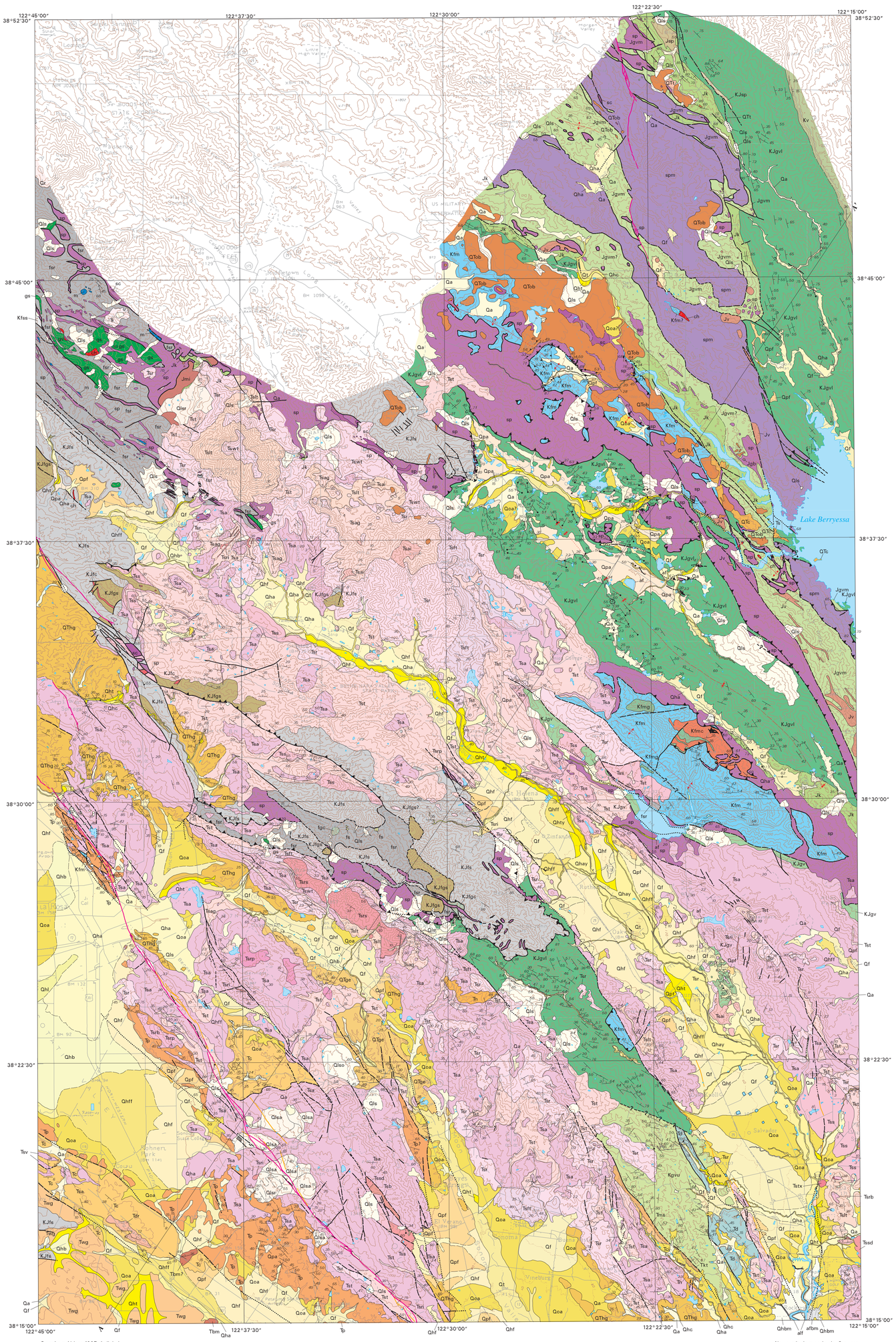
U.S. Department of the Interior
U.S. Geological Survey

Scientific Investigations Map 2956
Pamphlet accompanies map



CORRELATION OF MAP UNITS

[Numbers, radiometric ages (Ma), see Description of Map Units in pamphlet for specific age data. For mélange and metamorphic units, position of boxes with solid boundaries indicates age of assemblage or metamorphism, respectively; position of boxes with dashed boundaries indicates age of protolith.]

