U.S. DEPARTMENT OF THE INTERIOR
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PRELIMINARY GEOLOGIC MAP EMPHASIZING BEDROCK FORMATIONS IN CONTRA COSTA COUNTY, CALIFORNIA: A DIGITAL DATABASE

Compiled by

R.W. Graymer, D.L. Jones, and E.E. Brabb

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This database, identified as "Preliminary geologic map emphasizing bedrock formations in Contra Costa County, California: 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.

1994

Introduction

This digital map database, which is compiled from previously published and unpublished sources combined with new mapping, represents the general distribution and identity of bedrock in Contra Costa County, California. Together with the accompanying text file (ccgeo.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, and stratigraphic nomenclature. Quaternary units, however, are almost all combined into an undifferentiated unit, with the exception of Pleistocene gravels (Qmz) and several landslides on Mount Diablo (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. For those interested in the geology of Contra Costa County who do not use an ARC/INFO compatible Geographic Information System (GIS), we have included two Postscript plot files containing images of much of the data included in the digital database. The content and character of the database, as well as two methods of obtaining the database are described below.

Database Contents

The digital database consists of the geologic map database itself and the supporting data, including index maps, base maps, map explanation, sources of data, and references. The geologic map database consists of two ARC coverages:

cc_utm/	Faults, depositional contacts, and mapped rock unit identities
cc_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

ARC Coverages:

	cc-flt_utm/	
and	cc-flt_ano/	Together, these ARC coverages contain a fault map of Contra Costa County with major faults labeled.
	cc_dr/	Drainage base map.
	cc_cu/	Cultural base map.
	cc_topo/	Topographic contours base map.
	cc_so/	Index map of sources of data (see ccsource.txt).
	cc_as/	Index map of Assemblages in Contra Costa County (see ccgeo.txt for explanation of Assemblages).
	cc_quad/	
and	cc-quad_ano/	Together, these ARC coverages contain an index map of quadrangles in Contra Costa County

	cc-corr/	This ARC coverage contains a correlation table for the units in these maps.

Files:

	cckey.un	
	cckey.mrk	
and	cckey.ln	Together, these key files produce a plottable or displayable map explanation and key.
	ccgeo.txt	A text file containing detailed unit descriptions and geological information.
	ccdb.txt	A text file of this report.
	ccsource.txt	A text file containing references for data sources corresponding to areas outlined in the index map cc_so/.
	ccref.txt	A text file containing a complete reference list for all parts of this database.
	ccmap.ps	A Postscript plot file containing an image of the geologic maps and base maps at a scale of 1:75,000.
	ccexpl.ps	A Postscript plot file containing an image of the fault map, map keys, and index maps for Contra Costa County.

The database was compiled in ARC/INFO, a commercial Geographic Information System (Environmental Systems Research Institute, Redlands, California), and is stored in ARC coverage format (ARC/INFO version 6) in a UNIX tar file. A UNIX computer system is therefore required to extract the database from the tar file, and ARC/INFO is required for its use or conversion to other formats. 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

A 21.3 MB compressed tar file of the database and related files can be obtained by anonymous ftp over Internet, or by sending a tape with request and return address to:

Contra Costa Geologic Database
c/o Carl M. Wentworth
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 sierra.wr.usgs.gov	-make ftp connection with the USGS computer Sierra
Name: anonymous	-use "anonymous" as your user name
Password: your name	-use your own user name as password
cd pub	-go down to the pub directory
type binary	-change transfer type to binary
get cc_g1.tar.Z	-copy the compressed tar file across Internet to your directory
quit	-close the ftp connection

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 20	-/dev/rstn is the tape device with n an integer this puts the tar file in local_directory
uncompress cc_g1.tar.Z	-makes a 56 MB uncompressed tar file cc_g1.tar
cd local_directory2	-go to the directory that will hold the workspace ccgeo (if different from local_directory)
tar xvfb {path to tar file}/cc_g1.tar 20	-extract the ccgeo workspace from the tar file.

If you obtained the database by anonymous ftp:

uncompress cc_g1.tar.Z	-makes a 56 MB uncompressed tar file cc_g1.tar
cd local_directory2	-go to the directory that will hold the workspace ccgeo (if different from local_directory)
tar xvfb {path to tar file}/cc_g1.tar 20	-extract the ccgeo workspace from the tar file.

This process will create a workspace "/ccgeo" (a directory containing an INFO directory) that contains the databases and supporting files as described above.

Digital Compilation

The geologic map information was digitized from stable originals of the geologic maps mostly at 1:62,500 scale (geology in the San Quentin quadrangle was scanned at 1:24,000 scale). 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 Napa (1983 edition), Lodi (1993 edition), Stockton (1989 edition), and San Francisco (1978 edition) 1:100,000 topographic maps. 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 various 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 intended for reference only.

