U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

GEOLOGIC LOGS FROM 25 BOREHOLES NEAR STRONG MOTION ACCELEROGRAPHS THAT RECORDED THE 1989 LOMA PRIETA, CALIFORNIA, EARTHQUAKE

by

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and

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Open File Report 93-502

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INTRODUCTION

Ground shaking produced by the Loma Prieta earthquake was recorded at 90 free-field strong-motion accelerograph stations. Prior to the earthquake, shear wave velocities had been measured to depths of 20 to 105 meters at fourteen sites, principally stations of the Gilroy and APEEL arrays (Gibbs et al., 1975, 1976, 1977; Fumal et al., 1982; Shannon and Wilson, Inc., and Agbabian Associates, 1980). After the earthquake, several agencies, including the U.S. Geological Survey and the Electric Power Research Institute (EPRI), drilled boreholes at 42 additional sites for the purpose of investigating near-surface geology and obtaining downhole shear-wave velocity measurements. U.S. Geological Survey Open-File Report 92-287 (1992) presents geologic and geophysical data from eight boreholes at seven sites. This report presents geologic data from an additional 25 sites. P- and S-wave velocity logs will be published in separate reports.

The data in this report are from 18 sites on rock and 7 sites on sedimentary deposits. Included after each log is a site map and a geologic map of the area around the borehole. The geologic logs are based on descriptions of drill cuttings, samples, reaction of the drill rig, and inspection of nearby outcrops. Sediment samples are described using the field techniques of the Soil Conservation Service (1951). Descriptions include sediment texture, color, and the amount and size of coarse fragments. Texture refers to the relative proportions of clay, silt, and sand particles less than 2 millimeters in diameter. This is determined in the field without

using laboratory tests. The dominant color of the sediment and prominent mottles are determined from the Munsell soil color charts (1954).

Descriptions of rock samples include rock name, weathering condition, color, grain size, hardness, and fracture spacing. Classification of rock hardness and fracture spacing are those used by Ellen et al., (1972) in description hillside materials in San Mateo County, California.

Most information needed for describing relatively well-sorted soils and such properties of rock as lithology, color, and hardness are readily obtained from cuttings. Inspection of samples and nearby outcrops is necessary for determining the nature of poorly-sorted materials and fracture spacing. Reaction of the drill rig is useful in determining approximate sediment texture and in determining degree of fracturing because the rate of penetration in rock is highest for very closely fractured and crushed materials and drilling roughness is generally at a maximum in closely to moderately fractured rock. In-situ consistency of soil is determined largely from standard penetration measurements and rate of drill penetration.

There are special circumstances pertinent to two boreholes that merit mention. First, the bedrock beneath and around the UCSC/Lick Observatory accelerograph is a pelitic schist that is permeated by caves and openings formed through selective weathering of carbonate layers. When this borehole was drilled, the drill rig encountered layers of hard rock alternating with zones where there was no resistance and all fluid pressure was lost (the latter are

indicated on the log by "void"). To maintain fluid pressure during geophysical logging, PVC pipe was placed from the surface to the bottom of the hole and then anchored with cement grouting from 1 to 25 feet and from 42 to 46 feet. Second, the Snow Park borehole was drilled in Snow Park, Oakland, which is two blocks away from the office building that contains the instrument. As the geology is fairly flat-lying around this site, the distance between the borehole and the instrument should not cause a problem for the analysis.

Funding for permitting, drilling, and casing for 16 of the boreholes (marked in the table of contents by "*") was provided by *CUREe* (Mr. Charles Thiel). Drilling was arranged and coordinated by Dr. Joseph Sun and Ms. Susan Ch¬ng of *Woodward-Clyde Consultants*. *Pitcher Drilling Company* of Palo Alto, Ca drilled all 16 borings under contract with *Woodward-Clyde Consultants*. The other 9 were funded either by *EPRI* (Dr. John F. Schneider) or the *U.S. Geological Survey* (Dr. James F. Gibbs and Dr. Thomas Holzer) and were drilled by *Pitcher Drilling Company*. Finally, the authors would like to thank Thomas Holzer of the U.S. Geological Survey for reviewing this manuscript.

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Definitions of terms used for descriptions of sedimentary deposits and bedrock materials

Rock hardness: response to hand and geologic hammer: (Ellen et al., 1972)

hard - hammer bounces off with solid sound
firm - hammer dents with thud, pick point dents or penetrates slightly
soft - pick points penetrates
friable material can be crumbled into individual grains by hand.