SURFICIAL DEPOSITS

af | afbm | alf

Qhc | Qhay | Qha | Qa | Qhty | Qht | Qt | Qhf | Qf | Qhff | Qhl | Qhb | Qhbm

Qpa | Qpt | Qpf

Qoa

Qls | Qlsa | Qlsr

Qlso

Clear Lake Volcanics

Qr (1.1, 1.3, 2.1, 2.2)

QTob | QTt | Tr

QTc

QTge | QThg

Tsv* (2.5, 4.8)

Twg (6) | Tc | Tp

Tdr (8.5, 10)

Tbm (10.5, 12.5)

Tri | Tci

Trns

Tkt

Td

Ts

GREAT VALLEY COMPLEX
Great Valley sequence

Kgvu

Kv

KJgv

KJgvl

Jk | KJsp

Jgvm | Jsp

Coast Range ophiolite

Jv | Jmi | Jgb | sp | sc | spm

FRANCISCAN COMPLEX

Kfss

KJfc

KJfgc

KJfgs

fgc | ch | m | fsr | sp | fs | gs

Kfmc

Kfm | Kfmg

KJfs | fsr

Kfm | Kfmc | Kfmg

*Sonoma Volcanics, including Tsr, Tsri, Tsrs, Tsrp, Tsrb, Tsa, Tsai, Tsb, Tsfd, Tst, Tswt, Tstx, Tsag, Tslt, Tsft, Tss, and Tssd are divided by composition. Relative stratigraphic position varies throughout the map area

LIST OF MAP UNITS

[Some unit exposures on the map are too small to distinguish the color for unit identification. These units are labeled where possible, and unlabeled units are attributed in the database.]

SURFICIAL DEPOSITS

- af — Artificial fill (Historic)
- afbm — Artificial fill over Bay mud (Historic)
- alf — Artificial levee fill (Historic)
- Qhc — Stream channel deposits (late Holocene)
- Qhay — Younger alluvium (late Holocene)
- Qhty — Terrace deposits (late Holocene)
- Qha — Alluvium (Holocene)
- Qht — Terrace deposits (Holocene)
- Qhf — Alluvial fan deposits (Holocene)
- Qhff — Fine-grained alluvial fan deposits (Holocene)
- Qhl — Natural levee deposits (Holocene)
- Qhb — Basin deposits (Holocene)
- Qhbm — Bay mud (Holocene)
- Qa — Alluvium (Holocene and late Pleistocene)
- Qt — Terrace deposits (Holocene and late Pleistocene)
- Qf — Alluvial fan deposits (Holocene and late Pleistocene)
- Qls — Landslide deposits (Holocene and late Pleistocene)
- Qlsa — Andesitic composition
- Qlsr — Rhyolitic composition
- Qpa — Alluvium (late Pleistocene)
- Qpt — Terrace deposit (late Pleistocene)
- Qpf — Alluvial fan deposits (late Pleistocene)
- Qoa — Alluvium (late and early Pleistocene)
- Qlso — Landslide deposits (late and early Pleistocene)

Clear Lake Volcanics

- Qr — Rhyolite (Pleistocene)
- QTob — Olivine basalt (Pleistocene and Pliocene)
- QTt — Tuff (Pleistocene and(or) Pliocene)
- Tr — Rhyolite (Pliocene)
- QTc — Cache Formation (Pleistocene and(or) Pliocene)
- QTge — Glen Ellen Formation (early Pleistocene? and Pliocene)
- QThg — Huichica and Glen Ellen Formations, undivided (early Pleistocene? and Pliocene)

