

Save pulldown:

[Edit] | Map | LINES | PTS | AREAS | ANNO | TICS | Save | Dw | Zm | ^ALC |

cur map(ow) - save current edit map by overwriting the existing file.
cur map(new) - save current edit map as a new file; enter new file name.

all maps (ow) - save all open maps by overwriting existing files.

save-select? - set save to include current selected set of map elements (SEL item).
save-symbol? - set save to include current symbols assigned to elements (SYMB item).
save-audit? - set save to include audit trail.
show settings - report save settings.

save setup - save current settings to setup file.
use setup - pick existing map from which to read and use setup file for current map.

close menu - close Save pulldown menu and return to Edit bar menu.

Audit Trail Bar Menu

[Audit trail] | Show audit trail | ^PREV |

[Audit trail] - name of bar menu; no Commands menu available here.
Show audit trail - open the Show Audit Trail pulldown menu.
^PREV - return to the previous bar menu.

Audit Trail pulldown:

[Audit trail] | Show audit trail | ^PREV |

brief - list summary of changes made to edit map.
full - list in detail all changes made to edit map.

LINES BAR MENU

The Lines bar supports work with lines by providing access to the Digitize and Reshape bars, to the supporting Snap pulldown and Symbols bar, and to the Database pulldown. It is reached from the Edit bar (click **LINES**).

[Lines] | DIG | RSH | Snap | SYMB | Db | Sel | Op | Dw | Zm | ^EDIT |

[Lines] - name of bar menu; open the Commands popup menu.
DIG - go to the Digitize menu bar.
RSH - go to the Reshape bar menu.
Snap - open the Snap pulldown menu.

SYMB - go to the Symbols bar menu.
Db - open the Database pulldown menu.
Sel - open the Select popup menu.
Op - open the Options pulldown menu.
Dw - open the Draw popup menu.
Zm - open the Zoom popup menu.
^EDIT - return to the Edit bar.

Snap Pulldown:

[Lines] | DIG | RSH | **Snap** | SYMB | Db | Sel | Op | Dw | Zm | ^EDIT |

show snap - report current snap and other settings from setup file of edit map.
set snap - open forms menu in which to enter changes in snap and other settings.

Database pulldown:

[Lines] | DIG | RSH | Snap | SYMB | **Db** | Sel | Op | Dw | Zm | ^EDIT |

database: help - menu name; display help about menu.

set lines item - specify item for automatic line tagging and other ALACARTE functions.
list unique values - list unique values of current (or specified) lines item.
list attributes(S) - list attributes of selected set of lines.
list lines item attributes(S) - list current lines item and entries in that item for selected set of lines.
items - list items (and their definitions) in lines database of edit map (AAT).
calculate - enter value to be placed in specified numeric item for selected lines.
moveitem - enter character string to be placed in specified item for selected lines.
update - change entry in specified item using ARCEDIT Update function.
change - change entry in specified item with editor string using Change function.
lookup - assign screen symbols from a lookup table using Lookup function.
forms - open forms menu to view or change data entries for selected elements.
oops - remove the effect of the last ARC/INFO action.
statistics - make statistical queries using ARCEDIT Statistics function.
columns - access other databases using ARCEDIT Columns function.
connect to RDBMS - access other databases using ARCEDIT Connect function.
RELATE - go to Relate bar to access other data tables using Relate function.

close menu - close Database pulldown menu and return to the current bar menu.

Options pulldown:

[Lines] | DIG | RSH | Snap | SYMB | Db | Sel | **Op** | Dw | Zm | ^EDIT |

oops - remove the effect of the last ARC/INFO action.
Undelete(S): Restore lines deleted in the current edit session:
last - restore the last line that was deleted in the current session.
all - restore all lines that were deleted in the current session.
for expression - restore deleted lines according to expression typed at the prompt.
delete(S) - delete the selected set of lines.

select many - select many lines by clicking on them; close selection with *9*.
draw sel'd features - redraw selected lines in current drawselect color (default = yellow).
show sel'd features - redraw selected lines and report their identities.
draw w/ default colors - make all faults red, all contacts light blue, and all other lines white.
auto dw sel on - redraw lines in drawsel color (default = yellow) when selected.
auto dw sel off - turn auto drawselect off (default is on).
list attributes(S) - list attributes of selected lines.
distance - report distance in map units between pairs of clicks; close with a *9*.
where - report x,y coordinates of click points; close with a *9*.
change coord device - pick coordinate device from popup menu.
save(OW) - save the current edit map by overwriting the existing file.
restore save - reassign saved symbols and selected set for the current edit session.

close menu - close Options pulldown menu and return to the Lines bar.

Digitize (Lines) Bar Menu

The Digitize bar for lines supports digitizing and concurrent tagging of lines, assigning line types to existing lines (tagging), and selecting lines according to their line types. The Digitize bar is reached from the Lines bar (click **DIG**).

[Dig] | dig | tag | Sel | ? | C | F | A | O | Mod | Op | Dw | Zm | ^LINES |

[Dig] - name of the bar menu; open the Commands popup menu.
dig - start the Digitize Lines routine and the key menu to control it.
tag - tag the selected set of lines with the current line type.
Sel - open the Select popup menu.
? - report the current line type.
C - open the Contacts pulldown menu.
F - open the Faults pulldown menu.
A - open the Axes pulldown menu.
O - open the Other Lines pulldown menu.
Mod - open the Line Type Modifier pulldown menu.
Op - open the Options pulldown menu.
Dw - open the Draw popup menu.
Zm - open the Zoom popup menu.
^LINES - return to the Lines bar.

Select pulldown:

[Dig] | dig | tag | Sel | ? | C | F | A | O | Mod | Op | Dw | Zm | ^LINES |

help select

sel by current linetype:
select - select all lines tagged with the current line type.
aselect - add to the selected set all lines tagged with the current line type.
reselect - reselect from the selected set all lines tagged with the current line type.

unselect - remove from the selected set all lines tagged with the current line type.
nselect - select all lines in the map that are not currently selected.

Sel - open the Select popup menu.
select many - select many lines by clicking on them; close selection with a *9*.
sel polygon - select all features completely enclosed in a polygon clicked on screen.
sel,tag,color - start routine to select many lines, tag with current line type, assign color.
show sel'd features - redraw selected lines and report their identities.
close menu - close Select pulldown menu and return to the Digitize bar.

Contacts pulldown:

[Dig] | dig | tag | Sel | ? | C | F | A | O | Mod | Op | Dw | Zm | ^LINES |

help contacts - name of menu; display help for menu.

contact - set current line type to contact with modifier certain.
other contact - enter a qualifier: contact, [*your qualifier*] with modifier certain.

all cntcs, for select - set line type to contact with modifier all for selecting all contacts.

close menu - close Contacts pulldown menu and return to the Digitize bar.

Faults pulldown:

[Dig] | dig | tag | Sel | ? | C | F | A | O | Mod | Op | Dw | Zm | ^LINES |

help faults

fault - set current line type to fault with modifier certain.
normal - set current line type to normal fault with modifier certain.
attenuation - set current line type to attenuation fault with modifier certain.
thrust - set current line type to thrust fault with modifier certain.
reverse - set current line type to reverse fault with modifier certain.
strike-slip - set current line type to strike-slip fault with modifier certain.
" dextral - set current line type to strike-slip fault, r.l. with modifier certain.
" sinistral - set current line type to strike-slip fault, l.l. with modifier certain.
other fault - enter a qualifier: fault, [your qualifier] with modifier certain.

all flts, for select - set line type to fault with modifier all for selecting all faults.

close menu - close Faults pulldown menu and return to the Digitize bar.

Axes pulldown:

[Dig] | dig | tag | Sel | ? | C | F | A | O | Mod | Op | Dw | Zm | ^LINES |

help fold axes - name of menu; display help for menu.

fold axis - set current line type to f.a., fold axis with modifier certain.
syncline - set current line type to f.a., syncline with modifier certain.
synform - set current line type to f.a., synform with modifier certain.

anticline - set current line type to f.a., anticline with modifier certain.
antiform - set current line type to f.a., antiform with modifier certain.
monocline - set current line type to f.a., monocline with modifier certain.
other fold axis - enter a qualifier: f.a., [*your qualifier*] with modifier certain.

all fa's, for select - set line type to f.a. with modifier all for selecting all contacts.

close menu - close the Axes pulldown menu and return to the Digitize bar menu.

Other Types pulldown:

[Dig] | dig | tag | Sel | ? | C | F | A | **O** | Mod | Op | Dw | Zm | ^LINES |

help other lines - name of menu; display help for menu.

no attribute - clear current line type; digitizing or tagging will record a blank.
map boundary - set current line type to map boundary with the modifier blank.
water boundary - set current line type to water boundary with the modifier blank.
glacier bndry - set current line type to glacier boundary with the modifier blank.
scratch bndry - set current line type to scratch boundary with the modifier blank.
other - enter line type from the keyboard at the prompt; modifier will be blank.

Custom tag menu 1 - open custom menu LINETYPES1.
Custom tag menu 2 - open custom menu LINETYPES2.
Custom tag menu 3 - open custom menu LINETYPES3.

close menu - close Other Types pulldown menu and return to the Digitize bar menu.

