Geologic maps as baseline data for evaluating seismic hazards

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ABSTRACT
The California Geological Survey has compiled regional geologic maps of the delta, incorporating original mapping at 1:24,000 (1 inch = 2000 feet). These maps show the distribution of different geologic units that can be distinguished by their age, environment of deposition, and grain size. The physical properties of the geologic units are used directly in calculation of earthquake shaking hazards and liquefaction. Geologic maps therefore, can be used for assessing how liquefaction and earthquake shaking potential varies across the region.

These geologic maps are available as four separate maps covering 30x60 minute areas: the Lodi, Napa, Sacramento and Stockton quadrangles. Pdf images of the first three are available on the CGS Preliminary Geologic Maps webpage at:
http://www.conservation.ca.gov/cgs/rghm/rgm/Pages/preliminary_geologic_maps.aspx
The Stockton quadrangle is still in progress, but will be posted on the same web page when it is complete.

Location map showing the Sacramento, Lodi, and Stockton 30' x 60' Quadrangles, and Fairfield South and Vine Hill 7.5' Quadrangles

ABBREVIATED EXPLANATION

Approximate stratigraphic relationships only

CENOZOIC

QUATERNARY – HOLOCENE

- af — Artificial fill
- afbm — Artificial fill placed over bay mud
- alf — Artificial levee fill
- ads — Dredge spoils
- gq — Gravel quarry
- ac — Artificial stream channel
- Qhay — Latest Holocene alluvial deposits, undivided
- Qhfy — Latest Holocene alluvial fan deposits
- Qhty — Latest Holocene stream terrace deposits
- Qhly — Latest Holocene fan levee deposits
- Qhc — Latest Holocene stream channel deposits
- Qha — Holocene alluvium, undivided
- Qhf — Holocene alluvial fan deposits
- Qhff — Holocene alluvial fan deposits, fine grained facies
- Qhl — Holocene fan levee deposits
- Qht — Holocene stream terrace deposits
- Qhfp — Holocene flood plain deposits
- Qhb — Holocene basin deposits
- Qhbm — Holocene estuarine deposits (bay mud)
- Qhdm — Holocene Delta mud
- Qa — Alluvium, undivided
- Qf — Late Pleistocene to Holocene fan deposits
- Qt — Late Pleistocene to Holocene stream terrace deposits
- Qds — Late Pleistocene to Holocene dune sand deposits
- Qls — Landslide deposits

QUATERNARY – PLEISTOCENE

Modesto Formation: Qm | Qm_2 | Qm_{2b} | Qm_1 | Qm_{1b}
- Qm - Undivided
- Qm_2 - Upper member, undivided alluvium
- Qm_{2b} - Upper member, fine-grained
- Qm_1 - Lower member, undivided alluvium
- Qm_{1b} - Lower member, fine-grained

Riverbank Formation: Qr | Qr_3 | Qr_2 | Qr_1
- Qr - Undivided
- Qr_3 - Upper unit
- Qr_2 - Middle unit
- Qr_1 - Lower unit

- Qpa — Latest Pleistocene alluvium
- Qpf — Latest Pleistocene alluvial fan deposits
- Qpt — Latest Pleistocene terrace deposits
- Qpb — Latest Pleistocene basin deposits

Older alluvium: Qoa | Qoa_4 | Qoa_3 | Qoa_2 | Qoa_1
- Qoa - Undivided
- Qoa_4 - Unit 4
- Qoa_3 - Unit 3
- Qoa_2 - Unit 2
- Qoa_1 - Unit 1

- Qof — Early to late Pleistocene alluvial fan deposits
- Qot — Early to late Pleistocene terrace deposits
- Qop — Early to late Pleistocene pediment deposits
- Qmz — Montezuma Formation
- Qtl — Turlock Lake Formation
- QTi — Irvington gravels
- QTl — Livermore gravels
- QTu — Pittsburg Assemblage
- QTnm — North Merced Gravels

