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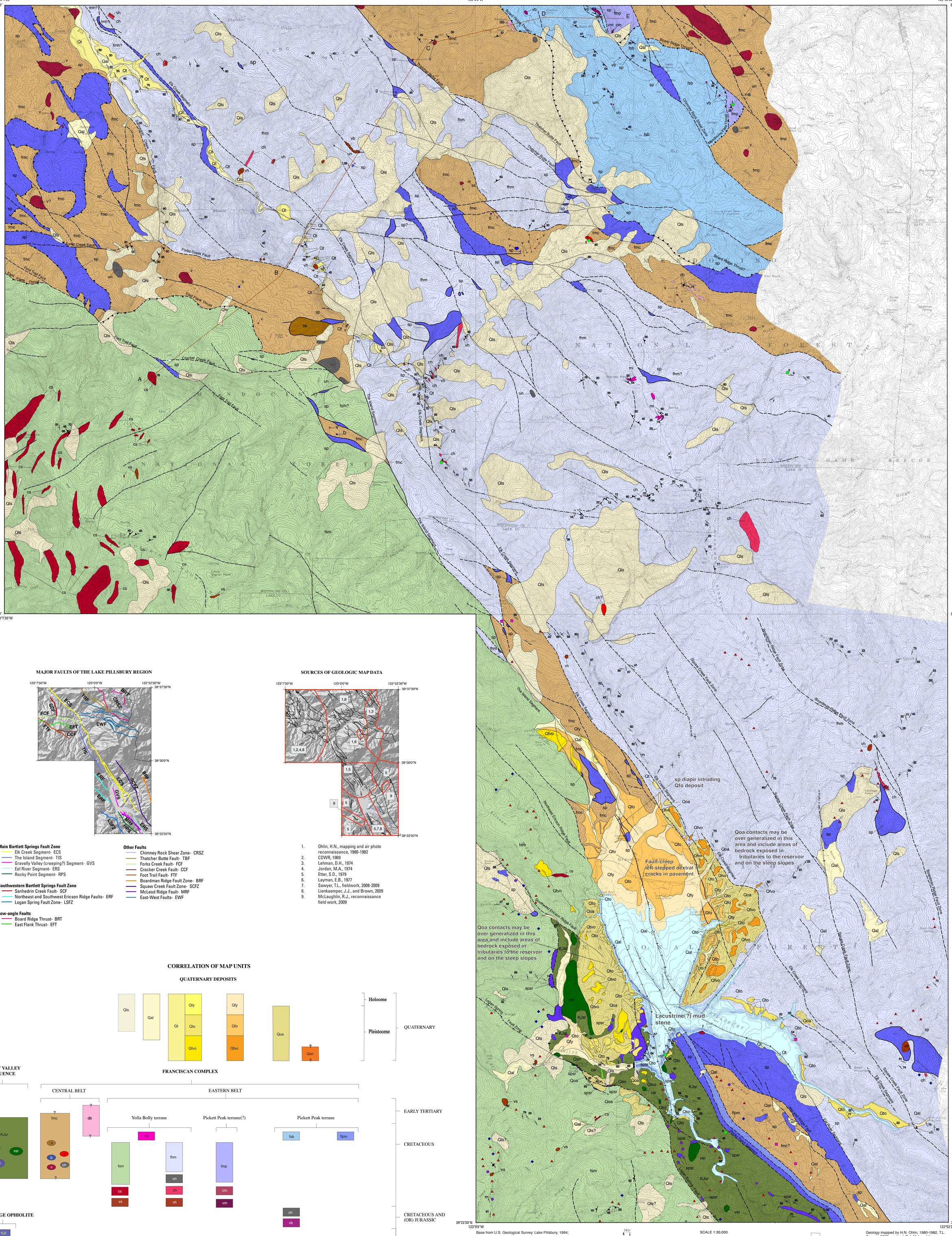
Pamphlet accompanies map



MAJOR FAULTS OF THE LAKE PILLSBURY REGION

Main Bartlett Springs Fault Zone
- Elk Creek Segment- ECS
- The Island Segment- TBF
- Gravelly Valley (creeping?) Segment- GVS
- Eel River Segment- ERS
- Rocky Point Segment- RPS