Modifiers pulldown:

[Dig] | dig | tag | Sel | ? | C | F | A | O | **Mod** | Op | Dw | Zm | ^LINES |

help modifiers - name of menu; display help for menu.

certain - set current linetype modifier to certain.
approx. located - set current linetype modifier to approx. located.
inferred - set current linetype modifier to inferred.
inferred ? - set current linetype modifier to inferred ?.
concealed - set current linetype modifier to concealed..
concealed ? - set current linetype modifier to concealed ?.
gradational - set current linetype modifier to gradational.
other - enter modifier from the keyboard at the prompt.
none - clear current modifier; digitizing or tagging will not record a modifier.

Custom tag menu 1 - open custom menu LINEMODS1.
Custom tag menu 2 - open custom menu LINEMODS2.
Custom tag menu 3 - open custom menu LINEMODS3.

close menu - close the Modifiers pulldown menu and return to the Digitize bar menu.

Options Pulldown:

[Dig] | dig | tag | Sel | ? | C | F | A | O | Mod | Op | Dw | Zm | ^LINES |

options: help	- name of menu; display help for menu.
oops	- remove the effect of the last ARC/INFO action.
Undelete(S):	Restore lines deleted in the current edit session:
last	- restore the last line that was deleted in the current session.
all	- restore all lines that were deleted in the current session.
for expression	- restore deleted lines according to expression entered at the prompt.
delete(S)	- delete the selected set of lines.
select many	- select many lines by clicking on them; close selection *w*ith a *9*.
draw sel'd features	- redraw selected lines in current drawselect color (default = yellow).
show sel'd features	- make selected lines blink on screen and report their identities.
list attributes(S)	- list attributes of selected set of lines.
distance	- report distance in map units between pairs of clicks; close *w*ith a *9*.
where	- report x,y coordinates of click points; close *w*ith a *9*.
duplicate arcs ok	- permit more than one line between the same pair of nodes.
no duplicate arcs	- deny duplicate arcs.
flip line dir'n(S)	- reverse the recorded direction of the selected lines.
change coord device	- pick coordinate device from popup menu.
save(OW)	- save current edit map by overwriting the existing file.
restore save	- reassign saved symbols and selected set for current session.
close menu	- close the Options pulldown menu and return to the Lines bar.

Reshape (Lines) Bar Menu

The Reshape bar supports modification of existing lines: reshape and adjust line segments in various ways, connect and combine broken lines, correct scanning artifacts and delete unwanted features, repair intersections, and move nodes. The Reshape bar is reached from the Lines bar (click **RSH**).

[Rsh] | C | E | Rsh | A | Sp | V | N | sm | sp | Se | Op | Dw | Zm | ^LINES |

[Rsh]	- name of the bar menu; open the Commands popup menu.
C	- open the Copy/Move pulldown menu.
E	- open the Extend pulldown menu.
Rsh	- open the Reshape pulldown menu.
A	- open the Align pulldown menu.
Sp	- open the Split/Combine pulldown menu.
V	- open the Vertices pulldown menu.
N	- go to the Nodes bar menu.
sm	- select one or more lines by clicking on them; close with a *9*.
sp	- select all lines completely within polygon clicked on screen; *9* to close.
Se	- open the Select popup menu.
Op	- open the Options pulldown menu.
Dw	- open the Draw popup menu.
Zm	- open the Zoom popup menu.
^LINES	- return to the Lines bar.

Copy/Move pulldown:

[Rsh] | **C** | E | Rsh | A | Sp | V | N | sm | sp | Se | Op | Dw | Zm | ^LINES |

copy: help	- display help for Copy.
copy(S)	- copy selected line set (click *from* and *to* points to place the copy).
copy many(S)	- click *from* and *to* points at prompts to place each copy; type *9* to close.
copy parallel(S):	Copy selected lines making each arc segment parallel to original segment.
*****	- click distance on screen (select only one arc).
distance	- enter distance in map units (positive = place to right, negative = to left).
move: help	- display help for Move.
move(S)	- move selected line(s) (click *from* and *to* points to place on screen).
move parallel(S):	Move selected line making each arc segment parallel to original segment.
*****	- click distance on screen (select only one arc).
distance	- enter distance in map units (positive = move to right, negative = to left).
close menu	- close the Copy/Move pulldown menu and return to the Reshape bar.

Extend pulldown:

[Rsh] | C | **E** | Rsh | A | Sp | V | N | sm | sp | Se | Op | Dq | Zm | ^LINES |

extend:	- name of menu.
both ends *	- extend ends of line(s) to intersect any other lines within clicked distance.
both ends distance	- extend ends of selected line(s) to intersect within typed distance.
from-end *	- extend the *from* end of line(s) to intersect within clicked distance.
from-end distance	- extend the *from* end of selected line(s) to intersect within typed distance.
to-end *	- extend the *to* end of lines to intersect line(s) within clicked distance.
to-end distance	- extend the *to* end of lines to intersect line(s) within typed distance.
close menu	- close Extend pulldown menu and return to the Reshape bar.

Reshape pulldown:

[Rsh] | C | E | **Rsh** | A | Sp | V | N | sm | sp | Se | Op | Dw | Zm | ^LINES |

reshape: help	- name of menu; display help for menu.
reshape(S1)	- click a new shape for selected line; cross that line at start and finish (*9*).
dash to solid	- convert a dashed or broken line to a single line segment (arc).
move in place	- activate snapping, intersecting, or similar function for selected lines.
Grain:	Grain is a numeric variable used in the Spline and Densify functions.
grain *	- set grain value by clicking distance on screen.
grain distance	- set grain value by entering distance in map units.
Spline:	Spline smooths or simplifies lines, depending on grain and vertex spacing:
help	- display help for Spline.
spline(S)	- apply spline function with current grain value to selected set of lines.
Densify:	Densify adds vertices to the selected line(s) at the specified spacing.
help	- display help for Densify.

densify default(S) - add vertices at grain spacing to the selected set of lines.
densify *(S) - click distance at which vertices are added to selected set of lines.
densify distance(S) - enter distance in map units at which vertices are added to selected set.

Generalize: Generalize simplifies lines using the weedtolerance or specified distance.
gen default(S) - generalize selected lines using current weedtolerance.
gen *(S) - click distance at which to generalize selected lines.
gen distance(S) - enter distance at which to generalize selected lines.

close menu - close the Reshape pulldown and return to the Reshape bar.

Align/Rotate pulldown:

[Rsh] | C | E | Rsh | **A** | Sp | V | N | sm | sp | Se | Op | Dw | Zm | ^LINES |

align/rotate: help - name of menu; display help for menu.

Align: Align moves vertices into a straight line between points clicked on screen
align * after specifying perpendicular search distance by clicking (*****) or entering
align distance (**distance**). All vertices on all lines within specified distance are aligned.
rotate(S) Rotate selected lines about a pivot point (click at prompt); specify
setangle: rotation angle with click on circle around pivot point or enter with
setangle **setangle** (positive = counterclockwise); clear current angle with
setangle 0 **setangle 0**, restore last angle entered with **setangle last**. Uses
setangle last last angle set unless that = 0, then requires angle to be clicked on screen.

Split/Combine pulldown:

[Rsh] | C | E | Rsh | A | **Sp** | V | N | sm | sp | Se | Op | Dw | Zm | ^LINES |

split: help - name of menu; display help for menu.

split(S1) - split a selected arc into two at clickpoint; same $ID for both.
split at vertex(S1) - split selected arc; click to specify vertex and enter *1* to verify; same $ID.

combine arcs(S) - join abutting arcs (at pseudonodes); unique $ID for each resulting line.

close menu - close the Split/Combine pulldown menu and return to the Reshape bar.

Vertices pulldown:

[Rsh] | C | E | Rsh | A | Sp | **V** | N | sm | sp | Se | Op | Dw | Zm | ^LINES |

vertices: help - name of menu; display help for menu.

add vertex(S1) - add with click on or near selected line; can reshape line; close with *9*.
delete vertex(S1) - click to pick vertex on selected line, delete with *4*; close with *9*.
move vertex - click to pick vertex; confirm with *4;* click on new position; *9* to close.
draw vertex(S1)
in red - draw vertices of selected line in red.
in other color - pick color from Color popup to draw vertices of selected line.

close menu - close the Vertices pulldown menu and return to the Reshape bar.

Options pulldown:

[Rsh] | C | E | Rsh | A | Sp | V | N | sm | sp | Se | Op | Dw | Zm | ^LINES |

options: help	- name of menu; display help for menu.
oops	- remove the effect of the last ARC/INFO action.
Undelete(S):	Restore lines deleted in the current edit session:
last	- restore the last line that was deleted in the current session.
all	- restore all lines that were deleted in the current session.
for expression	- restore deleted lines according to expression entered at the prompt.
delete(S)	- delete the selected set of lines.
select many	- select one or more lines by clicking on them; close with a *9*.
draw sel'd features	- redraw selected lines in current drawselect color (default = yellow).
show sel'd features	- blink selected lines on screen and report their identities.
list attributes(S)	- list attributes of selected set, line by line.
PUT	- go to the Put bar menu.
get	- incorporate all lines from specified map into edit map; snapping applies.
distance	- report distance in map units between pairs of clicks; close with a *9*.
where	- report x,y coordinates of click points; close with a *9*.
flip line dir'n(S)	- reverse the recorded direction of the selected lines.
change coord device	- pick coordinate device from popup menu.
save(OW)	- save current edit map by overwriting the existing file.
restore save	- reassign saved symbols and selected set for current edit session.
close menu	- close the Options pulldown menu and return to the Reshape bar.