Sonoma Volcanics

- Tsv — Sonoma Volcanics, undivided (Pliocene and late Miocene)
- Tsr — Rhyolite flows
- Teri — Rhyolite plugs
- Tsrs — Soda rhyolite flows
- Tsrp — Perlitic rhyolite
- Tsrb — Rhyolite breccia
- Tsa — Andesite to basalt lava flows
- Tsai — Andesite to dacite plugs
- Tsb — Basalt flows
- Tsfd — Basalt or andesite lava flows and sediments
- Tst — Pumiceous ash-flow tuff
- Tswt — Welded ash-flow tuff
- Tstx — Tuff(?)
- Tsag — Agglomerate
- Tslt — Tuff breccia
- Tsft — Tuff
- Tss — Volcanic sand and gravel
- Tssd — Diatomite
- Twg — Wilson Grove Formation (late Pliocene to late Miocene)
- Tc — Sand and gravel of Cotati (Pliocene and late Miocene)
- Tp — Petaluma Formation (early Pliocene and late Miocene)
- Tdr — Donnell Ranch Volcanics (late Miocene)
- Tn — Neroly Sandstone (late Miocene)
- Tci — Cierbo Sandstone (late Miocene)
- Tbm — Burdell Mountain volcanics (late and middle? Miocene)
- Trns — Unnamed sandstone (middle Miocene)
- Tkt — Kirker Tuff (early Miocene and(or) Oligocene)
- Td — Unnamed sandstone (Eocene and Paleocene)
- Ts — Unnamed sandstone (Eocene? or Paleocene?)

GREAT VALLEY COMPLEX

Great Valley sequence

- KJgv — Sandstone, shale, and conglomerate (Late Cretaceous to Late Jurassic)
- Kgvu — Sandstone, shale, and conglomerate (Late Cretaceous)
- Kv — Venado Formation (Late Cretaceous)
- KJgvl — Sandstone and shale (Early Cretaceous and Late Jurassic)
- KJsp — Sedimentary serpentinite member
- Jk — Knoxville Formation (Late Jurassic)
- Jsp — Sedimentary serpentinite member
- Jgvm — Mélange

Coast Range ophiolite

- Jv — Basaltic pillow lava and breccia (Jurassic)
- Jmi — Mafic intrusive complex (Jurassic)
- Jgb — Gabbro (Jurassic)
- sp — Serpentinite (Jurassic)
- sc — Silica-carbonate rock
- spm — Serpentinite-matrix mélange

FRANCISCAN COMPLEX

- fsr — Mélange, including blocks, mapped locally, of:
- sp — Serpentinite
- fs — Graywacke
- ch — Chert
- fgc — Greenstone and chert
- gn — Greenstone
- m — High-grade metamorphic rocks
- Kfss — Sandstone (Late Cretaceous, Turonian?)
- Kfm — Metagraywacke (Late and Early Cretaceous)
- Kfmc — Metachert (Late and Early Cretaceous)
- Kfmg — Metagreenstone (Late and Early Cretaceous)
- KJfs — Graywacke and melange (Early Cretaceous and Late Jurassic)
- KJfc — Chert (Cretaceous to Jurassic)
- KJfgc — Greenstone and chert (Cretaceous to Jurassic)
- KJfgs — Greenstone (Cretaceous to Jurassic)

MAP SYMBOLS

- Contact—Depositional or intrusive contact, dashed where approximately located, dotted where concealed
- Fault—Dashed where approximately located, small dashes where inferred, dotted where concealed, queried where location is uncertain, orange denotes Quaternary-active fault, magenta denotes Holocene active-fault
- Reverse or thrust fault—Dashed where approximately located,small dashes where inferred, dotted where concealed, queried where location is uncertain; sawteeth on upper plate
- Anticline—Dashed where approximately located, dotted where concealed
- Syncline—Dashed where approximately located, dotted where concealed
- Strike and dip of bedding
- Strike and dip of bedding, top indicator observed
- Strike and dip of bedding, approximate
- Overturned bedding
- Overturned bedding, top indicator observed
- Crumpled bedding
- Air photo attitude
- Vertical bedding
- Horizontal bedding
- Strike and dip of foliation
- Strike and dip of foliation and bedding
- Vertical foliation
- Strike and dip of joint

Base from Aitken, 1997. A digital version of the 1970 U.S. Geological Survey San Francisco Bay Region 1:125,000 scale topographic map