Fracture spacing: (Ellen et al., 1972)

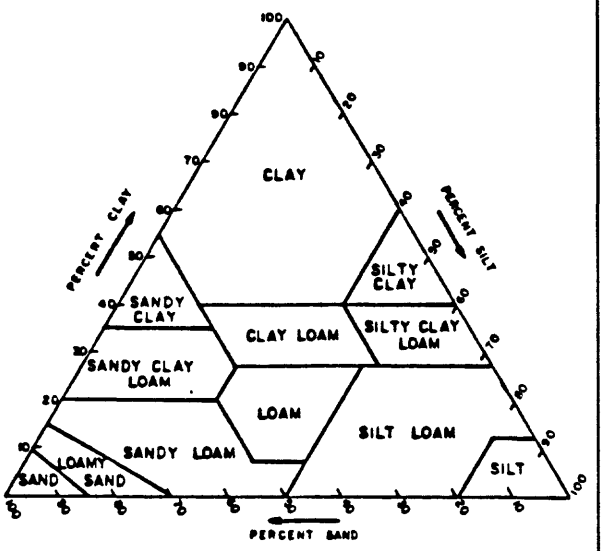
cm	in	fracture spacing
0-1	0-1/2	v. close
1-5	1/2-2	close
5-30	2-12	moderate
30-100	12-36	wide
>100	>36	v. wide

Weathering:
Fresh: no visible signs of weathering
Slight: no visible decomposition of minerals, slight discoloration
Moderate: slight decomposition of minerals and disintegration of rock, deep and thorough discoloration
Deep: extensive decomposition of minerals and complete disintegration of rock but original structure is preserved.

Relative density of sand and consistency of clay is correlated with penetration resistance: (Terzaghi and Peck, 1948)

blows/ft.	relative density	blows/ft.	consistency
0-4	v. loose	<2	v. soft
4-10	loose	2-4	soft
10-30	medium	4-8	medium
30-50	dense	8-15	stiff
>50	v. dense	15-30	v. stiff
		>30	hard

Texture: the relative proportions of clay, silt, and sand below 2mm. Proportions of larger particles are indicated by modifiers of textural class names. Determination is made in the field mainly by feeling the moist soil (Soil Survey, Staff, 1951).



Color: Standard Munsell color names are given for the dominant color of the moist soil and for prominent mottles.

Types of samples

SP - Standard Penetration 1 + 3/8 in in ID sampler)
S - Thin-wall push sampler
O - Osterberg fixed-piston sampler
P - Pitcher Barrel sampler
CH - California Penetration (2 in ID sampler)
DC - Diamond Core

▲ STRONG MOTION INSTRUMENT

⊕ BOREHOLE

Explanation of geologic logs.

