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

# GEOLOGIC MAP OF THE TILLAMOOK HIGHLANDS, NORTHWEST OREGON COAST RANGE: A DIGITAL DATABASE

By

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Open - File Report 95-670

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This database, identified as "Geologic map of the Tillamook Highlands, Northwest Oregon Coast Range: A digital database," has been approved for release and publication by the Director of the USGS. Although this database has been subjected to rigorous review and is substantially complete, the USGS reserves the right to revise the data pursuant to further analysis and review. Furthermore, it is released on condition that neither the USGS nor the United States Government may be held liable for any damages resulting from its authorized or unauthorized use.

1995

## INTRODUCTION

This digital geologic map database represents the distribution and character of Cenozoic geologic strata in six 15' quadrangles covering most of the Tillamook Highlands in the northwest Oregon Coast Range (Figure 1). The geologic map was published as Open-File Report 94-21, the Geologic Map of the Tillamook Highlands, Northwest Oregon Coast Range, by Wells and others. The map was produced as an encapsulated Postscript file and is available from Open File Services or as an encapsulated Postscript file on the World Wide Web at http://wrgis.wr.usgs.gov. The database is largely compiled from new mapping at 1:48,000 and 1:24,000 scales by the authors, in combination with published and unpublished previous work. The geology is the work of the first five authors; the digital compilation of the database and production of this report is the work of the last two authors. Together with the accompanying text file (tilgeo.ps or tilgeo.txt), it provides the most recent synthesis of the stratigraphy and structural geology of the northern Coast Range uplift. Bedrock map units are identified by age and lithology following informal stratigraphic nomenclature of the U.S. Geological Survey. Quaternary units are divided into beach and dune deposits, fluvial deposits and terraces, and landslides. The scale of the source maps generally limits spatial resolution (scale) of the database to 1:48,000 or smaller. The content and character of the database files are described herein, along with three methods of obtaining the database.

INDEX TO 7 1/2' AND 15' TOPOGRAPHIC MAPS

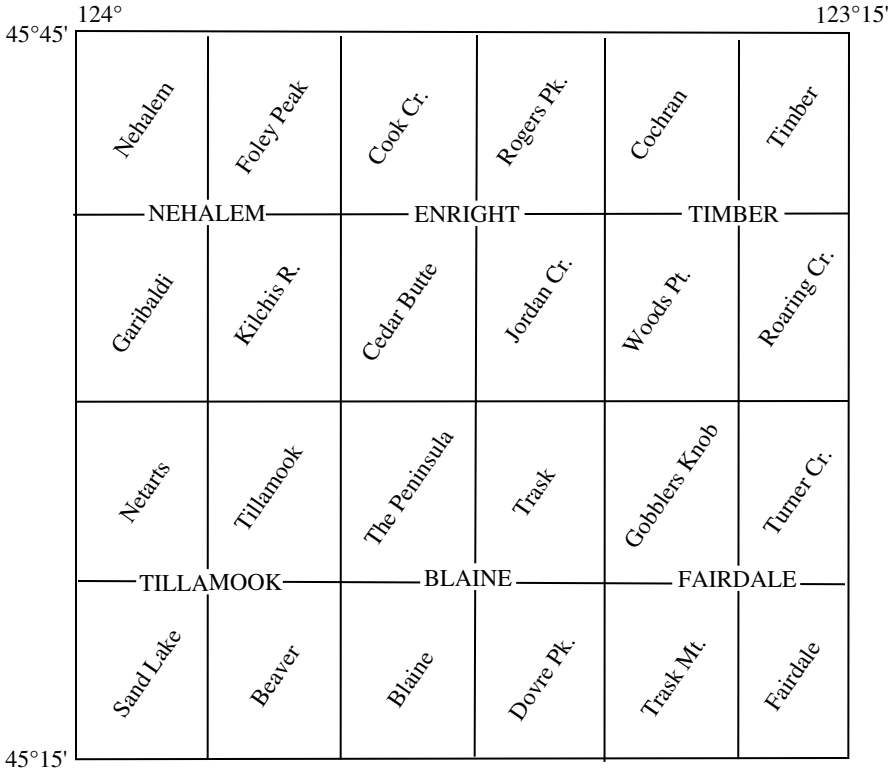


Figure 1

## DATABASE CONTENTS

The digital database consists of the geologic map database itself and the supporting data including base maps, annotation layers, specialized symbol sets, and text files. This database is divided into 6 sets of data based on 15' quadrangle boundaries which can be taken individually or as a complete data set. If the user has not chosen to acquire the entire data set, not all of the files listed below will be present. Data sets are listed by 15' quadrangle. The data is available in ARC/INFO export format.

