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

QUATERNARY GEOLOGY OF ALAMEDA COUNTY, AND PARTS OF CONTRA COSTA, SANTA CLARA, SAN MATEO, SAN FRANCISCO, STANISLAUS, AND SAN JOAQUIN COUNTIES, CALIFORNIA: A DIGITAL DATABASE

By

E.J. Helley[1] and R.W. Graymer[1]

Open - File Report 97-97

1997

[1]Western Region Mapping Group, U.S. Geological Survey, 345 Middlefield Rd., M/S 975, Menlo Park, CA 94025

Introduction

This Open-File report is a digital geologic map database. This pamphlet serves to introduce and describe the digital data. There is no paper map included in the Open-File report. The report does include, however, PostScript plot files containing images of a geologic map sheet and an explanation sheet, as well as the accompanying text describing the Quaternary geology of the area. For those interested in a paper plot of information contained in the database or in obtaining the PostScript plot files, please see the section entitled "For Those Who Don't Use Digital Geologic Map Databases" below.

This digital map database, compiled from previously unpublished data, and new mapping by the authors, represents the general distribution of surficial deposits in Alameda County and surrounding areas. Together with the accompanying text file (alqgeo.txt or alqgeo.ps), it provides current information on the quaternary stratigraphy of the area covered. The database delineates map units that are identified by general age and lithology following the stratigraphic nomenclature of the U.S. Geological Survey. The scale of the source maps limits the spatial resolution (scale) of the database to 1:24,000 or smaller. The content and character of the database, as well as three methods of obtaining the database, are described below.

For Those Who Don't Use Digital Geologic Map Databases

For those interested in the Quaternary geology of Alameda County who do not use an ARC/INFO compatible Geographic Information System (GIS), two PostScript plot files containing map images of much of the data in the digital database, as well as PostScript plot files of the explanatory text, have been included in the database package (please see the section "PostScript Plot Files" below). Those interested who have computer capability can access the PostScript plot files in any of the three ways described below to access the digital data (please see the section "Obtaining the Digital Data") including the Western Region Web Page (please see the section "Web Pages"). For those without computer capability, we have made the plot files available to an outside vendor or we can provide users with the PostScript plot files on digital tape that can be used by other vendors (please see the section "Obtaining Plots from an Outside Vendor").

Database Contents

The digital database package consists of the geologic map database itself, and the supporting data, including base maps, map explanation, geologic description, and references. A second data package consists of PostScript plot files of a geologic map, explanation sheet, and geologic description.

DIGITAL DATABASE PACKAGE

The first database package includes a separate geologic map database file for each of the 26 quadrangles with Quaternary deposits in Alameda County. The digital maps, or coverages, along with their associated INFO directory have been converted to uncompressed ARC/INFO export files. ARC export files promote ease of data handling, and are usable by some Geographic Information Systems in addition to ARC/INFO (see below for a discussion of working with export files). The ARC export files and the associated ARC/INFO coverages and directories, as well as the additional digital material included in the database package, are described below:

ARC/INFO export file	Resultant Coverage	Description of Coverage
at_sp-py.e00	at_sp-py	Altamont quadrangle
bh_sp-py.e00	bh_sp-py/	Byron Hot Springs quadrangle
cf_sp-py.e00	cf_sp-py/	Clifton Court Forebay quadrangle
cm_sp-py.e00	cm_sp-py	Cedar Mtn quadrangle
cr_sp-py.e00	cr_sp-py	Calaveras Reservoir quadrangle
du_sp-py.e00	du_sp-py/	Dublin quadrangle
em_sp-py.e00	em_sp-py	Eylar Mtn quadrangle
ha_sp-py.e00	ha_sp-py	Hayward quadrangle
hp_sp-py.e00	hp_sp-py	Hunters Point quadrangle
lc_sp-py.e00	lc_sp-py	La Costa Valley quadrangle
lt_sp-py.e00	lt_sp-py/	Las Trampas Ridge quadrangle
lv_sp-py.e00	lv_sp-py	Livermore quadrangle
mb_sp-py.e00	mb_sp-py	Mt Boardman quadrangle
md_sp-py.e00	md_sp-py	Mt Day quadrangle
mp_sp-py.e00	mp_sp-py	Milpitas quadrangle
ms_sp-py.e00	ms_sp-py	Mendenhall Springs quadrangle
mv_sp-py.e00	mv_sp-py	Mountain View quadrangle
mw_sp-py.e00	mw_sp-py	Midway quadrangle
ne_sp-py.e00	ne_sp-py	Newark quadrangle
ni_sp-py.e00	ni_sp-py	Niles quadrangle
oe_sp-py.e00	oe_sp-py	Oakland East quadrangle
ow_sp-py.e00	ow_sp-py	Oakland West quadrangle
ri_sp-py.e00	ri_sp-py/	Richmond quadrangle
rp_sp-py.e00	rp_sp-py	Redwood Point quadrangle
sl_sp-py.e00	sl_sp-py	San Leandro quadrangle

ta_sp-py.e00	ta_sp-py/	Tassajara quadrangle

The database directory also includes the following ARC coverages, and files:

ARC Coverages, which have been converted to uncompressed ARC/INFO export files:

ARC/INFO export file	Resultant Coverage	Description of Coverage
alq_quad.e00	alq_quad/	Index map of quadrangles in Alameda County.
alq_corr.e00	alq_corr/	Correlation table for the units in this map database.
al_dr-sp.e00	al_dr-sp/	Drainage base map (from 1:100,000 scale originals).
al_cu-sp.e00	al_cu-sp/	Cultural base map (from 1:100,000 scale originals).
al_topo-sp.e00	al_topo-sp/	Topographic contours base map (from 1:100,000 scale originals).

ASCII text files, including explanatory text, ARC/INFO key files, PostScript plot files, and a ARC Macro Language file for conversion of ARC export files into ARC coverages:

alqgeo.ps	A PostScript plot file of a report containing detailed unit descriptions and geological information, plus sources of data and references cited.
alqgeo.txt	A text-only file containing an unformatted version of alqgeo.ps
alqdb.ps	This file.
alqdb.txt	A text-only file containing an unformatted version of alqdb.ps
alqkey.un alqkey.ln	Together, these key files produce a plottable or displayable map explanation and key.
import.aml	ASCII text file in ARC Macro Language to convert ARC export files to ARC coverages in ARC/INFO.

The following supporting directory is not included in the database package, but is produced in the process of reconverting the export files into ARC coverages:

info/	INFO directory containing files supporting the databases. This directory is not included in the database release, but is created in the process of converting the export files into ARC coverages.

POSTSCRIPT PLOTFILE PACKAGE

A second digital data package is also available, which contains the PostScript images described below:

alqmap.ps	A PostScript plottable file containing an image of the geologic map and base maps of Alameda County at a scale of 1:100,000 (Sheet 1).
alqexpl.ps	A PostScript plottable file containing an image of map keys, correlation charts, and index maps for Alameda County (Sheet 2).
alqgeo.ps	A PostScript plot file of a report containing detailed unit descriptions and geological information, plus sources of data and references cited.

Database Release Format

The database was compiled in ARC/INFO, a commercial Geographic Information System (Environmental Systems Research Institute, Redlands, California), and is stored in uncompressed ARC export format (ARC/INFO version 7) in a compressed UNIX tar (tape archive) file. Tar and uncompress utilities are therefore required to extract the database from the tar file. These utilities are included in most UNIX systems, and can be obtained free of charge via the Internet from Internet Literacy's Common Internet File Formats Web page (http://www.matisse.net/files/formats.html). ARC/INFO export files (files with the .e00 extension) can be converted into ARC/INFO coverages (see below) and can be read by some other Geographic Information Systems, such as MapInfo via ArcLink. The digital compilation was done using version 7.0.3 of ARC/INFO with version 3.0 of the menu interface ALACARTE (Fitzgibbon and Wentworth, 1991, Fitzgibbon, 1991, Wentworth and Fitzgibbon, 1991).

Obtaining the Digital Data

The digital database package can be obtained in any of three ways:

a. Sending a tape with request
b. Anonymous ftp over the Internet
c. From the Western Region Geologic Information Web Page.

A 19.5 MB compressed tar file of the database and related files can be obtained by sending a tape with request and return address to:

Alameda County Quaternary Geologic Database
c/o Database 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.

To obtain the tar 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
Name: anonymous	-use "anonymous" as your user name
Password: your name	-use your own user name as password
cd pub/geologic	-go down to the pub/geologic directory
cd ca/of97-97	-go down to the open file directory
type binary	-change transfer type to binary
get al_q1.tar.Z	-copy the compressed tar file across Internet to your directory
quit	-close the ftp connection

Web Pages

The U.S. Geological Survey now supports a set of graphical pages on the World Wide Web. Digital publications (including this one) can be accessed via these pages. The location of the main web page for the entire U.S. Geological Survey is "http://www.usgs.gov". The web server for digital publications from the Western Region is "http://wrgis.wr.usgs.gov"; go to the California page to access this publication. In addition to providing easy access to the entire digital database, the Western Region web page also provides simple access to the PostScript plot files of the map and explanation sheet containing much of the data in the digital database for those interested in the Quaternary geology of Alameda County who do not use digital databases (see below).

Extracting the digital database package from the Tar file

If you obtained the database package 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 20	-/dev/rstn is the tape device with n an integer, this puts the tar file in local_directory
uncompress al_q1.tar.Z	-makes a 87 MB uncompressed tar file al_q1.tar
cd local_directory2	-go to the directory that will hold the directory alqgeo (if different from local_directory)
tar xvfb {path to tar file}/al_q1.tar 20	-extract the alqgeo directory from the tar file.