INDEX OF BEDROCK TYPES FOR SITES ON ROCK

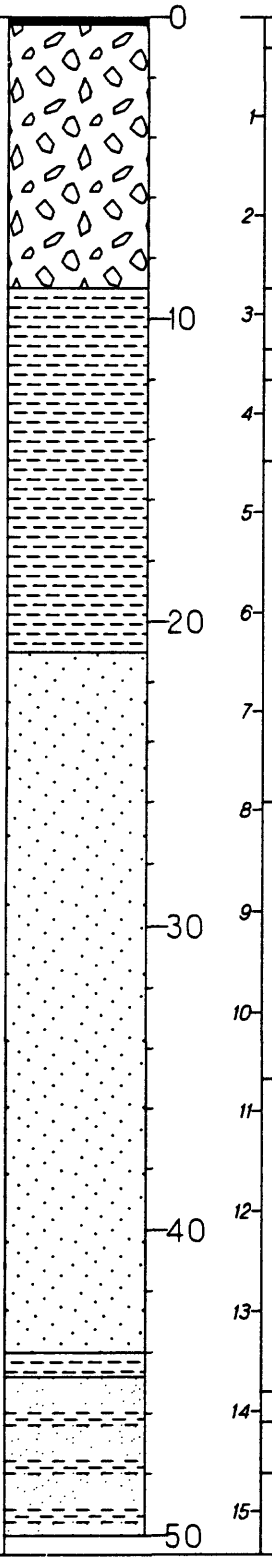
STATION	PAGE	ROCK/SEDIMENT TYPE	THICKNESS OF OVERBURDEN (m)
Monterey City Hall	86	Granite	7.0
Belmont Two-Story Office Building	11	Franciscan Shale and Sandstone	2.7
Berkeley/Haviland Hall	17	Franciscan Shale and Sandstone	.28
Halls Valley	65	Franciscan Shale and Sandstone	16.8
Lexington Dam	75	Franciscan Shale and Sandstone	.08
Piedmont Junior High School	109	Franciscan Shale and Sandstone	.05
Point Bonita	115	Franciscan Shale and Sandstone	1.5
Sierra Point	145	Franciscan Shale and Sandstone	.92
Treasure Island[1]	160	Franciscan Shale and Sandstone	88.4
Rincon Hill - San Francisco	135	Franciscan Shale and Greywacke	1.8
Diamond Heights Fire Station	41	Franciscan Shale, Sandstone, and Chert	.08
Presidio	129	Franciscan Shale and Serpentinite	2.7
Pacific Heights Fire Station	91	Cretaceous Shale and Sandstone	1.2
Gilroy #7 - Montelli Ranch	60	Cretaceous - Tertiary Shale and Sandstone	17.4
Sago South	140	Mesozoic Schist, Gneiss, and Granodiorite	1.8
UCSC / Lick Astronomy Shop	169	Pelitic Schists w/ voids	7.5
Gilroy #2 (EPRI #1)[1]	46	Santa Clara Sandstone, Conglomerate, and mudstone; Franciscan Serpentinite	39.6
Patterson Pass Road	104	Cierbo Shale and Sandstone	.08
Woodside Fire Station	173	Butano Sandstone and Claystone	6.0

Capitola Fire Station	22	Purisima Sandstone	12.0

INDEX OF SEDIMENT TYPES FOR SITES ON SEDIMENT

[1] - The Gilroy #2 and Treasure Island boreholes were included on both tables because both penetrated a significant amount of bedrock.