ARC/INFO export files:

NEHALEM 15' quadrangle, compressed tar file name: nehexp.tar.Z
3.9 MB compressed download file, 21.5 MB uncompressed data file

neh_geo.e00 Faults, depositional contacts, and geologic unit identities
neh_str.e00 Fold axes, oriented symbols (strike and dip information)
neh_topo.e00 Base map
neh_ann.e00 Labels for geologic units and faults

ENRIGHT 15' quadrangle, compressed tar file name: enrexp.tar.Z
6.7 MB compressed download file, 36.6 MB uncompressed data file

enr_geo.e00 Faults, depositional contacts, and geologic unit identities
enr_alt.e00 Alteration zones
enr_str.e00 Oriented symbols (strike and dip information)
enr_topo.e00 Base map
enr_ann.e00 Labels for geologic units and faults

TIMBER 15' quadrangle, compressed tar file name: timexp.tar.Z
4.5 MB compressed download file, 25.2 MB uncompressed data file

tim_geo.e00 Faults, depositional contacts, and geologic unit identities
tim_str.e00 Fold axes, oriented symbols (strike and dip information)
tim_topo.e00 Base map
tim_ann.e00 Labels for geologic units and faults

TILLAMOOK 15' quadrangle, compressed tar file name: tilexp.tar.Z
3.5 MB compressed download file, 19.1 MB uncompressed data file

til_geo.e00 Faults, depositional contacts, and geologic unit identities
til_str.e00 Oriented symbols (strike and dip information)
til_topo.e00 Base map
til_ann.e00 Labels for geologic units and faults
til_wel.e00 Well locations

BLAINE 15' quadrangle, compressed tar file name: blaexp.tar.Z
5.0 MB compressed download file, 27.1 MB uncompressed data file

bla_geo.e00 Faults, depositional contacts, and geologic unit identities
bla_str.e00 Fold axes, oriented symbols (strike and dip information)
bla_topo.e00 Base map
bla_ann.e00 Labels for geologic units and faults

FAIRDALE 15' quadrangle, compressed tar file name: faiexp.tar.Z
3.5 MB compressed download file, 19.3 MB uncompressed data file

fai_geo.e00 Faults, depositional contacts, and geologic unit identities
fai_str.e00 Fold axes, oriented symbols (strike and dip information)
fai_topo.e00 Base map
fai_ann.e00 Labels for geologic units and faults

Complete Data Set, compressed tar file name: all6exp.tar.Z
27.1 MB compressed download file, 148.9 MB uncompressed data file

| | |
|---|---|
| all6exp | Includes all of the data listed above |

Accessory Data, compressed tar file name: symbolexp.tar.Z
0.05 MB compressed download file, 0.3 MB uncompressed data file

| | |
|---|---|
| symbolexp | A directory containing custom symbolsets and fonts (not included with the ARC/INFO package), and an INFO directory with look-up tables used to match symbols, colors, etc. to the existing Open File Report 94-21 of the Tillamook map. |

The of95-670 Open File directory also includes the following files:

| | |
|---|---|
| tilgeo.ps | Postscript version of the text file containing detailed unit descriptions and geological information which accompanied Open File Report 94-21. NOTE: This text file was written to accompany the entire data set (6 15' quadrangles). All geologic units or features referenced in this text may not appear on a single 15' quadrangle. |
| tilgeo.txt | ASCII version of tilgeo.ps (Open File Report 94-21 with no figures). |
| tildb.ps | Postscript version of this report. |
| tildb.txt | ASCII text file of this report without figures. |

## ORGANIZATION OF THE DATA RELEASE

The database was compiled in ARC/INFO, a commercial Geographic Information System (Environmental Systems Research Institute, Redlands, California), and is available in uncompressed ARC export format (ARC/INFO version 6.1.1) in a compressed UNIX tar (tape archive) file. Tar and uncompress utilities are therefore required to extract the database from the tar file. Export files (.e00 extension) can be imported into ARC/INFO coverage format or can be read by some other Geographic Information Systems (such as MapInfo via ArcLink). The digital compilation was done using version 6.1.1 of ARC/INFO with version 2.0 of the menu interface ALACARTE (Fitzgibbon and Wentworth, 1991, Fitzgibbon, 1991, Wentworth and Fitzgibbon, 1991).

