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PRELIMINARY GEOLOGIC MAP EMPHASIZING BEDROCK FORMATIONS IN ALAMEDA COUNTY, CALIFORNIA: A DIGITAL DATABASE

By

R.W. Graymer[1], D.L. Jones[2], and E.E. Brabb[1]

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

[2]Department of Geology and Geophysics, Unversity of California, Berkeley, CA 94720

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, files containing images of a geologic map sheet and an explanation sheet. For those interested in a paper plot of information contained in the database, please see the section entitled "For Those Who Don't Use Digital Geologic Map Databases" below.

This digital map database, compiled from previously open-filed U.S. Geological Survey reports (Graymer and others, 1994), other published and unpublished data (see Sources of Data in algeo.txt), and substantial new mapping by the authors in about two-thirds of the county, represents the general distribution of rocks and geologic structures in Alameda County. Together with the accompanying text file (algeo.txt), it provides current information on the stratigraphy and structural geology 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. Quaternary units are almost all combined into an undifferentiated unit, with the exception of some artificial deposits (Qar), some early Holocene or late Pleistocene gravel deposits (Qt, Qoa) and a few large landslides (Qls). More specific information about the units may be available in the original publications. The scale of the source maps limits the spatial resolution (scale) of the database to 1:50,000 or smaller. The content and character of the database are described below.

For Those Who Don't Use Digital Geologic Map Databases

For those interested in the geology of Alameda County who do not use an ARC/INFO compatible Geographic Information System (GIS), two files containing images of much of the data in the digital database have been included.

Database Contents

The digital database consists of the geologic map database itself and the supporting data, including a fault map, base maps, map explanation, geologic description, and references. The digital maps, or coverages, along with their associated INFO directory have been converted to 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, are described below:

The geologic map database consists of two ARC coverages, which have been converted to uncompressed ARC/INFO export files:

ARC/INFO export file	Resultant Coverage	Description of Coverage
al_um-py.e00	al_um-py/	Faults, depositional contacts, and rock unit identities
al_um-sr.e00	al_um-sr/	Fold axes, strike and dip information

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

Directory:

	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.

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

ARC/INFO export file	Resultant Coverage	Description of Coverage
al_um-flt.e00	al_um-flt/	Map of faults and fold axes in Alameda County with additional database items containing fault name (if any).
al_so.e00	al_so/	Index map of sources of data (see algeo.txt for the corresponding list of sources of data).
al_as.e00	al_as/	Index map of Assemblages in Alameda County (see algeo.txt for explanation of Assemblages).
al_quad.e00	al_quad/	Index map of quadrangles in Alameda County.
al_corr.e00	al_corr/	Correlation table for the units in this map database.
al_dr.e00	al_dr/	Drainage base map.
al_cu.e00	al_cu/	Cultural base map.
al_topo.e00	al_topo/	Topographic contours base map.

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:

algeo.txt	A text only computer file containing detailed unit descriptions and geological information, plus sources of data and references cited.
aldb.txt	This file.
alkey.un alkey.ln alkey.mrk	Together, these key files produce a plottable or displayable map explanation and key.

almap.ps	A PostScript plottable file containing an image of the geologic map and base maps of Alameda County at a scale of 1:75,000 (Sheet 1).
alexpl.ps	A PostScript plottable file containing an image of the fault map, map keys, and index maps for Alameda County (Sheet 2).
import.aml	ASCII text file in ARC Macro Language to convert ARC export files to ARC coverages in ARC/INFO.

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 6) 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).

Extracting the Database from the Tar file

If you obtained the database from the web page:

uncompress al_g1.tar.Z	-makes a 97 MB uncompressed tar file al_g1.tar
cd local_directory2	-go to the directory that will hold the directory algeo (if different from local_directory)
tar xvfb {path to tar file}/al_g1.tar 20	-extract the algeo directory from the tar file.

This process will create a directory "/algeo" that contains the ARC export files and supporting 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 for newly mapped areas and 1:62,500 scale for the rest of the county. 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 with digital tics placed by hand at quadrangle corners. The scanned lines were edited interactively by hand using ALACARTE, color boundaries were tagged as a contact or fault as appropriate, and scanning artifacts visible at 1:50,000 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), 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 most landslides in the region, because only some large landslides are shown. For a more complete 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 1:50,000 means that higher resolution information is not present in the dataset. Plotting at scales larger than 1:50,000 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.