SITE: BELMONT 2-STORY BUILDING DATE: 7/23-24/92



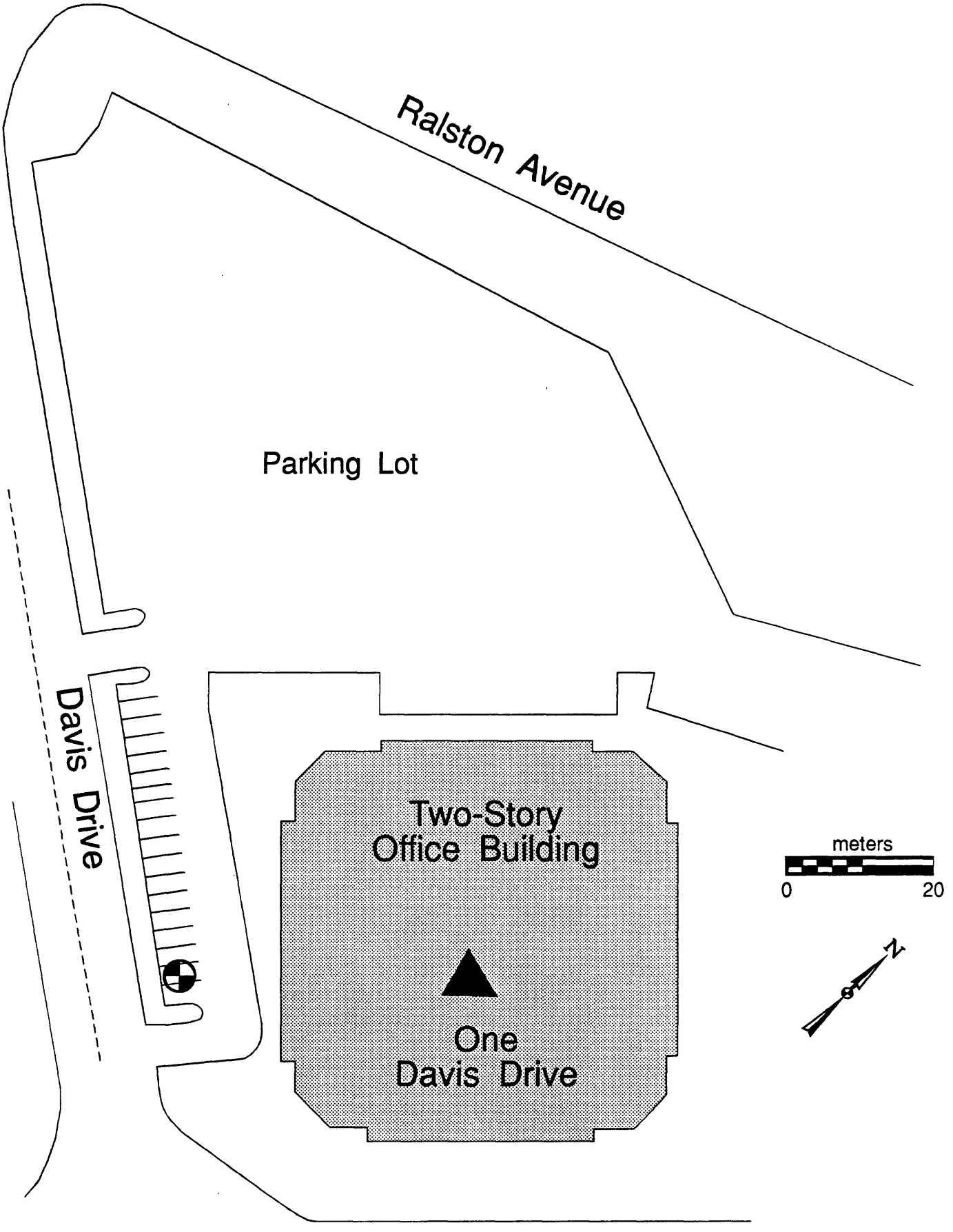
BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			1	asphalt GRAVEL (fill), very dark brown, fragments of siltstone, hard
			2	softer, small amounts of light brown clay
			3	SILTSTONE, very dark brown, fairly weathered, moderately to closely fractured, interbedded with minor amounts of strong brown fine sandstone, firm
			4	softer, clayey
				much harder, closely fractured
			5	closely to very closely fractured
				harder, moderately to closely fractured, moderately weathered
			6	
				SANDSTONE, reddish yellow to dark brown, medium grained, moderately fractured, moderately weathered, hard
			7	closely fractured
			8	moderately fractured, barely weathered
			9	
				softer, closely to very closely fractured, unweathered
			10	
				slightly harder
			11	softer
			12	harder, with quartz veins
			13	softer, no quartz
				SILTSTONE, red, closely fractured, very firm
			14	FINE SANDSTONE TO SILTSTONE, dark greenish grey, closely to very closely fractured, firm
				harder, with quartz veins (< 5cm thick)
			15	with clay (gouge?)