UTM projection, zone 10

SCALE 1:100 000

1 5 0 1 2 3 4 5 6 7 MILE

1 5 0 1 2 3 4 5 6 7 KILOMETER

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 THOUSAND FEET

Contour Interval 100 feet

APPROXIMATE MEAN DECLINATION, 2006

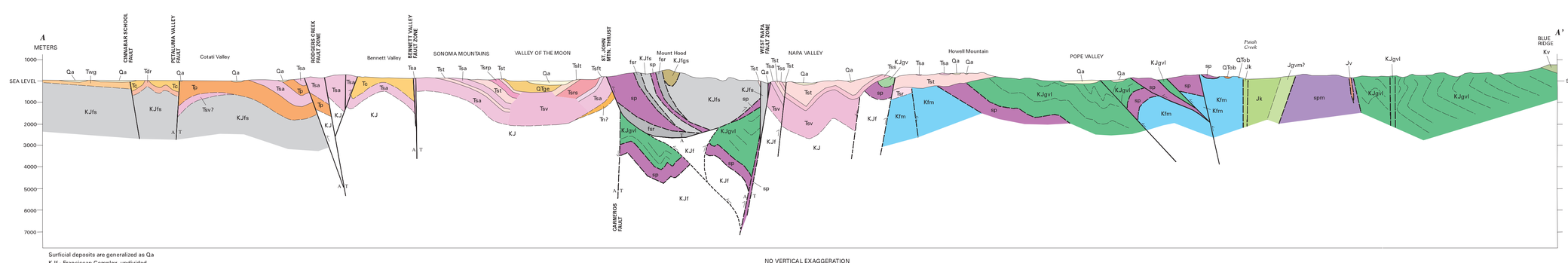
MAP LOCATION

New geologic mapping by Graymer, Jones, Brabb, Barnes, and Stamski, 1999-2003

Digital data and cartography prepared using Arc/Info 8.1 running under Solaris 2.6 on a UNIX workstation

Edited by Theresa Iki

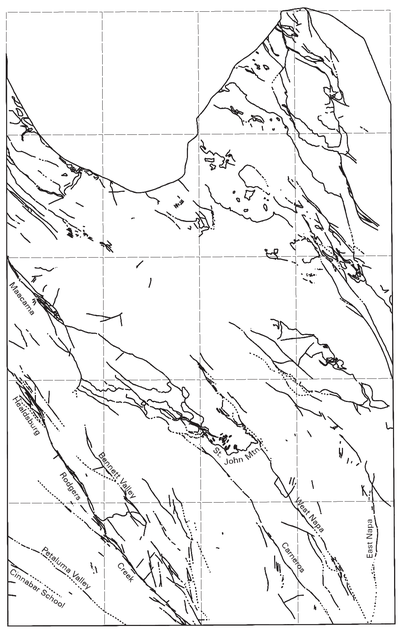
Manuscript approved for publication December 21, 2006



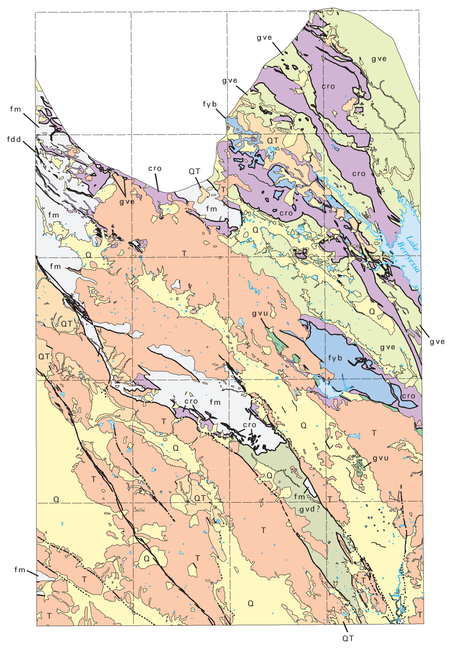
Surficial deposits are generalized as Qa
KJf - Franciscan Complex, undivided
Landslides are not shown
KJ - Mesozoic rocks, undivided
1000 meters = 3281 feet
A/T - Strike-slip offset, A = away from viewer, T = towards viewer