Southwestern Bartlett Springs Fault Zone
- Sanhedrin Creek Fault- SCF
- Northeast and Southwest Ericson Ridge Faults- ERF
- Logan Spring Fault Zone- LSFZ

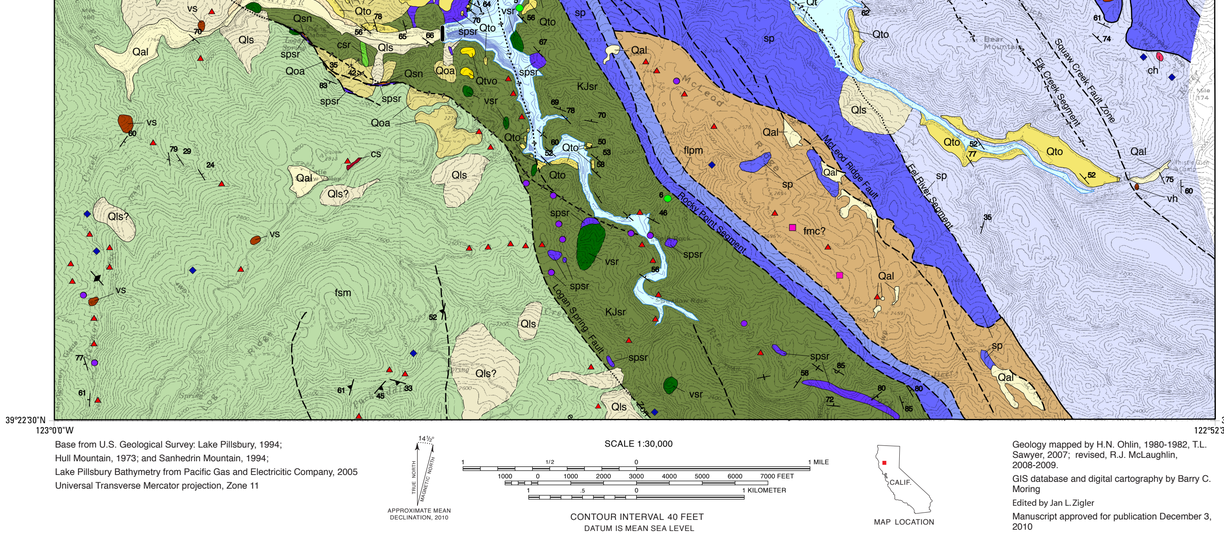
Low-angle Faults
- Board Ridge Thrust- BRT
- East Flank Thrust- EFT

Other Faults
- Chimney Rock Shear Zone- CRSZ
- Thatcher Butte Fault- TBF
- Forks Creek Fault- FCF
- Crocker Creek Fault- CCF
- Foot Trail Fault- FTF
- Boardman Ridge Fault Zone- BRF
- Squaw Creek Fault Zone- SCFZ
- McLeod Ridge Fault- MRF
- East-West Faults- EWF

SOURCES OF GEOLOGIC MAP DATA

1. Ohlin, H.N., mapping and air photo reconnaissance, 1980-1982
2. CDWR, 1969
3. Lehman, D.H., 1974
4. Jordan, M.A., 1974
5. Etter, S.D., 1979
6. Layman, E.B., 1977
7. Sawyer, T.L., fieldwork, 2008-2009
8. Lienkaemper, J.J., and Brown, 2009
9. McLaughlin, R.J., reconnaissance field work, 2009

CORRELATION OF MAP UNITS



Geology mapped by H.N. Ohlin, 1980-1982, T.L. Sawyer, 2007; revised, R.J. McLaughlin, 2008-2009.
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DESCRIPTION OF MAP UNITS

Qls — **Landslide deposits (Holocene and late Pleistocene)**—Unsorted, unconsolidated to weakly consolidated rock and soil debris, which has moved downslope by various landslide processes, including rotational slumping, surface creep, flowage, or combinations thereof. Earth flows are common in mélange of the Central Belt of the Franciscan Complex

Qal — **Alluvium (Holocene and Pleistocene)**—Poorly sorted, unconsolidated sand, silt, gravel, and boulders deposited in and adjacent to active stream channels

Qt — **Alluvial stream terrace deposits, undivided (Holocene and Pleistocene)**- Poorly sorted, weakly consolidated sand, silt, gravel, and boulder deposits; slightly dissected; deposited along or adjacent to major streams. Locally divided into:

Qty — **Young alluvial stream terrace deposits and surfaces (Holocene and late Pleistocene)**—Stream terraces that are least dissected and elevated above the active stream channel; unit is delineated by geomorphic expression of terrace surfaces and in places does not include alluvial deposits

Qto — **Old alluvial stream terrace deposits and surfaces (Pleistocene)**- Alluvial terrace deposits that are elevated above, dissected, and incised by young alluvial terrace and fan deposits. Includes as many as six stepped geomorphic surfaces that occur around margins of Lake Pillsbury basin at elevations between 1,800 and 1,920 ft

Qtvo — **Very old alluvial stream terrace deposits and surfaces (Pleistocene)**- Alluvial stream terrace remnants that include several stepped geomorphic terrace surfaces that occur between elevations of 2,000 and 2,700 ft

Alluvial fan deposits and surfaces (Holocene and late Pleistocene)

Qfy — **Young alluvial fan deposits and surfaces (Holocene and late Pleistocene)**—Poorly sorted, weakly consolidated sand, silt, gravel and boulder deposits of alluvial fan systems at different elevations, inset into older deposits, distributed around north and east margins of Lake Pillsbury basin. At least two young alluvial fan surfaces occur between the northern shoreline of Lake Pillsbury and elevation 1,920 ft

Qfo — **Old alluvial fan deposits and surfaces (Pleistocene)**—Alluvial fan deposits that are elevated, dissected, and incised by younger fans and alluvial terrace deposits. At least five stepped old alluvial fan surfaces are recognized around the north and east sides of Lake Pillsbury basin at elevations between 1,900 and 2,000 ft

Qfvo — **Very old alluvial fan deposits and surfaces (Pleistocene)**- Topographically high, dissected, and uplifted alluvial fan deposits including as many as four stepped fan surfaces mapped at elevations between 2,040 and 2,100 ft along northeast side of Lake Pillsbury basin

Qoa — **Older alluvial deposits, undivided (Pleistocene)**—Weakly consolidated, moderately organized to unorganized, weakly sorted to unsorted silt, sand, and gravel deposits that locally display clast imbrication, crossbedding, and channels; moderately to extremely dissected; present along the east and west sides of Lake Pillsbury basin and east side of Gravelly Valley. Unit includes deposits characteristic of alluvial fan and braided-stream depositional settings; locally including massive lacustrine(?) mudstone beneath old terraces (Qto) along west edge of Lake Pillsbury. Along east and west sides of Lake Pillsbury, unit contacts are highly generalized and encompass significant unmapped bedrock, particularly on steep slopes and in tributaries draining into reservoir. In places, unit may correlate with old strath terraces or thin old alluvial fan deposits cut on bedrock (Qto, Qtvo, Qfo, Qfvo)

Qsn — **Siliceous and calcareous sinter deposits (Pleistocene?)**—Vuggy opalitic and carbonate-veined and sheared serpentinite and argillitic microbreccia, present locally along Logan Spring Fault southeast of Logan Spring, probably related to extinct low temperature thermal seep activity

Great Valley Sequence (Cretaceous and Jurassic)

KJsr — **Ophiolitic mélange and sedimentary rocks of Split Rock (Early Cretaceous or younger)**—A broken sequence of sandstone, locally massive and conglomeratic, thinly interbedded argillite and turbiditic arkosic wacke, and mafic to ultramafic rocks. Unit is in places penetratively deformed into block-in-matrix mélange, comprised of mafic and ultramafic rocks, with argillite and sandstone matrix; elsewhere matrix is sheared serpentinite with blocks of sandstone and argillite, chert and mafic igneous rocks derived from Coast Range Ophiolite. Unit includes fossils of Late Jurassic (Tithonian) age within the map area (fossil localities 5, 6) and Late Jurassic (Tithonian) to Early Cretaceous (Valanginian to Hauterivian) age outside of the map area to the SE. Early Cretaceous or younger age assignment is based on timing of tectonic mixing of youngest mélange components southeast of map area (Berkland, 1973; Blake and Jones, 1974; McLaughlin and others, 1990; Campbell and others, 1993; Campbell and Bottjer, 1995; Campbell and others, 2002; Kiel and others, 2008). The Ophiolitic mélange and sedimentary rocks of Split Rock are correlated with similar rocks east of the Bartlett Springs Fault ~ 53 km to the SE, in the Wilbur Springs area (McLaughlin and others, 1990). The unit locally includes blocks:

vsr — **Blocks of mafic volcanic and plutonic rocks**—Including basaltic flows and breccia, diabase and gabbro

csr — **Blocks of chert**

spsr — **Blocks and lenticular bodies of ultramafic rock**

Coast Range Ophiolite (Middle Jurassic)

sp — **Ultramafic rocks and serpentinite of the Coast Range Ophiolite (Jurassic)**—Lenticular masses of tectonized dunite, peridotite, and pyroxenite in a sheared matrix of serpentine minerals. North of Bear Creek, includes gabbro:

g — **Blocks of gabbro**

Franciscan Complex (Early Tertiary(?) - Jurassic)

Central Belt

db — **Diabase intrusive into mélange of the Central Belt (Late Cretaceous or younger)**—Diabase dikes and sills, intrusive into mélange in northern part of map area. Although intrusive into and thus younger than the mélange, these diabase intrusives are here considered an integral element of the formational setting of the Central Belt

fmc — **Mélange of the Central Belt (Early Tertiary? or Late Cretaceous)**—A penetratively sheared chaotic mixture of rocks, with a matrix largely of sheared argillite and metasandstone that encloses outcrop to map-scale blocks and slabs of interbedded argillite and metasandstone. Matrix rocks are regionally metamorphosed to pumpellyite- and incipient lawsonite-grade and reconstituted to textural zone 1 of Blake and others (1967). Outside of the map area fossiliferous blocks in mélange of the Central Belt contain mollusks and ammonites of Late Jurassic (Tithonian) to Early Cretaceous (Late Valangimian) age (Blake and Jones, 1974); foraminifera of Middle to Late Cretaceous (Aptian –Coniacian) age (Sliter, 1984); and dinoflagellates of Late Jurassic (Tithonian) to Middle Cretaceous (Albian or Aptian) age (Lucas-Clark, 2007). Radiolaria from a chert block in the map area (fossil locality 2, table 1) are Late Jurassic (Tithonian) in age. Radiolarian ages from cherts elsewhere in the Central Belt (McLaughlin and Pessagno, 1978; Murchey and Jones, 1984) range from early Jurassic (Pliensbachian) to early Late Cretaceous (Cenomanian). White mica from blocks of blueschist gives potassium-argon ages of 151 to 155 m.y. (Lehman, 1974). A block of diorite from O'Neil Ridge that has undergone pumpellyite grade metamorphism gives a Pb-U age of 161 m.y. (J. Mattinson, written commun., 1982). The inferred age of mélange-forming tectonic mixing, based on the ages of youngest mélange components, is Coniacian or younger north of the map area and Campanian or younger (possibly Eocene or younger) south of the map area. Individual blocks and slabs in the mélange comprise:

s — **Metasandstone**—Textural zone 1, metamorphosed to pumpellyite grade or lower

c — **Chert**—Includes relatively unmetamorphosed chert and blocks that are highly metamorphosed and reconstituted texturally, containing blueschist minerals (stilpnomelane, sodic amphibole, or lawsonite)

v — **Mafic volcanic rocks**—Mostly metamorphosed to low greenschist (epidote-pumpellyite) grade; locally includes more highly metamorphosed texturally reconstituted blocks of blueschist grade that contain jadeite, sodic amphibole, and (or) lawsonite

b — **Blueschist and associated rocks**—High-grade blocks of glaucophane schist, eclogite, and garnet amphibolite

un — **Blocks of unknown composition**—Mapped from air photos

Eastern Belt (Cretaceous and Jurassic)