SITE: BELMONT 2-STORY BUILDING DATE: 7/23-24/92

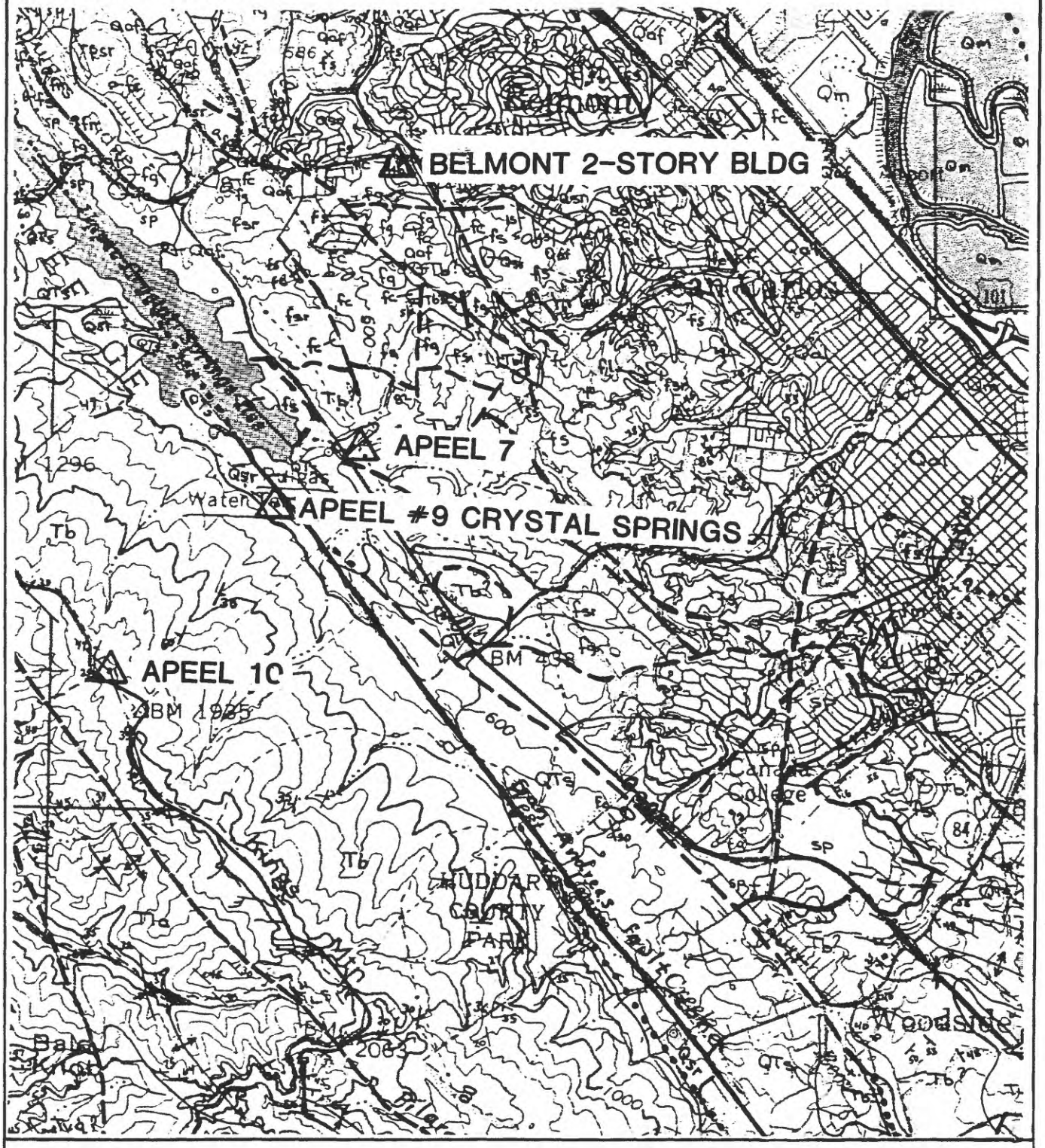
BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50	
			16	harder, closely fractured, no clay
			17	softer, closely to very closely fractured, with clay (gouge?)
				harder, no clay, with some quartz veins
			18	
			60	
			19	
			20	SANDY CLAY, dark brownish grey, sand is fine grained, soft
				INTERBEDDED SANDSTONE AND CLAYSTONE, sandstone is dark greenish grey and fine grained, claystone is light grey to dark brownish grey, with quartz veins, firm
			21	
			70	hard, mostly sandstone, moderately fractured
			22	soft, more clay
				harder, mostly sandstone
			23	
			24	very closely fractured
			80	soft, mostly clay
			25	
			26	
			27	
			90	
			28	
			29	hard, mostly sandstone, closely to very closely fractured
				softer, more clay
			30	harder, more sandstone
			100	

SITE: BELMONT 2-STORY BUILDING DATE: 7/23-24/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			100 31	softer, mostly clay
			32	
			33	harder, mostly sandstone
			110 34	softer, mostly clay
				harder, mostly sandstone
			35	
			36	
			120 37	FINE SANDSTONE TO SILTSTONE, dark greenish grey, moderately fractured, very hard
			38	
			39	
			130 40	
			41	
			42	
			140 43	
			44	
			45	
			150	



BELMONT TWO-STORY OFFICE BUILDING



SCALE 1:62 500

1 ½ 0 1 2 3 4 5 MILES

1 .5 0 1 2 3 4 5 6 7 KILOMETERS

PRELIMINARY GEOLOGIC MAP OF
SAN MATEO COUNTY, CALIFORNIA

Compiled by
Earl E. Brabb and Earl H. Pampeyan

1972

AP 9

Qu | Qal | Qsr | Qm | Qd | Qb | Qaf

Surficial deposits

Qu, surficial deposits, undivided
Qal, alluvium; gravel, sand, silt, and clay
Qsr, slope wash and ravine fill or colluvium, gravel, sand, silt, and clay
Qm, San Francisco Bay mud; soft clay and silt with some lenses of sand, shell, and plant material
Qd, windblown sand
Qb, beach deposits; sand and minor amounts of gravel
Qaf, artificial fill