## OBTAINING THE DIGITAL DATA

The digital data can be obtained in three ways:

a. anonymous ftp over Internet
b. on the World Wide Web
c. by sending a tape with request

**a.** To obtain each file (compressed tar file, text file, or Postscript file) by ftp, log in to your UNIX system and do the following:

| | |
|---|---|
| cd <local_directory> | -go to a directory to receive the tar file |
| ftp wrgis.wr.usgs.gov | -make ftp connection with the USGS computer wrgis (130.118.37.71) |
| Name: anonymous | -use "anonymous" as your user name |
| Password: your name | -use your own user name as password |
| cd pub/geologic/or/of95-670 | -go down to the pub directory |
| type binary | -change transfer type to binary |
| get <file> | -copy the file across Internet to your directory (fill in the file name from page 3 or 4 in place of <file>). Repeat for each file to be downloaded |
| quit | -close the ftp connection |

Extracting the Database from the Tar file:

If you obtained the ARC/INFO export files, which are compressed and archived with tar, by anonymous ftp, do the following:

| | |
|---|---|
| uncompress <file> | -do only if file name ends in .Z makes an uncompressed tar file <file>.tar |
| cd <local_directory2> | -go to the directory that will hold the data <file> (if different from local_directory) |
| tar xvfb {path to tar file}/<file>.tar | -extract the <file> data from the tar file. |

This process will create a directory for each quad in your local directory. Import AMLs are included with the export format data. To convert the export files into ARC coverage format, run the import AML scripts included in each directory:

arc: **&run import**

**b .** World Wide Web (WWW) site:
On the U.S. Geological Survey Western Region Geologic Information Server (URL: http://wrgis.wr.usgs.gov), click on OREGON to get to the Oregon dataset home page, then click on OF95-670 to get to the web page for this data.

**c.** Send a tape with request and return address to:

Tillamook Digital Database
c/o BWRG Data Coordinator
U.S. Geological Survey
345 Middlefield Road, M/S 975
Menlo Park, CA 94025

Do not omit any part of this address

The compressed tar file will be returned on the tape. The acceptable tape types are:
1/4 inch, 150 MB cartridge tape
2.3 or 5.0 GB, 8 mm Exabyte tape.

Extracting the Database from the Tar file:

If you obtained the database on tape:

| | |
|---|---|
| put the tape in your tape drive | |
| cd <local_directory> | -go to a directory to receive the tar file |
| tar xvfb /dev/rstn | -/dev/rstn is the tape device with n an integer this puts the tar file in local_directory |
| uncompress <file>.tar.Z | -makes an uncompressed tar file <file>.tar |
| cd local_directory2 | -go to the directory that will hold the data <file> (if different from local_directory) |
| tar xvfb {path to tar file}/<file>.tar | -extract the <file> workspace from the tar file. |

This process will create a directory for each quad in your local directory. Import AMLs are included with the export format data. To convert the export files into ARC coverage format, run the import AML scripts included in each directory:

## DIGITAL COMPILATION

The geologic map information from twenty four 1:24,000 scale field maps was reduced and compiled at 1:48,000 scale on six stable originals created from the 7.5' bases. The geology was digitized from the six 1:48,000 map sheets, each of which represent a quadrangle (Tillamook, Nehalem, Enright, Timber, Fairdale, and Blaine) in the discontinued 15' map series. The author manuscripts (ink on mylar) were scanned using a Tektronix 4991 monochrome scanner with a resolution of 304.8 dots per inch. The scanned images were vectorized and transformed from scanner coordinates to projection coordinates using digital tics at quadrangle corners. The scanned lines were edited interactively using ALACARTE, unit boundaries were tagged as a contact or fault as appropriate, and scanning artifacts visible at 1:24,000 were removed.