Yolla Bolly Terrane

fsm — **Metasedimentary rocks of Sanhedrin Mountain (Cretaceous and Jurassic)**—Composed of fine- to coarse-grained, thin-to medium-bedded metasandstone reconstituted to textural zone 2 of Blake and others (1967), with sheared interbedded argillite. Quartzofeldspathic sandstone predominates in the northeastern part of the unit with local sheared lenses of conglomerate and tuffaceous greenstone. Higher on Sanhedrin Mountain, metasandstone with a high percentage of lithic grains occurs with abundant thick manganiferous metachert lenses and less common metavolcanic rocks including tuff, pillow basalt, volcanic breccia, and diabase. Unit may include minor thin zones of undivided mélange in a few areas, as suggested by a few areas with scattered blocks of high-grade blueschist and serpentinite

vs — **Blocks and intercalated lenses of metavolcanic rocks**

cs — **Blocks and lenses of metachert associated with metavolcanic rocks**

mi — **Intrusive rocks of Monkey Rock (Cretaceous)**—Metagabbroic dike and sill-like bodies intrusive into metasandstone and argillite of Hull Mountain

fhm — **Metasandstone of Hull Mountain (Cretaceous)**—The Metasandstone of Hull Mountain consists largely of structurally stacked slabs of broken formation, possibly with minor undivided zones of mélange (suggested by a few scattered blocks of blueschist or serpentinite). The broken formation of these stacked slabs is composed largely of fine-grained, thin-bedded, lithic metasandstone and interbedded argillite; well-bedded, medium- to coarse-grained, lithic metasandstone; and intercalations of chert pebble conglomerate, grit, and rare lenses of volcanic rock and chert. Unit locally includes zones of broken metasandstone and argillite with abundant lenses and blocks of interleaved radiolarian chert, and porphyritic pillow basalt and tuff. Radiolarian fauna from the chert lenses indicates an Early Cretaceous age in the report area (fossil locality 4). Locally overlying this chert is well-bedded, medium- to coarse-grained, lithic metasandstone with interbeds of chert pebble conglomerate, grit, and rare lensoid bodies of tuffaceous volcanic rock and chert. The structurally highest part of the Metasandstone of Hull Mountain consists of a broken unit of metasandstone and sheared argillite containing a molluscan fauna of Cenomanian age (fossil locality 3). All the metasandstone is reconstituted to Textural Zones 1 to 2 of Blake and others (1967), containing the blueschist mineral assemblage (lawsonite + white mica ± sodic amphibole ± jadeite ± pumpellyite). Chert and volcanic rocks are also metamorphosed to blueschist grade, containing lawsonite ± sodic amphibole ± jadeite. Where mapped, unit includes following blocks:

un — **Blocks of unknown composition**—Mapped from air photos

ch — **Blocks and interleaved lenses of chert**

vh — **Blocks and interleaved lenses of metavolcanic rocks**

Pickett Peak Terrane(?)

fmp — **Metasedimentary rocks of Mendocino Pass (Early Cretaceous)**- Composed of slightly sheared, fine- to medium-grained, thin- to medium- bedded metasandstone reconstituted to textural zone 2 of Blake and others (1967), interbedded with black argillite. Metasandstone beds are locally graded, and interbedded chert and greenstone lenses are present at one locality. Metasandstone includes Valanginian Buchias at one locality (fossil locality 1, table 1). This unit is distinguished by development of a moderate foliation, in contrast with structurally overlying schistose metamorphic rocks of Black Butte and Bald Mtn., and by its intact coherent aspect, in contrast with structurally underlying disrupted rocks in mélange of the Central Belt. Unit may correlate with Valantine Spring Formation unit of Pickett Peak Terrane (Blake and others, 1992). East of Bald Mountain unit includes the following units:

cm — **Metachert lens interbedded with metagreenstone**

vm — **Metagreenstone lens interbedded with metachert**

Pickett Peak Terrane

fsb — **Metamorphic rocks of Black Butte and Bald Mountain (Early Cretaceous)**—Metasandstone metamorphosed to lawsonite grade and reconstituted to textural zones 2 and 3 of Blake and others (1967). In the Bald Mountain area unit consists of medium- to coarse-grained metasandstone with lenses of stretched-pebble conglomerate that structurally overlies finer grained, well-laminated and foliated metasandstone and argillite with blocks of mafic metavolcanic rocks and metagabbro. Radiometric dating of metasandstone in the Black Butte area (Suppe, 1969) yielded K-Ar ages for metamorphism of the unit of 123 to 127 m.y.