Nodes Bar Menu

The Nodes bar supports moving nodes as a part of editing lines. It is reached from the Reshape bar (click **N**).

[Nodes] | move | Snap | Symb | Op | Dw | Zm | ^RSH |

[Nodes]	- name of bar menu; open the Commands popup menu.
move	- click to pick node, *4* to confirm, click on new location, *9* to close.
Snap	- open the snap pulldown menu to set/change nodesnap.
Symb	- open Symbols pulldown menu to set/change symbol color and size.
Op	- open the Options pulldown menu.
Dw	- open the Draw popup menu.
Zm	- open the Zoom popup menu.
^RSH	- return to the Reshape bar.

Snap pulldown:

[Nodes] | move | Snap | Symb | Op | Dw | Zm | ^RSH |

nodesnap: help	- name of menu; display help for menu.
nodesnap first *	- set nodesnap to first listed; click snap distance on screen.
nodesnap first distance	- set nodesnap to first listed; enter snap distance in map units.

nodesnap closest * - set nodesnap to closest on map; click snap distance on screen.
nodesnap closest distance - set nodesnap to closest on map; enter snap distance in map units.

close menu - close the Snap pulldown menu and return to the Nodes bar.

Symbols pulldown:

[Nodes] | move | Snap | Symb | Op | Dw | Zm | ^RSH |

Nodecolor: Set the color of the node symbols from the Colors popup.
show - report the current color settings (color number).
node - set color of node symbol.
dangle - set color of dangle symbol.
pseudo - set color of pseudonode symbol.

Nodesize: Set the size of the node symbols (enter at the prompt, in inches on screen).
show - report the current size settings.
node - set size of node symbol.
dangle - set size of dangle symbol.
pseudo - set size of pseudonode symbol.

close menu - close the Symbols pulldown menu and return to the Nodes bar.

Options pulldown:

[Nodes] | move | Snap | Symb | Op | Dw | Zm | ^RSH |

options: help - name of menu; display help for menu.

oops - remove the effect of the last ARC/INFO action.
distance - report distance in map units between pairs of clicks; close with a 9.
where - report x,y coordinates of click points; close with a 9.
Change coord device - pick coordinate devince from popup menu.
save(OW) - save current edit map by overwriting the existing file.

close menu - close the Options pulldown menu and return to the Nodes bar.

SYMBOLS BAR MENU

The Symbols bar menu provides a place to change the current symbol sets and assignments for the current feature type and edit map and a means of displaying oriented symbols in the background.

[SYMB] | Symbolset | Lines | Pts | Areas | Anno | DW | Zm | ^PREV |

[SYMB] - name of the bar menu; open the Commands popup menu.

Symbolset - open the Symbolset pulldown menu.
Lines - open the Lines Symbols pulldown menu.
Pts - open the Points Symbols pulldown menu.
Areas - open the Areas Symbols pulldown menu.
Anno - open the Annotation pulldown menu.
Dw - open the Draw popup menu.

Zm - open the Zoom popup menu.
^PREV - return to the home bar from which the Symbols bar was reached.

Symbolset pulldown:

[SYMB] | Symbolset | Lines | Pts | Areas | Anno | DW | Zm | ^PREV |

show current - list the current markerset, lineset, and textset.
symbolset - specify a markerset, lineset, and textset together with a SYMBOLSET.

close menu - close the Symbolset pulldown and return to the Symbols bar menu.

Lines Symbols pulldown:

[SYMB] | Symbolset | Lines | Pts | Areas | Anno | DW | Zm | ^PREV |

lineset - specify a lineset.

close menu - close the Lines Symbols pulldown and return to the Symbols bar menu.

Points Symbols pulldown:

[SYMB] | Symbolset | Lines | Pts | Areas | Anno | DW | Zm | ^PREV |

Oriented symbols:
markerset - specify a markerset for oriented symbols by picking from list.
lookup table - specify a lookup table for oriented symbols by picking from list.
draw cov in back - specify a map layer to draw in background using oriented symbols.
draw in back off - turn off the drawing of oriented symbols in the background.

Non-oriented:
markerset - specify a markerset for points by picking from list opened from menu.
reset symbols - reassign symbol 1 of current markerset to all points in edit map.
lookup table - specify a lookup table for points by picking from list opened from menu.

close menu - close the Points Symbols pulldown and return to the Symbols bar menu.

Areas Symbols pulldown:

[SYMB] | Symbolset | Lines | Pts | Areas | Anno | DW | Zm | ^PREV |

markerset - specify a markerset for label points.

close menu - close the Areas Symbols pulldown menu and return to the Symbols bar.

Annotation Symbols pulldown:

[SYMB] | Lines | Pts | Areas | Anno | DW | Zm | ^PREV |

textset - specify a textset for annotation.

close menu - close the Annotation Symbols pulldown and return to Symbols bar menu.

RELATE BAR MENU

The Relate menu provides functions with which to relate or associate other database tables with the feature attribute table (AAT or PAT) of a specified map.

[Relate] | add | list | drop | save | restore | help | ^PREV |

[Relate]	- name of bar menu; open commands menu.
add	- add related table to existing relate environment.
list	- list tables in the existing relate environment.
drop	- remove a related table from the existing relate environment.
save	- save the set of current relates to an INFO file.
restore	- restore a set of relates from an INFO file.
help	- display help for the Relate command.
^PREV	- return to the previous bar menu.

PUT BAR MENU

The Put bar supports selecting map elements from the current edit map and placing copies of these elements into another, specified map. The Put bar is identical for lines, points, and areas and is reached from the Options pulldowns from the Reshape or Move bars (click **PUT**). The receiving map can be created from the edit map or chosen from a popup list of the map directory. Attributes are transferred with the selected elements only if the databases for the feature type are identical in the source and receiving layers.

[PUT] | so | sm | sp | aso | asm | asp | Sel | put | Op | Dw | Zm | ^PREV |

[Put]	- name of menu; open the Commands popup menu.
so	- select one map element by clicking on it; automatic return to current bar.
sm	- select one or more elements by clicking on them; close with a *9*.
sp	- selects all elements completely enclosed in a polygon clicked on screen.
aso	- add one element to selected set by clicking; automatic return.
asm	- add multiple elements to selected set by clicking; close with a *9*.
asp	- add to selected set all elements enclosed by clicked polygon; *9* to close.
Sel	- open the Select popup menu.
put	- put a copy of the selected set of map elements into a specified map layer.
Op	- open the Options pulldown menu.
Dw	- open the Draw popup menu.
Zm	- open the Zoom popup menu.
^PREV	- return to the home bar from which the Put bar was reached.

Options pulldown:

[PUT] | so | sm | sp | aso | asm | asp | Sel | put | Op | Dw | Zm | ^PREV |

oops	- remove the effect of the last ARC/INFO action.
Undelete(S):	Restore elements deleted in the current edit session:
last	- restore the last element that was deleted in the current session.

all	- restore all elements that were deleted in the current session.
for expression	- restore deleted elements according to expression typed at the prompt.
delete(S)	- delete the selected set.
select many	- select many elements by clicking on them; close with a *9*.
draw map	- redraw the currently defined map area.
draw sell'd features	- redraw selected elements in current drawselect color (default = yellow).
show sel'd features	- redraw selected elements and reports their identities.
list attributes(S)	- list attributes of selected set.
distance	- report distance in map units between pairs of clicks; close with a *9*.
where	- report x,y coordinates of click points; close with a *9*.
change coord device	- pick coordinate device from puopup menu.
save(OW)	- save the edit map by overwriting the existing file.
close menu	- close the Options pulldown menu and return to the Put bar.

POINTS BAR MENU

The Points bar supports work with various kinds of points, including attitudes, lineations, sample localities and any other data assigned to points on a map (except the label points that are used to identify polygons, which are treated under Areas). The Points bar is reached from the Edit bar (click **PTS**) and provides access to the Database pulldown and to separate bars to digitize, tag, or change points, planar features, linear features, and map symbols, and to a bar to move and copy points.

[Points] | Dig/tag | MOVE | SYMB | Db | Sel | Op | Dw | Zm | ^EDIT |

[Points]	- name of the bar menu; open the Commands popup menu.
Dig/tag	- open the Digitize/Tag pulldown menu.
MOVE	- go to the Move bar menu.
SYMB	- go to the Symbols bar menu.
Db	- open the Database pulldown menu.
Sel	- open the Select popup menu.
Op	- open the Options pulldown menu.
Dw	- open the Draw popup menu.
Zm	- open the Zoom popup menu.
^EDIT	- return to the Edit bar menu.

Digitize/Tag pulldown:

[Points] | Dig/tag | MOVE | SYMB | Db | Sel | Op | Dw | Zm | ^EDIT |

POINT	- go to the Digitize bar menu for point features.
PLANAR	- go to the Planar bar menu to work with planar features.
LINEAR	- go to Linear bar menu to work with linear features.
MAP SYMBOLS	- not implemented in Version 1.0 of ALACARTE.
no attribute	- start digitize routine for points with no attributes.
help	- display help for the Digitize/tag pulldown menu.
close menu	- close the Digitize/tag pyulldown menu and return to the Points bar.