### Base Maps

Base Map layers were prepared from scale-stable printing negatives at 1:48,000 scale, of the U.S. Geological Survey Tillamook (1955 edition), Nehalem (1955 edition), Enright (1955 edition), Timber (1955 edition), Fairdale (1955 edition), and Blaine (1955 edition) 15' topographic maps. This old base was used because there were no funds for digitizing the 24 7.5' bases and because a base derived from 7.5' quadrangles was unsuitable for plotting images of the entire map area. Scanned and vectorized images were transformed from scanner coordinates to projection coordinates using digital tics at map corners. Scanning artifacts are common in the base map coverages, and they were not removed. The base is intended for reference only; no information other than location is attached to the lines.

### Landslides

Although this database emphasizes bedrock relationships, a number of landslides are delineated. It is not, however, a complete inventory of landslides in the map area, nor does it distinguish between active and inactive slides.

### Spatial Resolution

Uses of this digital geologic map should not violate the spatial resolution of the data. Although the digital form of the data removes the constraint imposed by the scale of a paper map, the detail and accuracy inherent in map scale are also present in the digital data. The fact that this database was compiled from 7.5' maps at a scale of 1:48,000 means that higher resolution information is generally not present in the dataset, although it may be useful locally at 1:24,000 in areas of closely spaced field observations. Plotting at scales larger than 1:48,000 generally will not yield greater real detail, although it may reveal fine-scale irregularities below the intended resolution of the database. Similarly, where this database is used in combination with other data of higher resolution, the resolution of the combined output will be limited by the lower resolution of these data. Note that although the base map layers also have a resolution of 1:48,000, discrepancies between geologic contacts and topography may occur. The base map layers are provided for reference only.

## DATABASE SPECIFICS

The map databases consist of ARC coverages and supporting INFO files, which are stored in a UTM (Universal Transverse Mercator) projection (Table 1). Digital tics define a 15 minute grid of latitude and longitude with the tics corresponding to quadrangle corners.

**Table 1 - ARC/INFO Map Projection Specifications**

| | |
|---|---|
| PROJECTION UTM | -Universal Transverse Mercator |
| UNITS METERS | -on the ground |
| ZONE 10 | -UTM zone |
| PARAMETERS | |
| END | |

The content of the geologic database can be described in terms of the lines (arcs), areas (polygons) and the point locations (points) that compose the map. Descriptions of the database fields use the terms explained in Table 2.

**Table 2 - Field Definition Terms**

| | |
|---|---|
| ITEM NAME | name of the database field (item) |
| WIDTH | maximum number of digits or characters stored |
| OUTPUT | output width |
| TYPE | B-binary integer, F-binary floating point number, I-ASCII integer, C-ASCII character string |
| N. DEC. | number of decimal places maintained for floating point numbers |

Each 15' quadrangle data set will include at least four ARC/INFO coverages: a geology layer (xxx_geo), a structure layer (xxx_str), an annotation layer (xxx_ann), and a base layer (xxx_topo), where xxx is the three-letter quadrangle name abbreviation. Some quadrangles may have additional layer types including alteration zones (xxx_alt) or well locations (xxx_wel).

**Geology layers (xxx_geo) -**
Geology layers contain lines and areas.

Lines -

The lines (arcs) are recorded as strings of vectors and are described in the arc attribute table (Table 3). They define the boundaries of the map units (contacts), faults, dikes, boundaries of open bodies of water, and the map boundaries (fold axes are recorded on structure layers). These distinctions, including the geologic identities of the unit boundaries, are recorded in the LTYPE field according to the line types listed in Table 4. All line types listed may not appear on any one 15' quadrangle.

**Table 3 - Content of the Arc Attribute Tables of geology and structure layers**

| ITEM NAME | WIDTH | OUTPUT | TYPE | N. DEC | |
|---|---|---|---|---|---|
| FNODE# | 4 | 5 | B | | starting node of arc (from node) |
| TNODE# | 4 | 5 | B | | ending node of arc (to node) |
| LPOLY# | 4 | 5 | B | | polygon to the left of the arc |
| RPOLY# | 4 | 5 | B | | polygon to the right of the arc |
| LENGTH | 4 | 12 | F | 3 | length of arc in meters |
| <coverage># | 4 | 5 | B | | unique internal control number |
| <coverage>-ID | 4 | 5 | B | | unique identification number |
| LTYPE | 35 | 35 | C | | line type |