TERTIARY – PLIOCENE

- Pth — Tehama Formation
- Pol — Oro Loma Formation
- Pb — Basaltic intrusive rocks
- Plp — Unnamed freshwater limestone
- Pl — Laguna Formation
- Plt — Lawlor Tuff
- Ppc — Unnamed nonmarine clay
- MPss — Unnamed sandstone
- MPv — Unnamed volcanic rocks

Green Valley and Tassajara Formation: MPgv | MPgt
- MPgv - undivided
- MPgt - tuff marker bed

Mehrten Formation: MPm | MPmc | MPmb
- MPm - Undivided
- MPmc - Cobble comglomerate
- MPmb - Mudflow breccia

TERTIARY – MIOCENE

- Mor — Orinda Formation
- Mus — Unnamed sedimentary and volcanic rocks
- Musl — Unnamed limestone
- Mbp — Bald Peak Basalts
- Msv — Silicic intrusive rocks

Neroly Sandstone: Mnr | Mns | Mnc
- Mnr - undivided
- Mns - siltstone
- Mnc - conglomerate

Cierbo Sandstone: Mc | Mcsc
- Mc - undivided
- Mcsc - sandstone and conglomerate

- Mmss — Unnamed sandstone
- Mpb — Putnam Peak Basalt
- Mr — Rodeo Shale
- Mt — Tice Shale
- Mo — Oursan Sandstone
- Mro — Rodeo Shale, Hambra sandstone, Tice Shale and Oursan sandstone, undivided

Briones Formation: Mbr | Mbri | Mbrg | Mbre | Mbrd
- Mbr - Undivided
- Mbri - I member
- Mbg - G member
- Mbe - E member
- Mbd - D member

Claremont Shale: Mcs | Mccs
- Mcs - undivided
- Mccs - interbedded sandstone

- Mtem — Temblor Sandstone
- Ms — Sobrante Sandstone
- Msh — Unnamed shale
- ΦMvs — Valley Springs Formation

TERTIARY – OLIGOCENE

Kirker Tuff: Okt | Oks
- Okt - undivided
- Oks - Tuffaceous sandstone, conglomerate, and siltstone

TERTIARY – EOCENE

Markley Formation: Emk | Emku | Emsu | Emsl | Emkl | Emlu | Emll
- Emk - Undivided
- Emku - Upper member
- Emsu - Sidney Flat member, upper part
- Emsl - Sidney Flat member, lower part
- Emkl - Lower member
- Emlu - Lower member, upper siltstone
- Emll - Lower member, lower siltstone

Domengine Formation: Ed | Edu | Edl | Edls
- Ed - Undivided
- Edu - Upper member
- Edl - Lower member
- Edls - Lower member, sandstone

Nortonville Formation: Env | Envu
- Env - Undivided
- Envu - Upper member

Tesla Formation: Ete | Etel
- Ete - Undivided
- Etel - Lower sandstone

- Esh — Unnamed shale
- Ei — Ione Formation
- Ets — Tolman Formation

TERTIARY – PALEOCENE

Megonas Formation: Ꝑme | Ꝑmd | Ꝑmc | Ꝑmcs | Ꝑma
- Ꝑme - Upper member
- Ꝑmd - Sandstone member
- Ꝑmc - Shale member
- Ꝑmcs - Sandstone interbeds
- Ꝑma - Lower member

- Ꝑmz — Martinez Formation
- Ꝑmzu — Unnamed sandstone and shale, Upper member
- Ꝑmzl — Unnamed sandstone and shale, Lower member
- Ꝑps — Unnamed siltstone and sandstone
- Ꝑpu — Shale and sandstone

MESOZOIC

CRETACEOUS

Great Valley Complex (Juassic and Cretaceous)

Ku | Kuc | Kuhs | Kuss | Kssh | Kslt
- Ku - Unnamed sedimentary rocks
- Kuc - Unnamed conglomerate
- Kuhs - Unnamed sandstone and shale
- Kuss - Unnamed sandstone
- Kssh - Siliceous shale
- Kslt - Unnamed siltstone