Database pulldown:

[Points] | Dig/tag | MOVE | SYMB | **Db** | Sel | Op | Dw | Zm | ^EDIT |

database: help	- name of menu; display help for Database menu.
set points item	- specify item for automatic tagging and other ALACARTE functions.
list unique values	- list unique values of current (or specified) points item.
list attributes(S)	- list attributes of selected set of points.
items	- list items (and their definitions) in points database of edit map (PAT).
calculate	- enter value to be placed in specified numeric item for selected points.
moveitem	- enter character string to be placed in specified item for selected points.
update	- change entry in specified item using ARCEDIT Update function.
change	- change entry in specified item with editor string using Change function.
lookup	- assign screen symbols from a lookup table using Lookup function.
forms	- open forms menu to view or change data entries for selected points.
oops	- remove the effect of the last ARC/INFO action.
statistics	- make statistical queries using ARCEDIT Statistics function.
columns	- access other databases using ARCEDIT Columns function.
connect to RDBMS	- access other databases using ARCEDIT Connect function.
RELATE	- go to Relate bar to access other data tables using Relate function.
close menu	- close Database pulldown menu and return to the Edit bar menu.

Options pulldown:

[Points] | Dig/tag | MOVE | SYMB | Db | Sel | **Op** | Dw | Zm | ^EDIT |

options: help	- name of menu; display help for menu.
oops	- remove the effect of the last ARC/INFO action.
Undelete(S):	Restore points deleted in the current edit session:
last	- restore the last point that was deleted in the current session.
all	- restore all points that were deleted in the current session.
for expression	- restore deleted points according to expression entered at the prompt.
delete(S)	- delete the selected set of points.
select many	- select many points by clicking on them; close selection with a *9*.
draw sel'd features	- redraw selected points in current drawselect symbol.
show sel'd features	- redraw selected points and reports their identities.
list attributes(S)	- list attributes of selected points.
distance	- report distance in map units between pairs of clicks; close with a *9*.
where	- report x,y coordinates of click points; close with a *9*.
change coord device	- pick coordinate device from popup menu.
save(OW)	- save current edit map by overwriting the existing file.
restore save	- reassign saved symbols and selected set for current edit session.
close menu	- close the Options pulldown menu and return to the Edit bar.

Digitize (Points) Bar Menu

The Digitize bar for points supports digitizing points and concurrent tagging and assigning of sample numbers (if desired), assigning point types to existing points (tagging), and selecting points according to point type or sample number. The Digitize bar is reached from the Points bar (Click **POINT** on the Dig/tag pulldown).

[Dig] | dig | Tag | Sel | ? | Point Tags | Op | Dw | Zm | ^POINTS |

[Dig]	- name of the bar menu; open the Command popup menu.
dig	- digitize points (and assign sample numbers if included).
Tag	- open the Tag Points pulldown menu.
Sel	- open the Select pulldown menu.
?	- report the current point type.
Point Tags	- open the Point Tags pulldown menu.
Op	- open the Options pulldown menu.
Dw	- open the Draw popup menu.
Zm	- open the Zoom popup menu.
^POINTS	- return to the Points bar menu.

Tag Pulldown:

[Dig] | dig | Tag | Sel | ? | Point Tags | Op | Dw | Zm | ^POINTS |

point tag	- tag selected set with current point type.
sample nbr tag	- enter new sample number(s) for selected set of points (one by one).
point & samp tag	- not installed in Version 1.0 of ALACARTE.
close menu	- close the Tag pulldown menu and return to the Digitize bar.

Select Pulldown:

[Dig] | dig | Tag | Sel | ? | Point Tags | Op | Dw | Zm | ^POINTS |

help select	- menu name; display help for menu.
sel by current point type:	
select	- select all points tagged with the current point type.
aselect	- add to the selected set all points tagged with the current point type.
reselect	- reselect from the selected set all points tagged with the current point type.
unselect	- remove from the selected set all points tagged with the current point type.
nselect	- select all points in the map that are not currently selected.
Sel	- open the Select popup menu.
select many	- select many points by clicking on them; close selection with a *9*.
show sel'd features	- redraw selected points and report their identities.
close menu	- close the Select pulldown menu and return to the Points bar.

Point Tags Pulldown:

[Dig] | dig | Tag | Sel | ? | Point Tags | Op | Dw | Zm | ^POINTS |

key-in	- enter point type from the keyboard at the prompt.
Custom tag menu 1	- open custom menu POINTS1.
Custom tag menu 2	- open custom menu POINTS2.
Custom tag menu 3	- open custom menu POINTS3.
Sample nbr:	
help	- display help for Sample Number.
set field	- pick database item (field) for sample number (default=SAMPNO).
on	- include prompt to enter sample number in digitize routine (default=off).
off	- turn prompt off for sample number in digitize routine (default).
close menu	- close Point Tags pulldown menu and return to the Digitize bar.

Options pulldown:

[Dig] | dig | Tag | Sel | ? | Point Tags | Symb | Op | Dw | Zm | ^POINTS |

options: help	- name of menu; display help for menu.
oops	- remove the effect of the last ARC/INFO action.
Undelete(S):	Restore points deleted in the current edit session:
last	- restore the last point that was deleted in the current session.
all	- restore all points that were deleted in the current session.
for expression	- restore deleted points according to expression entered at the prompt.
delete(S)	- delete the selected set of points.
select many	- select many points by clicking on them; close selection with a *9*.
draw sel'd features	- redraw selected points with current drawselect symbol.
show sel'd features	- redraw selected points and report their identities.
list attributes(S)	- list attributes of selected points.
distance	- report distance in map units between pairs of clicks; close with a *9*.
where	- report x,y coordinates of click points; close with a *9*.
change coord device	- pick coordinate device from popup menu.
save(OW)	- save current edit map by overwriting the existing file.
restore save	- reassign saved symbols and selected set for current session.
close menu	- close Options pulldown menu and return to the Edit bar.

Digitize Planar Features (Points) Bar Menu

The Digitize bar for planar features supports digitizing attitudes, joints, foliations, and other planar features, changing data entries for these elements, and selecting planar features according to type, strike, and/or dip. The Planar bar is reached from the Points bar (click **PLANAR** on the Dig/tag pulldown).

[Planar] | dig | Chg | Sel | ? | Pt Tags | Set | Op | Dw | Zm | ^PTS |

[Planar]	- name of the bar menu; open the Command popup menu.

dig - enter planar features according to current entry format (default=Digitize).
Chg - open the Change pulldown menu.
Sel - open the Select pulldown menu.
? - report the current point type.
Pt Tags - open the Point Tags pulldown menu.
Set - open the Set Symbols pulldown menu.
Op - open the Options pulldown menu.
Dw - open the Draw popup menu (assignment of symbols not available).
Zm - open the Zoom popup menu.
^PTS - return to the Points bar menu.

Change pulldown:

[Planar] | dig | Chg | Sel | ? | Pt Tags | Set | Op | Dw | Zm | ^PTS |

current point type(S) - tag selected set with current point type.
strike & dip(S) - not installed in Version 1.0 of ALACARTE.
strike only(S) - not installed in Version 1.0 of ALACARTE.
dip only(S) - not installed in Version 1.0 of ALACARTE.

close menu - close Change pulldown menu and return to Planar Features bar.

Select pulldown:

[Planar] | dig | Chg | Sel | ? | Pt Tags | Set | Op | Dw | Zm | ^PTS |

sel by current point type:
select - select all points tagged with the current point type.
aselect - add to the selected set all points tagged with the current point type.
reselect - reselect from the selected set all points tagged with the current point type.
unselect - remove from the selected set all points tagged with the current point type.
nselect - select all points in the map that are not currently selected.

select by strike value - select (reselect, etc.) according to strike value(s).

select by dip value - select (reselect, etc.) according to dip value(s).

Select - open the Select popup menu.
select many - select many points by clicking on them; close selection with a *9*.
show sel'd features - redraw selected points and report their identities.

close menu - close the Select pulldown menu and return to the Planar bar.

Point Tags pulldown:

[Planar] | dig | Chg | Sel | ? | Pt Tags | Set | Op | Dw | Zm | ^PTS |

bedding - set current point type to bedding.
approx bedding - set current point type to approx bedding.
ot bedding - set current point type to ot bedding.
bedding w/ tops - set current point type to bedding w/ tops.
ot bedding w/ tops - set current point type to ot bedding w/ tops.

flat bedding - set current point type to flat bedding.
vert bedding - set current point type to vert bedding.
vert bedding w/ tops - set current point type to vert bedding w/ tops.
crumpled bedding - set current point type to crumpled bedding.
foliation - set current point type to foliation.
foliation and bedding - set current point type to foliation and bedding.
vert foliation and bedding - set current point type to vert foliation and bedding.
horz foliation - set current point type to horz foliation.
inclined cleavage - set current point type to inclined cleavage.
inclined cleavage w/ tops - set current point type to inclined cleavage w/ tops.
joint - set current point type to joint.
horz joint - set current point type to horz joint.
vert joint - set current point type to vert joint.
joint unmineralized - set current point type to joint unmineralized.
air photo attitude - set current point type to air photo attitude.

key-in - enter point type from keyboard at prompt.

Custom tag menu 1 - open custom menu ATTITUDES1.
Custom tag menu 2 - open custom menu ATTITUDES2.
Custom tag menu 3 - open custom menu ATTITUDES3.

close menu - close the Point Tags pulldown menu and return to the Planar bar.

Set Symbols pulldown:

[Planar] | dig | Chg | Sel | ? | Pt Tags | **Set** | Op | Dw | Zm | ^PTS |

draw first time w/ current - draw screen to display symbols from current markerset and lookup table.
show current settings - report current settings for items, entry method, and symbols.