Qtf

Terrace deposits

Predominantly sand; some silt, clay, and gravel. Subscripts refer to different levels in local areas. Many small areas not shown

Pleistocene and Holocene

Qc

Colma Formation

Predominantly sand; some silt, clay, and gravel

UNCONFORMITY

Pleistocene

QTs

Santa Clara Formation

Conglomerate, sandstone, siltstone, and claystone, some lignite locally

UNCONFORMITY

Pliocene and Pleistocene

WEST OF SAN ANDREAS FAULT

Tp | Tptu | Tpl | Tpsg | Tpo | Tpt

Purisima Formation

Tp, Purisima Formation, undivided; siltstone, mudstone, sandstone, and conglomerate
Tptu, Tunitas Member of Cummings and others (1962); sandstone
Tpl, Lobitos Member of Cummings and others (1962); mudstone
Tpsg, San Gregorio Member of Cummings and others (1962); sandstone
Tpo, Pomponio Member of Cummings and others (1962); siltstone
Tpt, Tahana Member of Cummings and others (1962); sandstone and siltstone

Tsc

Santa Cruz Mudstone of Clark (1966)

Tsm

Santa Margarita Sandstone

UNCONFORMITY

Tm

Monterey Shale

Tlo

Lompico Sandstone of Clark (1966)

Miocene

UNCONFORMITY

Tla | Tvq | Tsr | Tst | Tmb | Tsl | Tls

Sandstone, shale, and volcanic rocks

Tla, Lambert Shale
Tvq, Vaqueros Sandstone
Tmb, Mindego Basalt and other volcanic rock
Tsl, San Lorenzo Formation, undivided; mudstone and shale
Tsr, Rices Mudstone Member of Lorenzo Formation of Brabb (1964)
Tst, Twobar Shale Member of San Lorenzo Formation of Brabb (1964)
Tls, Lambert and San Lorenzo Formations, undivided; mudstone and shale

Oligocene

AP 10

Tb | Tbs

Butano Sandstone

Tb, Butano Sandstone, undivided, predominantly sandstone, minor shale and conglomerate
Tbs, shale

Eocene

UNCONFORMITY

Tss

Sandstone, shale, and conglomerate

UNCONFORMITY

Paleocene

WEST OF SAN GREGORIO FAULT

Kpp

Pigeon Point Formation

BETWEEN SAN GREGORIO AND PILARCITOS-SAN ANDREAS FAULTS

Kgr

Granitic rocks

Mainly quartz diorite but includes some potash feldspar-rich varieties. Pegmatite and aplite dikes common

KJv

Unnamed volcanic rocks

Spatial relations uncertain but seem to underlie Pigeon Point Formation. Age may possibly be Cretaceous

m

Marble

Includes hornfels and schist

Upper Cretaceous

IN ORDER TO EMPHASIZE THE DISTRIBUTION OF BEDROCK, NO LANDSLIDE DEPOSITS ARE SHOWN ON THIS MAP. LANDSLIDES AND AN ANALYSIS OF SLOPE STABILITY WILL BE SHOWN ON SEPARATE MAPS.

QUATERNARY

EAST OF SAN ANDREAS FAULT

QTm

Merced Formation

Sandstone, siltstone, and claystone, minor conglomerate and volcanic ash

UNCONFORMITY

TERTIARY AND QUATERNARY

Tus

Unnamed sandstone

Tpm

Page Mill Basalt

UNCONFORMITY

TERTIARY

AP 7

Tb?

Butano(?) Sandstone

Predominantly massive sandstone and claystone with some siltstone, and pebbly sandstone interbeds

EAST OF SAN ANDREAS-PILARCITOS FAULTS

Ksh

Shale near Palo Alto

CRETACEOUS

sp

Serpentine

Sheared and foliated serpentine and hard blocky serpentine in a sheared matrix. Includes small areas of other mafic rock and silica-carbonate rock

BEL

KJf | fs | fg | fc | fcg | fl | fm | fsr

Franciscan assemblage of Bailey, Jones, and Irwin (1964)