If you obtained the database package by anonymous ftp or from the web page:

uncompress al_q1.tar.Z	-makes a 87 MB uncompressed tar file al_q1.tar
cd local_directory2	-go to the directory that will hold the directory alqgeo (if different from local_directory)
tar xvfb {path to tar file}/al_q1.tar 20	-extract the alqgeo directory from the tar file.

This process will create a directory "/alqgeo" that contains the ARC export files and supporting files as described above.

PostScript Plot Files

The database is in ARC export format, and therefore requires use of ARC/INFO or another compatible GIS system to access the information contained within it. For those interested in the Quaternary geology of the Alameda County who don't use an ARC/INFO compatible GIS system we have included a separate data package with three PostScript plot files. One contains a color plot of the geologic map database at 1:100,000 scale (Sheet 1, alqmap.ps). The second contains a color plot of the map keys and index map (Sheet 2, alqexpl.ps). Because this release is primarily a digital database, the plot files (and plots derived therefrom) have not been edited to conform to U.S. Geological Survey standards. Small units have not been labeled with leaders and in some instances map features or annotation may overlap. Sample plots by the authors have proven to be quite legible and useful, however. In addition, a third PostScript file containing the geologic description and discussion is provided (alqgeo.ps). These plot files are available in any of the three ways described above, including the World Wide Web pages. However, the plot files are stored in compressed UNIX tar files requiring uncompress and tar utilities to access the files. These utilities are included in most UNIX systems, or can be obtained free of charge via the Internet from Internet Literacy's Common Internet File Formats Web page (http://www.matisse.net/files/formats.html). The PostScript image of Sheet 1 is 44 inches wide by 34 inches high, so it requires a large plotter to produce paper copies at the intended scale. The image of Sheet 2 is 15 by 20 inches. In addition to size constraints, some plotters, such as those with continual paper feed from a roll, are oriented with the long axis in the vertical direction, so the PostScript image will have to be rotated 90 degrees to fit entirely onto the page. Some plotters and plotter drivers, as well as many graphics software packages, can perform this rotation. The geologic description is on 8.5 by 11 inch pages.

Obtaining Plots from an Outside Vendor

For those interested in the Quaternary geology of Alameda County who do not use computers, we have made the PostScript plot files available to Capitol Color (phone: (800) 700-2656 or (408) 727-7560, FAX: (408) 727-0737). They will provide plots of the PostScript images of the geologic map sheet and explanation sheet for a fee (around $25 per sheet, with discounts for orders of multiple copies). We will also provide the PostScript plot files on digital tape for use by other vendors. A 12 MB compressed tar file (alqps.tar.Z, 40 MB when uncompressed) of the PostScript plot files can be obtained by sending a tape with request and return address to:

Alameda County Quaternary Geology PostScript Plotfiles
c/o Database 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.

Make sure your vendor is capable of reading these tape types and PostScript plot files. Important information regarding tape file format is included in the section "PostScript Plot Files" above, so be certain to provide a copy of this document to your vendor.

Extracting the PostScript plotfile package from the Tar file

If you obtained the plotfile package 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 20	-/dev/rstn is the tape device with n an integer, this puts the tar file in local_directory
uncompress alqps.tar.Z	-makes a 40 MB uncompressed tar file alqps.tar
cd local_directory2	-go to the directory that will hold the directory alqplot (if different from local_directory)
tar xvfb {path to tar file}/alqps.tar 20	-extract the alqplot directory from the tar file.

If you obtained the database by anonymous ftp or from the web page:

uncompress alqps.tar.Z	-makes a 40 MB uncompressed tar file alqps.tar
cd local_directory2	-go to the directory that will hold the directory alqplot (if different from local_directory)
tar xvfb {path to tar file}/alqps.tar 20	-extract the alqplot directory from the tar file.

This process will create a directory "/alqplot" that contains the PostScript plot files as described above.

Converting ARC export files

ARC export files are converted to ARC coverages using the ARC command IMPORT with the option COVER. In order to ease conversion and to maintain naming conventions, we have included an ASCII text file in ARC Macro Language that will convert all of the export files in the database into coverages and create the associated INFO directory. From the ARC command line type:

Arc: &run import.aml

ARC export files can also be read by some other Geographic Information Systems. Please consult your GIS documentation to see if you can use ARC export files and the procedure to import them.

Digital Compilation

The geologic map information was digitized from stable originals of the geologic maps at 1:24,000 scale. The author manuscripts (pencil on mylar) were scanned using a Altek monochrome scanner with a resolution of 800 dots per inch. The scanned images were

vectorized and transformed from scanner coordinates to projection coordinates with digital tics placed by hand at quadrangle corners. The scanned lines were edited interactively by hand using ALACARTE, color boundaries were tagged as appropriate, and scanning artifacts visible at 1:24,000 were removed.