Choose markerset - pick markerset for oriented point symbols (default = ALCGEOL.MRK).
Choose lookup table - pick lookup table to relate point types to markerset (default=[mapname].LUT).
Select db items - change database items for point tag, strike, and/or dip from defaults.

set dip numeral height - change size of type (in map units) from .05 inches at recorded map scale.
set attitude entry format - Digitize (=default) (Quadrant and Azimuth not installed in Version 1.0).

close menu - close the Set Symbols pulldown menu and return to the Points bar.

Options pulldown:

[Planar] | dig | Chg | Sel | ? | Pt Tags | Set | **Op** | Dw | Zm | ^PTS |

options: help - name of menu; display help for menu.

oops - remove the effect of the last ARC/INFO action.
Undelete(S): Restore points deleted in the current edit session:
  last - restore the last point that was deleted in the current session.
  all - restore all points that were deleted in the current session.
  for expression - restore deleted points according to expression entered at the prompt.
delete(S) - delete the selected set of points.

select many - select many points by clicking on them; close selection with a *9*.
draw sel'd features - redraw selected points with current drawselect symbol.
show sel'd features - redraw selected points and report their identities.
list attributes(S) - list attributes of selected points.
distance - report distance in map units between pairs of clicks; close with a *9*.
where - report x,y coordinates of click points; close with a *9*.
save(OW) - save current edit map by overwriting the existing file.
restore save - reassign saved symbols and selected set for current session.

close menu - close Options pulldown menu and return to the Planar bar.

Digitize Linear Features (Points) Bar Menu

The Digitize bar for linear features supports digitizing lineations and other linear features, changing data entries for these features, and selection of linear features according to type, bearing, and/or plunge. The Linear bar is reached from the Points bar (click **LINEAR** on the Dig/tag pulldown).

[Linear] | dig | Chg | Sel | ? | Pt Tags | Set | Op | Dw | Zm | ^PTS |

[Linear] - name of the bar menu; open the Commands popup menu.
dig - enter linear features according to current entry format (default=Digitize).
Chg - open the Change pulldown menu.
Sel - open the Select pulldown menu.
? - report the current point type.
Pt Tags - open the Point Tags pulldown menu.
Set - open the Set Symbols pulldown menu.
Op - open the Options pulldown menu.
Dw - open the Draw popup menu (assignment of symbols not available).
Zm - open the Zoom popup menu.
^PTS - return to the Points bar menu.

Change pulldown:

[Linear] | dig | Chg | Sel | ? | Pt Tags | Set | Op | Dw | Zm | ^PTS |

current point type(S) - tag selected set with current point type.
bearing & plunge(S) - not installed in Version 1.0.
bearing only(S) - not installed in Version 1.0.
plunge only(S) - not installed in Version 1.0.

close menu - close the Change pulldown menu and return to the Linear bar.

Select pulldown

[Linear] | dig | Chg | Sel | ? | Pt Tags | Set | Op | Dw | Zm | ^PTS |

sel by current point type:
select - select all points tagged with the current point type.
aselect - add to the selected set all points tagged with the current point type.
reselect - reselect from the selected set all points tagged with the current point type.

unselect - remove from the selected set all points tagged with the current point type.
nselect - select all points in the map that are not currently selected.

select by bearing value - select (reselect, etc.) according to curent bearing value(s).

select by plunge value - select (reselect, etc.) according to current plunge value(s).

Select - open the Select popup menu.
select many - select many points by clicking on them; close selection with a *9*.
show sel'd features - redraw selected points and report their identities.

close menu - close the Select pulldown menu and return to the Linear bar.

Point Tags pulldown:

[LInear] | dig | Chg | Sel | ? | Pt Tags | Set | Op | Dw | Zm | ^PTS |

lineations:
inclined - set current point type to inclined lineation.
" at attitide - set current point type to inclined lineation at attitude.
horizontal - set current point type to horizontal lineation.
vertical - set current point type to vertical lineation.

slickenside:
inclined, normal - set current point type to inclined slickenside, normal slip sense.
inclined, reverse - set current point type to inclined slickenside, reverse slip sense.
inclined, unknown - set current point type to inclined slickenside, unknown slip sense.
bd-clvg inters. lin. - set current point type to bedding-cleavage intersection lineation.

minor anticline - set current point type to minor anticline.
minor syncline - set current point type to minor syncline.
minor f.a., inclined - set current point type to minor inclined fold axis.
minor f.a., horiz. - set current point type to minor horizontal fold axis.

paleocurrent - set current point type to inclined paleocurrent.
dip of fault sfc - set current point type to dip of fault surface.

key-in - enter point type from keyboard at prompt.

Custom tag menu 1 - open custom menu LINEATIONS1.
Custom tag menu 2 - open custom menu LINEATIONS2.
Custom tag menu 3 - open custom menu LINEATIONS3.

close menu - close the Point Tags pulldown menu and return to the Linear bar.

Set Symbols pulldown:

[Linear] | dig | Chg | Sel | ? | Pt Tags | Set | Op | Dw | Zm | ^PTS |

draw first time w/ current - draw screen to display symbols from current markerset and lookup table.
show current settings - report current settings for items, entry method, and symbols.

Choose markerset - pick markerset for oriented point symbols (default = alcgeol.mrk).
Choose lookup table - pick lookup table to relate point types to markerset (default=[mapname].lut).
Select db items - change database items for point tag, bearing, and/or plunge from defaults.

set plunge numeral height - change size of type (in map units) from .05 inches at recorded map scale.
set attitude entry format - Digitize (=default) (Quadrant and Azimuth not installed in Version 1.0).

close menu - close the Set Symbols pulldown menu and return to the Linear bar.

Options pulldown:

[Linear] | dig | Chg | Sel | ? | Pt Tags | Set | Op | Dw | Zm | ^PTS |

options: help - name of menu; display help for menu.

oops - remove the effect of the last ARC/INFO action.
Undelete(S): Restore points deleted in the current edit session:
last - restore the last point that was deleted in the current session.
all - restore all points that were deleted in the current session.
for expression - restore deleted points according to expression entered at the prompt.
delete(S) - delete the selected set of points.
select many - select many points by clicking on them; close selection with a *9*.
draw sel'd features - redraw selected points with current drawselect symbol.
show sel'd features - redraw selected points and report their identities.
list attributes(S) - list attributes of selected points.
change coord device - pick coordinate device from popup menu.
distance - report distance in map units between pairs of clicks; close with a *9*.
where - report x,y coordinates of click points; close with a *9*.
save(OW) - save current edit map by overwriting the existing file.
restore save - reassign saved symbols and selected set for current session.

close menu - close Options pulldown menu and return to the Edit bar.

Move (Points) Bar Menu

The Move bar for points supports moving existing points and making copies of points and their associated data. The Move bar is reached from the Points bar (click **MOVE**).

[Move] | move | Copy | sm | sp | Sel | Op | Dw | Zm | ^POINTS |

[Move] - name of bar menu; open Commands popup menu.
move - move selected point(s) (click from and to points to place on screen).
Copy - open Copy pulldown menu.
sm - redraw selected points and report their identities.
sp - select points within polygon clicked on screen; close with a *9*.
Sel - open the Select popup menu.
Op - open the Options pulldown menu.
Dw - open the Draw popup menu.
Zm - open the Zoom popup menu.
^POINTS - return to the Points bar.

Copy pulldown:

[Move] | move | Copy | sm | sp | Sel | Op | Dw | Zm | ^POINTS |

copy: help	- menu name; display help for Copy.
copy(S)	- copy select points set (click from and to points to place copy.
copy many(S)	- click from and to points at prompts to place each copy: close with a *9*.
close menu	- close Copy pulldown menu and return to the Move bar.

Options pulldown:

[Move] | move | Copy | sm | sp | Sel | Op | Dw | Zm | ^POINTS |

options: help	- name of menu; display help for menu.
oops	- remove the effect of the last ARC/INFO action.
Undelete(S):	Restore points deleted in the current edit session:
last	- restore the last point that was deleted in the current session.
all	- restore all points that were deleted in the current session.
for expression	- restore deleted points according to expression entered at the prompt.
delete(S)	- delete the selected set of points.
select many	- select many points by clicking on them; close selection with a *9*.
draw sel'd features	- redraw selected points with current drawselect symbol.
show sel'd features	- redraw selected points and report their identities.
list attributes(S)	- list attributes of selected points.
distance	- report distance in map units between pairs of clicks; close with a *9*.
where	- report x,y coordinates of click points; close with a *9*.
save(OW)	- save current edit map by overwriting the existing file.
restore save	- reassign saved symbols and selected set for current session.
close menu	- close Options pulldown menu and return to the Edit bar.

AREAS BAR MENU

The Areas bar supports work with the label points that identify areas (polygons) by providing access to the Digitize and Move bars and to the Database pulldown. The bar is reached from the Edit bar (click **AREAS**).

[Areas] | DIG | MOVE | SYMB | Db | Sel | Op | Dw | Zm | ^EDIT |

[Areas]	- name of the bar menu; open the Commands popup menu.
MOVE	- go to the Move (Areas) bar.
SYMB	- go to the Symbols bar menu.
Db	- open the Database pulldown menu.
Sel	- open the Select popup menu.
Op	- open the Options pulldown menu.
Dw	- open the Draw popup menu.
Zm	- open the Zoom popup menu.
^EDIT	- return to the Edit bar menu.