un — **Blocks of unknown composition**—Mapped from air photos

vb — **Metavolcanic rocks**—Blocks of mafic metavolcanic and metagabbroic rocks, possibly intrusive locally. Metavolcanics are more abundant and varied to the north of map area

flpm — **Metamorphic rocks of Lake Pillsbury (Early Cretaceous)**- Foliated fine-grained pelite and metasandstone (Textural Zone 3 to high Textural Zone 2 of Blake and others, 1967) and rare intercalated mafic metavolcanic rocks. Questionably correlated with the South Fork Mountain schist of the Pickett Peak terrane of the Eastern Belt (Blake and others, 1982; Irwin and others, 1974) by Etter (1979). Unit was considered by Etter (1979) to have been metamorphosed to blueschist grade ~137 Ma, based on a whole-rock K-Ar age for the metasandstone (Suppe and Foland, 1978). A recent Pb/U age on detrital zircons from these rocks provides a depositional age of 123 Ma, and an $^{40}Ar/^{39}Ar$ determination on phengitic white mica provides a metamorphic age of about 120 Ma (Dumitru and others, 2009). The Pb-U and $^{40}Ar/^{39}Ar$ ages are here considered more reliable than the older K-Ar ages

EXPLANATION OF MAP SYMBOLS

Contact—Solid where location is accurate; long-dashed where approximate; dotted where concealed

Photolineament marking resistive bedding

Fault—Solid where location is accurate; long-dashed where approximate; short-dashed where inferred; dotted where concealed. Queries added where identity or existence may be questionable

Fault Scarp—Showing fault line at base of scarp with hachure pointing up slope

Thrust fault—Solid where location is accurate; long-dashed where approximate; short-dashed where inferred; dotted where concealed. Sawteeth on upper plate.

Fault lineament— Inferred from features on aerial photography; dotted where projected beneath surficial deposits; queried where uncertain

Strike and dip of beds

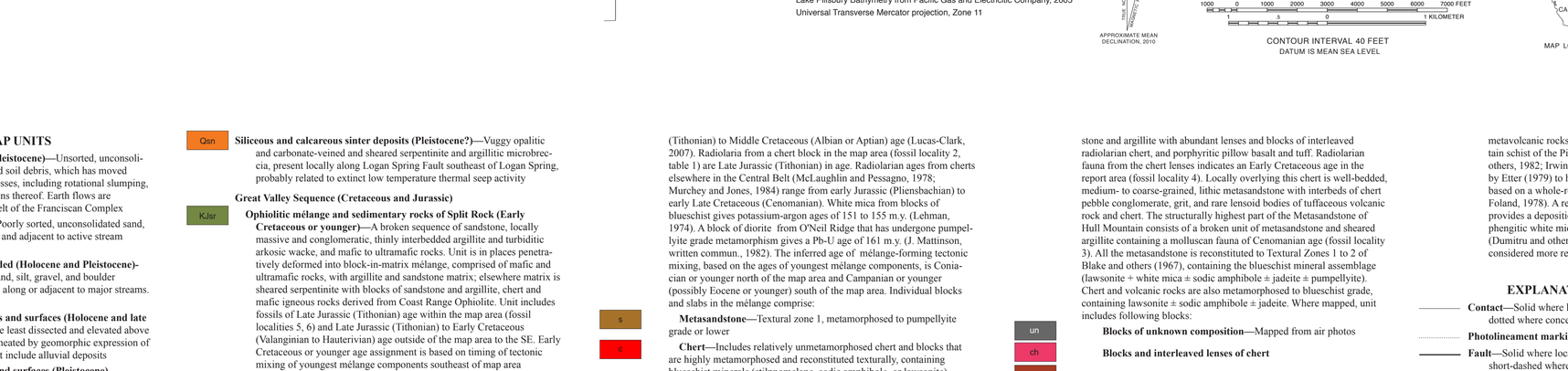
- 35 **Inclined**
- 70 **Overturned**
- **Vertical**

Strike and dip of metamorphic fabric in sheared or foliated rocks

- 61 **Inclined**
- **Vertical**

Location of block or lens too small to map in broken formation or mélange

- **Blueschist**
- **Serpentinite**
- **Volcanic rock**
- **Chert**
- 5 **Fossil Location**—See table 1 for fossil information
- **Scott Dam**



Geologic map of the Bartlett Springs Fault Zone in the Vicinity of Lake Pillsbury and Adjacent Areas of Mendocino, Lake, and Glenn Counties, California

By

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