**Table 4 - Line Types Recorded in the LTYPE Field of geology layers**

contact, approx. located
contact, certain
contact, concealed
contact, concealed, queried
contact, inferred, queried
dike, Tib
dike, Tis
fault, approx. located
fault, certain
fault, inferred, queried
fault, concealed
fault, concealed, queried
thrust fault, approx. located
thrust fault, certain
thrust fault, concealed
thrust fault, inferred, queried_
water boundary, certain
map boundary, certain
scratch boundary

The geologic line types are ALACARTE line types that correlate with the geologic line symbols in the ALACARTE line set GEOL61.LIN according to the ALACARTE lines lookup table GEOL61.LUT. The LTYPE, "thrust fault, inferred, queried_" is equivalent to "thrust fault, inferred, queried" and is used to display question mark symbols according to fault orientation. The scratch boundary is used to close off areas with unknown areal extent for display purposes.

Areas -

Geologic map units (polygons) are described in the polygon attribute table (Table 5) The identities of the map units are recorded in the PTYPE field by map label (Table 6). All units listed may not appear on any one 15' quadrangle. Map units are described more fully in the accompanying text file (tilgeo.ps or tilgeo.txt).

**Table 5 - Content of the Polygon Attribute Tables of geology layers**

| ITEM NAME | WIDTH | OUTPUT | TYPE | N. DEC | |
|---|---|---|---|---|---|
| AREA | 4 | 12 | F | 3 | area of polygon in square meters |
| PERIMETER | 4 | 12 | F | 3 | length of perimeter in meters |
| <coverage># | 4 | 5 | B | | unique internal control number |
| <coverage>-ID | 4 | 5 | B | | unique identification number |
| PTYPE | 35 | 35 | C | | unit label |

**Table 6 - Map Units Recorded in the PTYPE Field of geology layers**
(See tilgeo.ps or tilgeo.txt for descriptions of units)

| | | |
|---|---|---|
| | Tbru | Tk |
| QTg | Tbs | Tms |
| Qb | Tbs? | Tmst |
| Qf | Tbsu | Tn |
| Qls | Tbu | Tpb |
| Qls? | Tc | Tpb? |
| Qt | Tc? | Tpg |
| Qtb | Tchb | Trsk |
| Taa | Tcm | Trsk? |
| Tac | Teib | Tsb |
| Tacs | Tet | Tsbr |
| Tal | Tgr | Tsbr? |
| Tals | Thbr | Tsf |
| Tam | Thpb | Tsg |
| Tan | Thpb? | Tspb |
| Tba | Ths | Tts |
| Tba? | Tiab | Twfs |
| Tbc | Tib | Ty |
| Tbcm | Tid | Ty? |
| Tbl | Tidb | Tybs |
| Tbpl | Tidb? | Tyt |
| Tbpu | Tifs | Tyt? |
| Tbr | Tifs? | water |
| Tbr? | Tigr | |

**Structure layers (xxx_str) -**
Structure layers contain points and annotation, and may contain lines if fold axes are represented.

Points -

Points are described in the point attribute table (Table 7) Point types are recorded in the PTTYPE field according to the point types listed in Table 8. Points in the structure layer represent attitude measurements. Planar attitudes record strike in the STRIKE field and dip in the DIP field. Linear attitudes record bearing in the STRIKE field and plunge in the DIP field. All point types listed may not appear on any one 15' quadrangle.

**Table 7 - Content of the Point Attribute Tables of structure layers**

| ITEM NAME | WIDTH | OUTPUT | TYPE | N. DEC | |
|---|---|---|---|---|---|
| AREA | 4 | 12 | F | 3 | not applicable (always 0) |
| PERIMETER | 4 | 12 | F | 3 | not applicable (always 0) |
| <coverage># | 4 | 5 | B | | unique internal control number |
| <coverage>-ID | 4 | 5 | B | | unique identification number |
| PTTYPE | 35 | 35 | C | | point type |
| DIP | 3 | 3 | I | | plunge or dip of linear or planar feature |
| STRIKE | 3 | 3 | I | | azimuth of oriented symbol |

**Table 8 - Point Types Recorded in the PTTYPE Field of structure layers**

approx bedding
bedding
flat bedding
foliation
inclined cleavage
ot bedding
vert bedding

The orientation of the point symbol which represents the attitude is rotated to match the appropriate orientation indicated in the STRIKE field. The amount of rotation for each symbol is stored in the $ANGLE pseudo item.