Database pulldown:

[Areas] | DIG | MOVE | SYMB | **Db** | Sel | Op | Dw | Zm | ^EDIT |

database: help	- name of menu; display help for Database menu.
set points item	- specify item for automatic tagging and other ALACARTE functions.
list unique values	- list unique values of current (or specified) points item.
list attributes(S)	- list attributes of selected set of points.
items	- list items (and their definitions) in polygon database of edit map (PAT).
calculate	- enter value to be placed in specified numeric item for selected points.
moveitem	- enter character string to be placed in specified item for selected points.
update	- change entry in specified item using ARCEDIT Update function.
change	- change entry in specified item with editor string using Change function.
lookup	- assign screen symbols from a lookup table using Lookup function.
forms	- open forms menu to view or change data entries for selected points.
oops	- remove the effect of the last ARC/INFO action.
statistics	- make statistical queries using ARCEDIT Statistics function.
columns	- access other databases using ARCEDIT Columns function.
connect to RDBMS	- access other databases using ARCEDIT Connect function.
RELATE	- go to Relate bar to access other data tables using Relate function.
close menu	- close Database pulldown menu and return to the Edit bar menu.

Options pulldown:

[Areas] | DIG | MOVE | SYMB | Db | Sel | **Op** | Dw | Zm | ^EDIT |

options: help	- name of menu; display help for menu.
oops	- remove the effect of the last ARC/INFO action.
Undelete(S):	Restore points deleted in the current edit session:
last	- restore the last point that was deleted in the current session.
all	- restore all points that were deleted in the current session.
for expression	- restore deleted points according to expression entered at the prompt.
delete(S)	- delete the selected set of points.
select many	- select many points by clicking on them; close selection with a *9*.
draw sel'd features	- redraw selected points in current drawselect symbol.
show sel'd features	- redraw selected points and reports their identities.
list attributes(S)	- list attributes of selected points.
distance	- report distance in map units between pairs of clicks; close with a *9*.
where	- report x,y coordinates of click points; close with a *9*.
change coord device	- pick coordinate device from popup menu.
save(OW)	- save current edit map by overwriting the existing file.
restore save	- reassign saved symbols and selected set for current edit session..
close menu	- close the Options pulldown menu and return to the Edit bar.

Digitize (Areas) Bar Menu

The Digitize bar for areas supports digitizing and concurrent tagging of label points for polygons, the assignment of area types to existing label points, and the selection of polygon label points according to their area types. The Digitize bar is reached from the Areas bar (click **DIG**).

[Dig] | dig | tag | Sel | ? | key | m1 | m2 | m3 | Op | Dw | Zm | ^AREAS |

[Dig]	- name of the bar menu; open the Commands popup menu.
dig	- digitize polygon label points tagged with the current area type.
tag	- tag the selected set of label points with the current area type.
Sel	- open the Select pulldown menu.
?	- report the curent area type.
key	- enter area type from the keyboard at the prompt.
m1	- open custom menu AREAS1.
m2	- open custom menu AREAS2.
m3	- open custom menu AREAS3.
Op	- open the Options pulldown menu.
Dw	- open the Draw popup menu.
Zm	- open the Zoom popup menu.
^AREAS	- return to the Areas bar menu.

Select pulldown:

[Dig] | dig | tag | Sel | ? | key | m1 | m2 | m3 | Op | Dw | Zm | ^AREAS |

help select	- menu name; display help for Select.
sel by current area type:	
select	- select all label points tagged with the current area type.
aselect	- add to the selected set all label points tagged with the current area type.
reselect	- reselect from the selected set all points tagged with the current area type.
unselect	- remove from the selected set all points tagged with the current area type.
nselect	- select all label points in the map thjat are not currently selected.
Sel	- calls the Select popup menu.
select many	- select many label points by clicking on them; close selection with a *9*.
select polygon	- select label points within polygon clicked on the screen; close with *9*.
sel,tag,color	- select many points, tag with current area type, and assign color.
show sel'd features	- redraw selected label points and report their identities.
close menu	- close Select pulldown menu and return to the Digitize bar.

Options pulldown:

[Dig] | dig | tag | Sel | ? | key | m1 | m2 | m3 | Op | Dw | Zm | ^AREAS |

oops	- remove the effect of the last ARC/INFO action.
Undelete(S):	Restore points deleted in the current edit session:
last	- restore the last point that was deleted in the current session.
all	- restore all points that were deleted in the current session.

for expression	- restore deleted points according to expression entered at the prompt.
delete(S)	- delete the selected set of points.
select many	- select many points by clicking on them; close selection with a *9*.
draw sel'd features	- redraw selected points in current drawselect color (default = yellow).
autodig on	- start digitize routine when change ptype from key-in or custom menu.
autodig off	- turn off automatic start of digitize routine when change ptype (default).
color units in backgnd	- specify color & ptype (or untagged) to color polygons on draw and zoom.
color units: off	- turn off the coloring of specified poygons in the background.
post attribute: on	- post ptype (or current areas item) at label points on draw and zoom.
post attribute: off	- turn off the automatic posting of ptype (default).
show sel'd features	- redraw selected points and repors their identities.
list attributes(S)	- list attributes of selected points.
distance	- report distance in map units between pairs of clicks; close with a *9*.
where	- report x,y coordinates of click points; close with a *9*.
change coord device	- pick coordinate device from popup menu.
save(OW)	- save current edit map by overwriting the existing file.
restore save	- reassign saved symbols and selected set for current edit session.
close menu	- close Options pulldown menu and return to the Edit bar menu.

Move (Areas) Bar Menu

The Move bar for areas supports moving existing label points and making copies of label points and their associated data. The Move bar is reached from the Areas bar (click **MOVE**).

[Move] | move | Copy | sm | sp | Sel | Op | Dw | Zm | ^AREAS |

[Move]	- name of bar menu; open Commands popup menu.
move	- move selected point(s) (click from and to points to place on screen).
Copy	- open Copy pulldown menu.
sm	- redraw selected label points and report their identities.
sp	- select label points within polygon clicked on screen; close with a *9*.
Sel	- open the Select popup menu.
Op	- open the Options pulldown menu.
Dw	- open the Draw popup menu.
Zm	- open the Zoom popup menu.
^POINTS	- return to the Points bar.

Copy pulldown:

[Move] | move | Copy | sm | sp | Sel | Op | Dw | Zm | ^POINTS |

copy: help	- menu name; display help for Copy.
copy(S)	- copy selected label points set (click from and to points to place copy).
copy many(S)	- click from and to points at prompts to place each copy: close with a *9*.
close menu	- close Copy pulldown menu and return to the Move bar.

Options pulldown:

[Move] | move | Copy | sm | sp | Sel | Op | Dw | Zm | ^POINTS

options: help	- name of menu; display help for menu.
oops	- remove the effect of the last ARC/INFO action.
Undelete(S):	Restore points deleted in the current edit session:
last	- restore the last point that was deleted in the current session.
all	- restore all points that were deleted in the current session.
for expression	- restore deleted points according to expression entered at the prompt.
delete(S)	- delete the selected set of points.
select many	- select many points by clicking on them; close selection with a *9*.
draw sel'd features	- redraw selected points with current drawselect symbol.
show sel'd features	- redraw selected points and report their identities.
list attributes(S)	- list attributes of selected points.
distance	- report distance in map units between pairs of clicks; close with a *9*.
where	- report x,y coordinates of click points; close with a *9*.
save(OW)	- save current edit map by overwriting the existing file.
restore save	- reassign saved symbols and selected set for current session.
close menu	- close Options pulldown menu and return to the Edit bar.

ANNOTATION BAR MENU

The Annotation bar supports work with map-face text by providing access to the bars from which annotation can be added or changed. The bar is reached from the Edit bar (click **ANNO**). The first time that you go to the Annotation bar in an Edit session, the Annotation Environment popup menu appears to report current annotation settings and offer a chance to change them, although the settings can also be changed from the Digitize annotation bar.

[Anno] | DIG | CHANGE | SYMB | Sel | Op | Dw | Zm | ^EDIT |

[Anno]	- name of the bar menu; open the Commands popup menu.
DIG	- go to the Digitize Annotation bar menu.
CHANGE	- go to the Change Annotation bar menu.
SYMB	- go to the Symbols bar menu.
Sel	- open the Select popup menu.
Op	- open the Options pulldown menu.
Dw	- open the Draw popup menu.
Zm	- open the Zoom popup menu.
EDIT	- return to the Edit bar menu.

Options pulldown:

[Anno] | DIG | CHANGE | SYMB | Sel | Op | Dw | Zm | ^EDIT |

options: help	- name of menu; display help for Options.
oops	- remove the effect of the last ARC/INFO action.
Undelete(S):	Restore annotation deleted in the current edit session**:**

last	- restore the last annotation that was deleted in the current session**.**
all	- restore all annotation that was deleted in the current session**.**
for expression	- restore deleted annotation according to specified expression**.**
delete(S)	- delete the selected annotation.
select many	- select annotation by clicking (at lower left); close selection with a *9*.
draw sel'd features	- redraw selected annotation in current drawselect color (default = green).
show sel'd features	- redraw selected annotation and report identities.
auto dw sel on	- draw annotation in drawsel color (default = green) when selected.
auto sw sel off	- annotation not automatically drawn in drawsel color when selected.
list attributes(S)	- list record number of selected annotation.
distance	- report distance in map units between pairs of clicks; close with a *9*.
where	- report x,y coordinates of click points; close with a *9*.
change coord device	- pick coordinate device from popup menu.
save(OW)	- save current edit map by overwriting the existing file.
close menu	- close the Options pulldown menu and return to the Annotation bar.