Base Maps

Base Map layers were prepared from scale-stable printing negatives of the U.S. Geological Survey San Francisco (1978 edition), Stockton (1989 edition), Palo Alto (1983 edition), and San Jose (1978 edition) 1:100,000 topographic maps, which have a 50 meter contour interval. Scanned and vectorized images were transformed from scanner coordinates to projection coordinates with digital tics placed by hand at map corners. The images were then trimmed interactively by hand using ALACARTE to conform to the area of the geologic coverages, and the four portions were combined. Small mismatches at the boundaries caused by slight differences in the original scans remain in the three base map coverages. These base map layers are digital images but no information other than location is attached to the lines. The base maps are provided for reference only.

Faults and Landslides

This map is intended to be of general use to engineers and land-use planners. However, its small scale does not provide sufficient detail for site development purposes. In addition, this map does not take the place of fault-rupture hazard zones designated by the California State Geologist (Hart, 1988). Similarly, the database cannot be used to identify or delineate landslides in the region. For a depiction of landslide distribution, see Nilsen and others (1979).

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 edited at a scale of 1:24,000 means that higher resolution information is not present in the dataset. Plotting at scales larger than 1:24,000 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 in contrast to the geologic coverages, the base map layers have a resolution of 1:100,000, so significant discrepancies with the geologic coverages are possible. 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 Stateplane (California coordinate system) projection (Table 1). Digital tics define a 2.5 minute grid of latitude and longitude in the geologic coverages corresponding with quadrangle corners and internal tics. In the base map layers, the tics define a 7.5 minute grid, corresponding with quadrangle corners.

Table 1 - *Map Projection*
The map is stored in Stateplane projection

PROJECTION STATEPLANE	
UNITS METERS	-on the ground
ZONE 3326	-Arc/Info Stateplane zone corresponding to California coordinate system zone 3
PARAMETERS	
END	

The content of the geologic database can be described in terms of the lines and the areas 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

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, the boundaries of open bodies of water, and the map boundaries. 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.

Table 3 - *Content of the Arc Attribute Tables*

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 (see Table 4)
SEL	1	1	I		user defined field used to save a selected set
SYMB	3	3	I		user defined field used to save symbol assignments (such as color)

Table 4 - *Line Types Recorded in the LTYPE Field*

contact, certain
contact, concealed
contact, approx. located
contact, inferred
water boundary
map boundary

The geologic linetypes 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).

AREAS -

Map units (polygons) are described in the polygon attribute table (Table 5) The identities of the map units from compilation sources are recorded in the PTYPE field by map label (Table 6). Map units are described more fully in the accompanying text file alqgeo.txt or alqgeo.ps. Note that ARC/INFO coverages cannot contain both point and polygon information, so only coverages with polygon information will have a polygon attribute table, and these coverages will not have a point attribute table.

Table 5 - *Content of the Polygon Attribute Tables*

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
SEL	1	1	I		user defined field used to save a selected set
SYMB	3	3	I		user defined field used to save symbol assignments (such as color)

Table 6 - *Map Units*
(See alqgeo.txt or alqgeo.ps for descriptions of units)

	Qhbr	Qpaf1
af	Qhbs	Qpaf2
alf	Qhfp	Qpoaf
br	Qhfp1	QTi
br?	Qhfp2	QTi?
GP	Qhl	QTl
H2O	Qhpm	QTp?
Qhaf	Qhsc	QTu
Qhaf1	Qls	
Qhasc	Qms	
Qhb	Qmt	
Qhbm	Qpaf	

Acknowledgments

Carl M. Wentworth, Todd T. Fitzgibbon, and Geoffrey A. Phelps graciously provided assistance with Alacarte and ARC/INFO. The scanning and initial editing of the digital maps of some of the quadrangles was done by the following: Heather Schoonover (Midway, Newark), Marjorie Lucks (Livermore), Scott Graham (Altamont), Lisa Gerhardt (San Leandro), Jennifer Tarsoly (Hayward), Carolyn Randolph (Hunters Point, Redwood Point), Molly Burgett (Oakland West), Michelle Roberts (Niles, La Costa Valley). Earl E. Brabb provided much helpful advice and feedback, as well as arranging for material support for the project.

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.

Hart, E.W., 1988, Fault-rupture hazard zones in California; Alquist-Priolo Special Studies Zones Act of 1972 with index to special studies zones maps: California Division of Mines and Geology Special Publication 42.

Nilsen, T.H., Wright, R.H., Vlasic, T.C., and Spangle, W.E., 1979, Relative slope stability and land-use planning in the San Francisco Bay region, California: U.S. Geological Survey Professional Paper 944, 96 p.

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