Annotation -

Structure coverages contain annotation features. Annotation has meaning for display purposes only and does not represent any real world object. Annotation representing the value coded in the DIP field is placed near each point. The text of the annotation, a character string identical to the DIP value, is stored in the $TEXT pseudo item. No annotation is placed by attitude symbols which imply dip inherently, e.g. horizontal or vertical bedding symbols.

Lines -

The lines (arcs) are recorded as strings of vectors and are described in the arc attribute table (Table 3). They define fold axes and are recorded in the LTYPE field according to the line types listed in Table 9. Not all structure layers include fold axes, and all line types listed may not appear on any one 15' quadrangle.

**Table 9 - Line Types Recorded in the LTYPE Field of structure layers**

f.a., anticline, certain
f.a., anticline, concealed
f.a., anticline, inferred, queried
f.a., syncline, approx. located
f.a., syncline, certain
f.a., syncline, concealed
f.a., syncline, inferred

The geologic line types are ALACARTE line types that correlate with the geologic line symbols in the ALACARTE line set GEOL61.LIN according to the ALACARTE lines lookup table (GEOL61.LUT). The designation "f.a." is used in ALACARTE to distinguish fold axes.

**Annotation layers (xxx_ann) -**
Annotation layers contain annotation and lines. Annotation layers do not include geologic data; they are cartographic layers to be used for graphical display.

Annotation -

Annotation coverages contain the names of geologic units and faults. These are placed and sized for display on a plotted version of the map at 1:62500 scale. They are meant to be displayed with their associated leaders as some labels may lie outside of the geologic unit they describe.

Lines -

The lines (arcs) are recorded as strings of vectors and are described in the arc attribute table (Table 3). Lines on an annotation layer are leaders to unit labels which lie outside of their geologic unit. The LTYPE field is left blank for these layers.

**Base layers (xxx_topo) -**
Base layers contain lines.

Lines -

The lines (arcs) are recorded as strings of vectors and are described in the arc attribute table (Table 3). The base layers are scans and have no attributes (there is no LTYPE field in the arc attribute table of base layers).

**Alteration Zone layers (xxx_alt) -**
Alteration zone layers contain lines and areas.

Lines -

The lines (arcs) are recorded as strings of vectors and are described in the arc attribute table (Table 3). They define the boundaries of alteration zones as well as oil shale locations. These distinctions are recorded in the LTYPE field according to the line types listed in Table 10. All line types listed may not appear on any one 15' quadrangle.

**Table 10 - Line Types Recorded in the LTYPE Field of alteration layers**

| |
|---|
| alteration boundary |
| oil shale |

Areas -

Alteration zones (polygons) are described in the polygon attribute table (Table 5) All polygons are labeled as "alteration zone" in the PTYPE field.

**Well layers (xxx_wel) -**
Well layers contain points.

Points -

Points are described in the point attribute table (Table 7) Wells are recorded in the PTTYPE field according to the point types listed in Table 11. The DIP and STRIKE fields are not present in the point attribute table for well layers.

**Table 11 - Point Types Recorded in the PTTYPE Field of well layers**

| |
|---|
| ONG CZ#1 (well identifier) |
| REC CZ#1 (well identifier) |

## ACKNOWLEDGMENTS

Compilation of the digital database depended on advice and assistance in the use of ALACARTE - ARC/INFO from T.T. Fitzgibbon, C.M. Wentworth, and G.A. Phelps.

## REFERENCES CITED

Fitzgibbon, T.T., 1991, ALACARTE installation and system manual (version 1.0): U.S. Geological Survey, Open-File Report 91-587B.

Fitzgibbon, T.T., and Wentworth, C.M., 1991, ALACARTE user interface - AML code and demonstration maps (version 1.0): U.S. Geological Survey, Open-File Report 91-587A.

__ALACARTE 2.0 for ARC/INFO 6.x is available over Internet:
ftp://wrgis.wr.usgs.gov/pub/software/arc_stuff/alacarte/alacarte2.0.tar.Z

Wentworth, C.M., and Fitzgibbon, T.T., 1991, ALACARTE user manual (version 1.0): U.S. Geological Survey, Open-File Report 91-587C.