Kus | Kcv | Ksh | Ks | Kss | Ksu | Ksuh | Ksus
- Kus - Undivided sandstone and shale
- Kcv - Unnamed sandstone, conglomerate, and shale
- Ksh - Unnamed shale
- Ks - Unnamed sandstone and shale
- Kss - Unnamed sandstone
- Ksu - Unnamed sandstone and shale
- Ksuh - Unnamed shale
- Ksus - Unnamed sandstone and shale

Keu | Kel | Kels
- Keu - Unit E, upper member
- Kel - Unit E, lower member
- Kels - Unit E, lower member, sandstone

Kcu | Kcus | Kcm | Kcl | Kcls
- Kcu - Unit C, upper member, shale and siltstone
- Kcus - Unit C, upper member, sandstone
- Kcm - Unit C, middle member, wacke
- Kcl - Unit C, lower member, shale and siltstone
- Kcls - Unit C, lower member, sandstone

Kd | Kds
- Kd - Unit D, sandstone
- Kds - Unit D, shale

Kb | Kbsh | Kbs
- Kb - Unit B, sandstone and shale
- Kbsh - Unit B, shale
- Kbs - Unit B, sandstone

- Ka — Unit A, shale
- Kfo — Forbes Formation
- Kg — Guinda Formation
- Krc — Redwood Canyon Formation
- Kdv — Deer Valley sandstone
- Kc — Chico Formation
- Ko — Oakland sandstone/ conglomerate
- Kkh — Horsetown Formation of Huey

Moreno Formation: Km | Kms
- Km - undivided
- Kms - sandstone

Panoche Formation: Kpa | Kpl | Kps
- Kpa - Undivided
- Kpl - Shale
- Kps - Sandstone

- Kr — Rocklin Pluton
- Mzg — Granite, undivided
- Mzd — Diorite, undivided
- Mzqd — Quartz dorite, undivided

JURASSIC

Franciscan Complex: KJf | KJfe | KJfg | KJfm | KJqd
- KJf - Franciscan
- KJfe - Eylar Mountain terrane
- KJfg - Franciscan greenstone
- KJfm - Franciscan melange
- KJqd - Franciscan quartz diorite

Blocks within Franciscan Complex: fc | fbc | fm | fs | fss | sc | fg | gl | gl+fb | vk | vb | di | gb | sp
- fc - chert
- fbc - basalt and chert
- fm - melange
- fs - greywacke
- fss - sandstone and shale
- sc - silica carbonate
- fg - greenstone
- gl - glaucophane
- gl+fb - glaucophane + basalt
- vk - keratophyre
- vb - diorite diabase
- di - diabase
- gb - gabbro - peridotite
- sp - serpentinite

Knoxville Formation: KJk | KJkc
- KJk - undivided
- KJkc - conglomerate

Coast Range Ophiolite: Jb | Jdb | Jpb | Jgb
- Jb - Basalt and diabase
- Jdb - Diabase
- Jpb - Pillow basalt
- Jgb - Gabbro and diabase

- Jp — Penryn Pluton
- Jch — Copper Hill Volcanics
- Jss — Salt Springs Slate
- Jgo — Gopher Ridge Volcanics

Foothill Melange: mv | mvs | ms
- mv - Metavolcanic rock
- mvs - Metasedimentary and meta-volcanic rock, undivided
- ms - Metasedimentary rock

Coherent rocks within Foothill Melange: sp | sa | py | pg | gb | ls
- sp - Serpentine and peridotite
- sa - Serpentine and amphibole, interlayered
- py - Pyroxenite and metapyroxenite
- pg - Pyroxenite and gabbro
- gb - Gabbro and metagabbro
- ls - Limestone

CGS
CALIFORNIA GEOLOGICAL SURVEY

SCALE 1:100,000

1 0 1 2 3 4 5 6 7 8 MILES

1 0 1 2 3 4 5 6 7 8 9 10 KILOMETERS

13.6°
TRUE NORTH
MAGNETIC NORTH

APPROXIMATE MEAN DECLINATION, 2016

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