Digitize (Annotation) Bar Menu

The Digitize bar for annotation supports entry of map-face text in different fonts and sizes either from the keyboard or by extraction from the map database. Various methods of placement provide flexibility in fitting the text into the map. The Digitize bar is reached from the Annotation bar (click **DIG**).

[Dig] | add | Add options | Sel | Op | Dw | Zm | ^ANNO |

[Dig]	- name of bar menu; open Commands popup menu.
add	- start add annotation routine; enter text at prompt; place with click.
Add options	- open the Add Options pulldown menu.
Sel	- open the Select popup menu.
Op	- open the Options pulldown menu.
Dw	- open the Draw popup menu.
Zm	- open the Zoom popup menu.
^ANNO	- return to the Annotation bar menu.

Add Options pulldown:

[Dig] | add | Add options | Sel | Op | Dw | Zm | ^ANNO |

status - add	- report settings for Add Annotation routine.
Annoenvironment	- open Annotation Environment forms menu to view or change settings.
annosize *	- set size of annotation with clickpoints on screen.
new	- reset size and symbol for new annotation to be those of selected string.
show(S1)	- report attributes of the selected string of annotation.
close menu	- close the Add Options pulldown menu and return to the Digitize bar.

Options pulldown:

[Dig] | add | Add options | Sel | Op | Dw | Zm | ^ANNO |

options: help	- name of menu; display help for Options menu.
oops	- remove the effect of the last ARC/INFO action.
Undelete(S):	Restore annotation deleted in the current edit session:
last	- restore the last annotation that was deleted in the current session.
all	- restore all annotation that was deleted in the current session.
for expression	- restore deleted annotation according to expression entered at the prompt.
delete(S)	- delete the selected annotation.
select many	- select annotation by clicking (at lower left); close selection with a *9*.
draw sel'd features	- redraw selected annotation in current drawselect color (default = green).
show sel'd features	- redraw selected annotation and report identities.
list attributes(S)	- list attributes of selected annotation.
distance	- report distance in map units between pairs of clicks; close with *9*.
where	- report x,y coordinates of click points; close with *9*.
change coord device	- pick coordinate device from popup menu.
save(OW)	- save current edit map by overwriting the existing file.
close menu	- close the Options pulldown menu and return to the Digitize bar.

Change (Annotation) Bar Menu

The Change bar for annotation supports moving and rotating text and changing content, size, and font. The bar is reached from the Annotation bar (click **CHANGE**).

[Change] | Change | Move | Rot | sm | sp | Se | Op | Dw | Zm | ^ANNO |

[Change]	- name of bar menu; open the Commands popup menu.
Change	- open the Change Annotation pulldown menu.
Move	- open the Move Annotation pulldown menu.
Rot	- open the Rotate Annotation pulldown menu.
sm	- select one or more annotation strings by clicking lower left corners.
sp	- select all annotation strings enclosed in a polygon clicked on screen.
Se	- open the Select popup menu.
Op	- open the Options pulldown menu.
Dw	- open the Draw popup menu.
Zm	- open the Zoom popup menu.
^ANNO	- return to the Annotation bar menu.

Change Annotation pulldown:

[Change] | Change | Move | Rot | sm | sp | Se | Op | Dw | Zm | ^ANNO |

annolevel(S)	- change level to which selected annotation is assigned.
annosize(S)	- change size of selected annotation by entering new size.
annosymbol(S)	- change symbol in current textset assigned to selected annotation.

setarrow(S1) - draw arrow for seleted text by clicking *from* and *to* ends (*9* to close).
Select and Setarrow - select text and draw arrow ; repeat or close with *9*.
deletearrows(S) - delete arrows from selected annotation.

select &text = - select all annotation matching entered string.
change(S) $text - append, change, overlay, or replace all or parts of selected annotation.
Replace text string - replace selected strings with entered string.

show(S1) - report attributes of the selected string of annotation.

close menu - close the Change pulldown menu and return to the Change bar.

Move Annotation pulldown:

[Change] | Change | Move | Rot | sm | sp | Se | Op | Dw | Zm | ^ANNO |

move(S) - move selected annotation (click *from* and *to* points to place).
Select and Move - select strings one by one and move by clicking *from* and *to* points..
reposition(S1) - relocate selected string using current placement method.

smartanno(Tek) - turn on to drag and place selected string with **move(S)**.
position(Tek) - drag selected string with mouse, rotate on pivot with *1* (Smartanno on).
help - display help for Smartanno.

copy(S) - copy selected annotation (click *from* and *to* points to place).
copy many(S) - click a *from* point and then as many *to* points as copies; close with a *9*.

close menu - close the Move Annotation pulldown menu and return to the Change bar.

Rotate Annotation pulldown:

[Change] | Change | Move | Rot | sm | sp | Se | Op | Dw | Zm | ^ANNO |

rotate: help - name of menu; display help for Rotate menu.

rotate(S) rotate selected annotation about a pivot point (click at prompt); specify
Setangle: rotation angle with click on circle around pivot point or enter with
setangle **setangle** (positive=counterclockwise); clear current angle with
setangle 0 **setangle 0**, restore last angle entered with **setangle last**. Uses
setangle last last angle set unless that = 0, then requires angle to be clicked on screen.

Options pulldown:

[Change] | Change | Move | Rot | sm | sp | Se | Op | Dw | Zm | ^ANNO |

options: help - name of menu; display help for Options menu.

oops - remove the effect of the last ARC/INFO action.
Undelete(S): Restore annotation deleted in the current edit session:
last - restore the last annotation that was deleted in the current session.
all - restore all annotation that was deleted in the current session.
for expression - restore deleted annotation according to expression entered at the prompt.

delete(S) - delete the selected annotation.
select many - select annotation by clicking (at lower left); close selection with a *9*.
draw sel'd features - redraw selected annotation in current drawselect color (default = green).
show sel'd features - redraw selected annotation and report identities.
list attributes(S) - lists attributes of selected annotation.
PUT - go to the PUT bar (see description under Lines, p. 223).
get - incorporate all annotation from specified map into edit map.
distance - report distance in map units between pairs of clicks; close with *9*.
where - report x,y coordinates of click points; close with *9*.

change coord device - pick coordinate device from popup menu.
save(OW) - save current edit map by overwriting the existing file.

close menu - close the Options pulldown menu and return to the Change bar.

TICS BAR MENU

The Tics bar supports digitizing, placing, and numbering digital registration tics in a map. It is reached from the Edit bar (click **TICS**).

[Tics] | add | Move | so | sm | Db | Sel | Op | Dw | Zm | [^EDIT] |

[Tics] - name of bar menu; call the Commands popup menu.
add - start digitize tics routine and the key menu that controls it.
Move - open the Move pulldown menu.
so - select one tic by clicking on on it.
sm - select several tics by clicking; close selection with a *9*.
Db - open the Database pulldown menu.
Sel - open the Select popup menu.
Op - open the Options pulldown menu.
Dw - open the Draw popup menu.
Zm - open the Zoom popup menu.
[^EDIT] - return to the Edit bar.

Move Tics pulldown:

[Tics] | add | Move | so | sm | Db | Sel | Op | Dw | Zm | [^EDIT] |

move(S) - move selected tic(s); click *from* and *to* points at prompts.
move many - cycles through the steps to locate, select, and place tics individually.

Database pulldown:

[Tics] | add | Move | so | sm | Db | Sel | Op | Dw | Zm | [^EDIT] |

database: help - name of menu; display help for Database menu.

list attributes(S) - report identity and x,y location of selected tics.
items - list items (and their definitions) in database of edit map.

calculate - enter item name and value to be recorded in it for selected tic(s).

close menu - close the Database pulldown menu and return to the Tics bar menu.

Options pulldown:

[Tics] | add | Move | so | sm | Db | Sel | Op | Dw | Zm | [^EDIT] |

options: help - name of menu; display help for Options menu.

oops - remove the effect of the last ARC/INFO action.
Undelete(S): Restore tics deleted in the current edit session:
last - restore the last tic that was deleted in the current session.
all - restore all tics that were deleted in the current session.
for expression - restore deleted tics according to expression typed at the prompt**.**
delete(S) - delete the selected set of tics.
select many - select many tics by clicking on them; close selection with a *9*.
draw sel'd features - redraw selected tics in current drawselect color (default = yellow).
show sel'd features - redraw selected tics on screen and report their identities.
list attributes(S) - report identity and x,y location of selected tics.
get - incorporate all tics from specified map into edit map.
distance - report distance in map units between pairs of clicks; close with a *9*.
where - report x,y coordinates of click points; close with a *9*.
change coord device - pick coordinate device from popup menu.
save(OW) - save current edit map by overwriting the existing file.
restore save - reassign saved symbols and selected set for current edit session.

close menu - close the Options pulldown menu and return to the Tics bar.

Plot Section

The Plot section in Version 1.0 of ALACARTE supports the preparation of plot files for on-screen and hard-copy plotting. You will need to consult the system administrator concerning available output devices and probably will need to consult an expert user, the ARC/INFO manual, and/or the manual for MAPX to make sucessful plots with the present level of support for plotting in ALACARTE.