Fault Information Map (al_um-flt)

This coverage contains additional information about the faults in Alameda County. Named faults have been assigned a route in the route system FAULT. A database item called FNAME has been added to the Route Attribute Table, and the fault name has been recorded there. See below for more information about database items. This coverage contains fault lines (arcs), but no contact lines (arcs) or polygon information.

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 7.5 minute grid of latitude and longitude in the geologic coverages corresponding with quadrangle corners. 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 UTM projection

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 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, faults that do not bound 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
fault, certain
fault, approx. located
fault, concealed
fault, concealed, queried
fault, inferred
fault, inferred, queried
s.s. fault, r.l., approx. located
s.s. fault, r.l., certain
s.s. fault, r.l., concealed
thrust fault, approx. located
thrust fault, certain
thrust fault, concealed
thrust fault, concealed, queried
tuff bed
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). Note that fault and s.s. fault, r.l. are assigned the same symbol in the lookup table.

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 algeo.txt. Note that ARC/INFO coverages cannot contain both point and polygon information, so only coverages with polygon information (al_um-py, al_so, al_as) 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 algeo.txt for descriptions of units)

	Kel	Tbp
.	Kjm	Tbr
JKf	Kkh	Tc
JKfe	Ko	Tcc
JKfg	Kp	Tccs
JKfgm	Kr	Tcs
JKfm	Ksc	Tes
JKfn	Ksh	Tgvt
JKfs	Kslt	Tgvt?
JKgd	Kss	Tgvtt
JKk	Ksu	Th
JKkc	Ksuh	Tlp
JKkv	Ksus	Tmb
Jb	Ku	Tmll
Jgb	QTi	Tmls
Jpb	QTl	Tn
Jsv	QTl?	Tnc
Kbsh	Qa	To
Kc	Qls	To?
Kcl	Qoa	Tol
Kcls	Qt	Tor
Kcm	Qu	Torv
Kcu	Tbd	Tps
Kcu?	Tbe	Tr
Kcus	Tbf	Tro
Kd	Tbg	Ts
Kds	Tbgc	Tsh
Keh	Tbgl	Tso?
Keh?	Tbi	Tsos?

Tss	Tts	fm
Tst	Tus	fs
Tsv	Tush	gb
Tt	Tusl	sc
Tt?	Tv	sp
Tte	fc	sp?
Ttem	fg	
Ttls	fl	

Points -

Point information (strikes and dips) is recorded as coordinate and related information and are described in the Point Attribute Table (Table 7). Note that ARC/INFO coverages cannot contain both point and polygon information, so only coverages with point information (al_um-sr) will have a point attribute table, and these coverages will not have a polygon attribute table.

Table 7 - Content of the Point Attribute Tables

ITEM NAME	WIDTH	OUTPUT	TYPE	N.DEC	
AREA	4	12	F	3	this field is not used
PERIMETER	4	12	F	3	this field is not used
<coverage>#	4	5	B		unique internal control number
<coverage>-ID	4	5	B		unique identification number
PTTYPE	35	35	C		point type (see Table 8).
DIP	3	3	I		dip angle in degrees
STRIKE	3	3	I		strike angle in degrees
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 8 - Point Types Recorded in the PTTYPE Field

approx bedding
bedding
bedding w/ tops
crumpled bedding
crumpled foliation
flat bedding
foliation
foliation and bedding
joint
ot bedding
ot bedding w/ tops
vert bedding
vert bedding w/ tops

vert foliation
vert foliation and bedding

Routes -

In the fault map coverage (al_um-flt), strands (individual arcs) of named faults are grouped together into routes, and fault names and related information are stored in the Route Attribute Table (Table 9). The route system or subclass is named FAULT.

Table 9 - Content of the Route Attribute Tables

ITEM NAME	WIDTH	OUTPUT	TYPE	N. DEC	
<subclass>#	4	5	B		unique internal control number
<subclass>-ID	4	5	B	unique	identification number
FNAME	35	35	C		fault name

Table 10 - Fault Names Recorded in the FNAME Field

Arroyo Aguague fault
Calaveras fault
Chabot fault
Dresser fault
Greenville fault
Hayward fault
Las Positas fault
Mill Creek fault
Miller Creek fault
Mission fault
Moraga fault
Palomares fault
Pirate Creek fault
Sheridan Creek fault
South Las Positas fault
Stonybrook fault
Verona fault
Warm Springs fault
Williams fault

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