Landslides

The database cannot be used to identify or delineate most landslides in the region, because only a few large landslides, in the Mount Diablo area, are shown. See ccgeo.txt for more information regardingthe depiction of landslides in this database.

Faults

The faults represented in this database are not intended to show hazards at any specific site, or to take the place of fault-rupture hazard zones designated by the California State Geologist (Hart, 1988). See ccgeo.txt for more information regarding the depiction of faults in this database.

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 because the base map layers have a resolution of 1:100,000, significant discrepancies with the geologic coverages are possible. The base map layers are provided for reference only.

Postscript Plot Files

The database is in ARC coverage format, and therefore requires use of ARC/INFO or compatible GIS system to access the information contained within it. For those interested in the geology of Contra Costa County, but who don't use an ARC/INFO compatible GIS system, we have included two Postscript plot files. One contains a plot of the map database, and the other contains a plot of much of the supporting data. 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. Fold axes are undifferentiated, small units are unlabled, dip numbers are plotted an arbitrary distance from strike and dip symbols, and in some instance map features or annotation overlap. Preliminary plots by us have proved to be quite legible and usable, and so the plot files have been included in this release.

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, the tics corresponding with quadrangle corners. In the base map layers, the tics also define a 7.5 minute grid, corresponding with quadrangle corners.

Table 1 - Map 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 (arcs) and the areas (polygons) 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 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
LENGTH4	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)

Table 4 - Line Types Recorded in the LTYPE Field

contact, certain
contact, approx. located
contact, concealed
contact, inferred
contact, inferred, queried
fault, certain
fault, approx. located
fault, inferred
fault, inferred, queried
fault, concealed
fault, concealed, queried
thrust fault
thrust fault, approx. located
thrust fault, inferred
thrust fault, inferred, queried_
thrust fault, concealed
thrust fault, concealed, queried
thrust fault, concealed, queried_
f.a., anticline, certain
f.a., anticline, inferred
f.a., anticline, concealed
f.a., syncline, certain
f.a., syncline, inferred
f.a., syncline, concealed
water boundary, certain
map boundary
scratch boundary

The geologic linetypes are ALACARTE line types that correlate with the geologic line symbols in the ALACARTE line set ALCWRG.LIN according to the ALACARTE lines lookup table. The LTYPEs, "thrust fault, concealed, queried_" and "thrust fault, inferred, queried_" are differentiated for plotting purposes (in order to allow for different orientation of fault teeth and question marks on plotted maps) and in all other respects are equivalent to "thrust fault, concealed, queried" and "thrust fault, inferred, queried." The designation, "f.a." is used in ALACARTE to distinguish fold axes. The map boundary is equivalent to the county boundary for this database. The scratch boundary is used to divide polygons (see below) that are too large for ARC/INFO to handle as a single entity.

Areas -

Areas, or 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 ccgeo.txt.

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

Table 6 - Map Units (See ccgeo.txt for descriptions of units)

	Kbsh?	Kjm
H2O	Kcl	Ko
JKk	Kcl?	Kph
JKk?	Kcls	Kr
Jdb	Kcm	Ksc
Jpb	Kcs	Ksh
Jsv	Kcu	Kslt
KJf	Kcu?	Ku
Ka	Kcus	Ku?
Ka?	Kd	Kuh
Kas	Kd?	Kus
Kb	Kdsh	Qls
Kb?	Kdv	Qmz
Kbs	Kel	Qu
Kbs?	Kels	Tb
Kbsh	Keu	Tbd

Tbe
Tbf
Tbg
Tbh
Tbl
Tbp
Tbr
Tbu
Tc
Tc?
Tcc
Tccs
Tcgl
Tcglt
Tcs
Tcsc
Td
Tdi
Tdl
Tdls
Tdu
Teh
Tehs
Tes
Tes?
Tgs
Tgvt
Tgvtt
Th
Th?
Tks
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Tl
Tlj
Tlj?
Tljl
Tlju
Tll
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Tlu
Tm
Tma
Tmc
Tmcs
Tmd
Tme
Tmk
Tmkl
Tmku
Tmku?
Tmll
Tmll?
Tmlu
Tmr
Tmrl
Tmru
Tms
Tmu
Tmzl
Tmzu
Tn
Tns
Tnv
To
Tor
Tpt
Tr
Tro
Ts
Ts?
Tsa
Tsh
Tshc
Tsl
Tsr
Tst
Tsu
Tsv
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Tts
Ttu
Tub
Tul
Tus
Tut
Tvh
Tvhl
Tvhu
fbc
fc
fg
fm
fs
fss
sc
sp

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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.

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