PLOT BAR MENU

The Plot bar provides access to (1) the Arcplot command line, (2) a connection to MAPX for preparing a parameter file for plotting (A.C. Tarr, unpub.; MAPX must be separately obtained and installed), and (3) procedures to make error plots, to prepare plot files for single colored maps, and to display plot files on the screen. The Plot bar is reached from the Alacarte bar (click **PLOT**).

[Plot] | arcplot cmd line | mapx | Plotfiles | ^ALC |

[Plot] - name of bar menu; open Commands popup menu.
arcplot cmd line - go to Arcplot command line; enter *quit* to return to Plot bar.
mapx - go to MAPX to prepare a parameter file for plotting (if MAPX installed).
Plotfiles - open Plotfiles pulldown menu.
^ALC - return to the Alacarte bar.

Plotfiles pulldown:

[Plot] | arcplot cmd line | mapx | Plotfiles | ^ALC |

Make standard plot	- prepare ARC/INFO plotfile for a standard ALACARTE geologic map.
Make edit plot	- prepare an error plot of a map.
Draw plotfile to screen	- display an ARC/INFO plot file on the screen.
close menu	- close the Plotfiles pulldown menu and return to the Plot bar.

Analysis Section

The Analysis section in Version 1.0 of ALACARTE provides some basic tools to manipulate digital maps to produce derivative extractions and combinations. These tools and their controlling variables are not recast from their original ARC/INFO teminology and function. Many other analysis and query functions that are available in ARC and ARCPLOT are not incorporated in Version 1.0.

ANALYSIS BAR

The Analysis bar provides access to the INFO command line and to a limited suite of ARC analysis functions in menu form. It is reached from the Alacarte bar (click **ANALYSIS**).

[Analysis] | info | Proximity | Boundary | Logical | Spatial | ^ALC |

[Analysis]	- name of bar menu; open Commands menu.
info	- go to the INFO command line; enter *stop* or *q stop* to return to Analysis bar.
Proximity	- open Proximity Functions pulldown menu.
Boundary	- open Boundary Functions pulldown menu.
Logical	- open Logical Functions pulldown menu.
Spatial	- open Spatial Functions pulldown menu

Proximity Functions pulldown:

[Analysis] | info | Proximity | Boundary | Logical | Spatial | ^ALC |

Buffer	- create lines (and polygons) at specific distances around specific map elements.
Near	- find distances from points in one layer to nearest map elements in another layer.
Pointdistance	- find distances from points in one layer to points in another layer.

Boundary Functions pulldown:

[Analysis] | info | Proximity | Boundary | Logical | Spatial | ^ALC |

append	- combine separate maps or layers with identical databases into a single layer.
Clip	- copy a specified area from one map to produce another map.
Erase	- blank out specified area(s) in a map.
Mapjoin	- combine separate maps into one layer (as with Append) and recreate topology.
Split	- subdivide a map into specified areas as separate maps.
Update	- 'cut and paste' new lines and polygons from one layer into another.

Logical Functions pulldown:

[Analysis] | info | Proximity | Boundary | Logical | Spatial | ^ALC |

Dissolve	- merge adjacent polygons that have the same entry in a specified database item.
Eliminate	- combine selected lines or polygons along or across longest length or boundary.
Reselect	- extract elements from a map according to specified database attributes.

Spatial Functions pulldown:

[Analysis] | info | Proximity | Boundary | Logical | Spatial | ^ALC |

Identity	- combine one map with the overlapping area of another map.
Intersect	- combine two maps only for their jointly overlapping area.
Union	- combine two maps and produce a composite database for overlapping polygons.

The Conversion Section

The Conversion section provides access to various conversion routines to be applied to maps and map data already in ARC/INFO or that are being imported into the system or exported to another system.

CONVERSION BAR MENU

The Conversion bar supports the projection and transform of maps, various file format, import, and export functions, and various conversions between ARC and the Scitex system. It is reached from the Alacarte bar (click **CONVERSION**).

[Conversion] | Projection | Export | Scitex | ^ALC |

[Conversion]	- name of the ar menu; open the Commands popup menu**.**
Projection	- open the Projection pulldown menu**.**
Export	- open the Export forms menu**.**
Scitex	- open the Scitex pulldown menu**.**
^ALC	- return to the Alacarte bar**.**

Projection pulldown:

[Conversion] | Projection | Export | Scitex | ^ALC |

Projection: help	- name of menu; display help for Projection menu.
Transform	- transform one map into another**.**
Project:	
Project file	- change the projection of coordinates in a file**.**
Project coverage	- change the projection of a map**.**
close menu	- Close the Projection pulldown menu and return to the Conversion bar**.**

Export pulldown:

[Conversion] | Projection | Export | Scitex | ^ALC |

Export	- convert ARC/INFO file for transfer to a different ARC/INFO host**.**
Import	- convert ARC/INFO export file to ARC/INFO working format.
Tapewrite	- write file to 9-track tape in universal ARC/INFO format**.**
Taperead	- read from 9-track tape in universal ARC/INFO format.
Assign tape(Prime)	- allocate Prime tape drive for use.
Unassign tape(Prime)	- release Prime tape drive after use.
close menu	- close the Export pulldown menu and return to the Conversion bar.

Scitex pulldown:

[Conversion] | Projection | Export | Scitex | ^ALC |

Scitex: help	- name of menu; display help for Scitex menu.
Scitex to ARC/INFO	
Scitexline	- convert a Scitex DIGIT file to a line coverage in ARC.
Scitexpoint	- convert s Scitex DIGIT file to a point coverage in ARC.
Scitexpoly	- convert a Scitex DIGIT file to a polygon coverage in ARC.
Arc/Info to Scitex	
Arc cover to Scitex	- convert an ARC coverage to a set of SCITEX files**.**
Arc cov to Sci-poly	- convert an ARC polygon layer to a set of Scitex files (automated).
Plotfile to Scitex	- convert an ARC/INFO plotfile to SCITEX format.
Scitex tape:	
Read a Scitex tape	- load Scitex files in TCOPY tape format.
Write a Scitex tape	- write Scitex files in TCOPY tape format.
close menu	- close the Scitex pulldown menu and return to the Conversion bar.

General Section

The General section supports a variety of whole-map operations as well as housekeeping functions for map files and directories.

GENERAL BAR MENU

The General bar supports file handling, modification of map databases, and such bulk map processes as Createlabels and Clean, and provides access to various symbols editors. It is reached from the Alacarte bar (click **GENERAL**).

[General] | Files | Topology | Symbol editors | ^ALC |

[General]	- name of the bar; open the Commands popup menu.

Files - open the Files pulldown menu.
Topology - open the Topology pulldown menu.
Symbol editors - open the Symbol Editors pulldown menu.
^ALC - return to the Alacarte bar**.**

Files pulldown:

[General] | Files | Topology | Symbols Editor | ^ALC |

Copy - copy an existing map as a new map.
rename - enter old-name and new-name.
Kill - delete an existing map (with ALL its associated files).
Create map - make empty map layer; can copy tics and projection from existing map.
create workspace - make new directory in current directory; specify name at prompt.
Change workspace - enter name of map directory (full pathname where not subordinate).
externalall - apply to map files that have been moved to make attributes accessible.
generate - make empty layer or new map elements from specified coordinate data.
Add item - add an item (field and its definition) to a map database.
Drop item - remove an item from a map database.
Create labels - create labels for every valid polygon in a map.
Match nodes - snap nodes throughout a map with specified snap distance (extend opt.).
Add save items - add the items to a map database needed to save symbols and selected set.
Add ALC items - add standard ALACARTE database items for [line, point, area] types.
copy ALC files - open menu to copy all ALC files from one map to another.
Restore edit session - restore edits lost when an edit session is terminated by system failure.

close menu - close the Files pulldown menu and return to the General bar.

Topology pulldown:

[General] | Files | Topology | Symbols Editor | ^ALC |

Clean - find intersections, trim dangles, and build or rebuild topology in a map.
Build - build or rebuild topology in a map.
Tolerances - change or list tolerances for a map layer.
Labelerrors - report any polygon label errors in a map (unedited since last built).

close menu - close the Topology pulldown menu and return to the General bar.

Symbol Editors pulldown:

[General] | Files | Topology | Symbols Editor | ^ALC |

marker editor - go to the marker editor; enter *quit* to return to the General bar.
line editor - go to the line editor; enter *quit* to return to the General bar.
shade editor - go to the shade editor; enter *quit* to return to the General bar.
text editor - go to the text editor; enter *quit* to return to the General bar.

close menu - close Symbols Editor pulldown menu and return to the General bar.

INDEX TO MENUS

The listing of the menu items shows their position in the menu hierarchy using sequence from the item upward and applies the ALACARTE captialization code. Thus:

add vertex(S1)
/Vertices/RESHAPE Lines, 219

represents the menu item **add vertex(S1)**, which is on the Vertices pulldown from the Reshape bar.

The menus themselves are listed in the form:

Alacarte Bar Menu, 203

Page numbers refer to descriptions of the menus in the manual.

A

B

C

D

E

F

G

H

I

K

L

M

N

O

P

R

S

T

U

V

W

X

Z

INDEX TO USER MANUAL

See *Index to Menus*, p. 247, for index to *Structure and Functions* and to specific menu items.

D

E

F

G

H

I

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Z