NO VERTICAL EXAGGERATION

INDEX MAP OF FAULTS



INDEX MAP SHOWING MESOZOIC AND TERTIARY COMPLEX TERRANES IN THE STUDY AREA



EXPLANATION OF TERRANE MAP

- Q — Quaternary surficial deposits
- QT — Quaternary–Tertiary gravels
- T — Tertiary volcanic and sedimentary rocks

GREAT VALLEY COMPLEX

- gve — Elder Creek terrane
- gvd — Del Puerto terrane
- gvu — Great Valley complex, undivided
- cro — Coast Range ophiolite

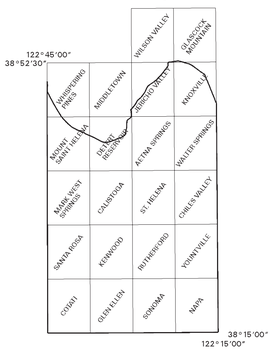
FRANCISCAN COMPLEX

- fdd — Devils Den terrane
- fyb — Yolla Bolly terrane
- fm — Mélange

Depositional or intrusive contact

Fault –Dashed where approximated, dotted where concealed

INDEX MAP OF 7.5-MINUTE QUADRANGLES

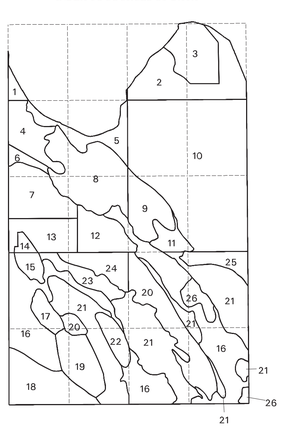


SOURCES OF DATA

See pamphlet (or digital file eswnmf.pdf or eswnmf.txt) for references cited
Quaternary surficial deposits modified from Sowers and others (1998) and Knudsen and others (2000)

1. Brice (1953), Hearn and others (1995)
2. E.F. Ciancanelli (unpub.), Conrey (1948), Fox and others (1973), Phipps (1984), Hearn and others (1995)
3. Averitt (1945), as modified and reinterpreted by E.F. Ciancanelli (unpub.), Phipps (1984), Hearn and others (1995)
4. Bailey (1946), as modified by E.F. Ciancanelli (unpub.), Fox and others (1973), McLaughlin (1978)
5. Yates and Hilpert (1946), as modified by E.F. Ciancelli (unpub.)
6. E.F. Ciancelli (unpub.)
7. Hurlbut (1948), Fox and others (1973)
8. Fox and others (1973), Crutchfield (1953)
9. Fox and others (1973), with additions from N.L. Taliaferro (unpub.)
10. E.F. Ciancanelli (unpub.), N.L. Taliaferro (unpub.), Wagner (1975) Fox and others (1973), Shouldice (1947), Angel (1948), Clark (1948), Phipps (1984), Hearn and others (1995), A.N. Moiseyev (unpub.)
11. N.L. Taliaferro (unpub.), Fox and others (1973)
12. Johnston (1948), Fox and others (1973)
13. Goss (1948), Fox and others (1973)
14. Huffman (1971), Fox and others (1973)
15. C.W. Jennings (unpub.), Fox and others (1973)
16. Sowers and others (1998), Knudsen and others (2000)
17. Fox and others (1973), C.W. Jennings (unpub.)
18. Fox and others (1973), Weaver (1949), Cardwell (1958), Davies (1986)
19. Fox and others (1973), Huffman (1971), Weaver (1949)
20. Weaver (1949)
21. Fox and others (1973), Weaver (1949), Kunkel and Upson (1960), Cardwell (1958)
22. J.O. Berkland (unpub.), Fox and others (1973)
23. Fox and others (1973), Weaver (1949), Cardwell (1958), R.L. Rose (unpub.)
24. Fox and others (1973), R.L. Rose (unpub.)
25. A.N. Moiseyev (unpub.), Fox and others (1973)
26. Weaver (1949), Fox and others (1973)

INDEX TO SOURCES OF DATA



Geologic Map and Map Database of Eastern Sonoma and Western Napa Counties, California

By

R.W. Graymer, E.E. Brabb, D.L. Jones, J. Barnes, R.S. Nicholson, and R.E. Stamski

2007

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