KJf, undivided Franciscan assemblage; mostly sandstone and shale, some greenstone, limestone, and chert
fs, predominantly sandstone (graywacke), minor shale
fg, greenstone (altered basalt, diabase and other volcanic rocks)
fc, chert
fcg, pebble or cobble conglomerate
fl, limestone
fm, metamorphic rocks of blueschist facies
fsr, sheared rocks; hard rounded masses or "knockers" of sedimentary, metamorphic, and volcanic rocks in a softer matrix of clay minerals

KJs

Sandstone at San Bruno Mountain

JURASSIC OR CRETACEOUS

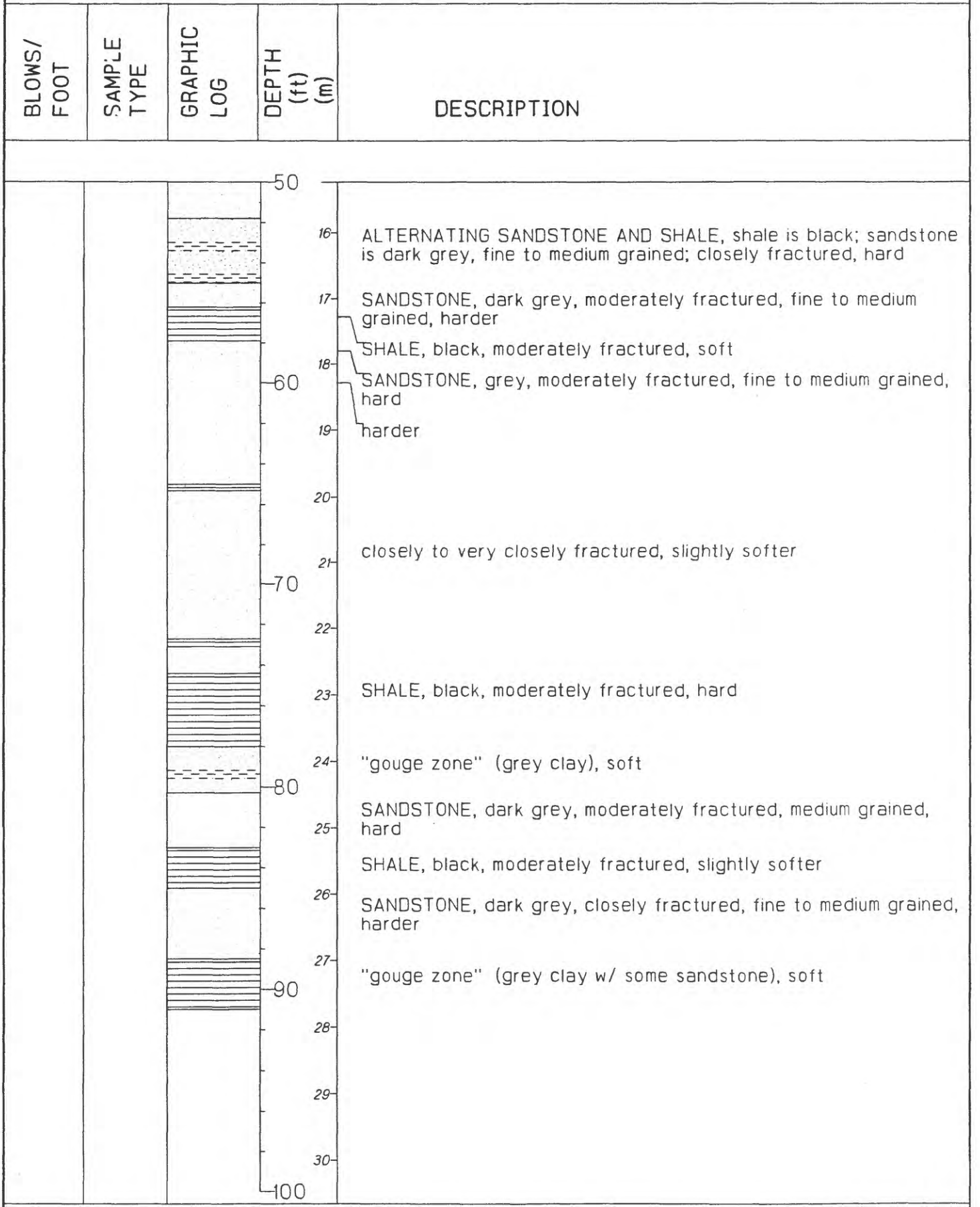
JURASSIC AND CRETACEOUS

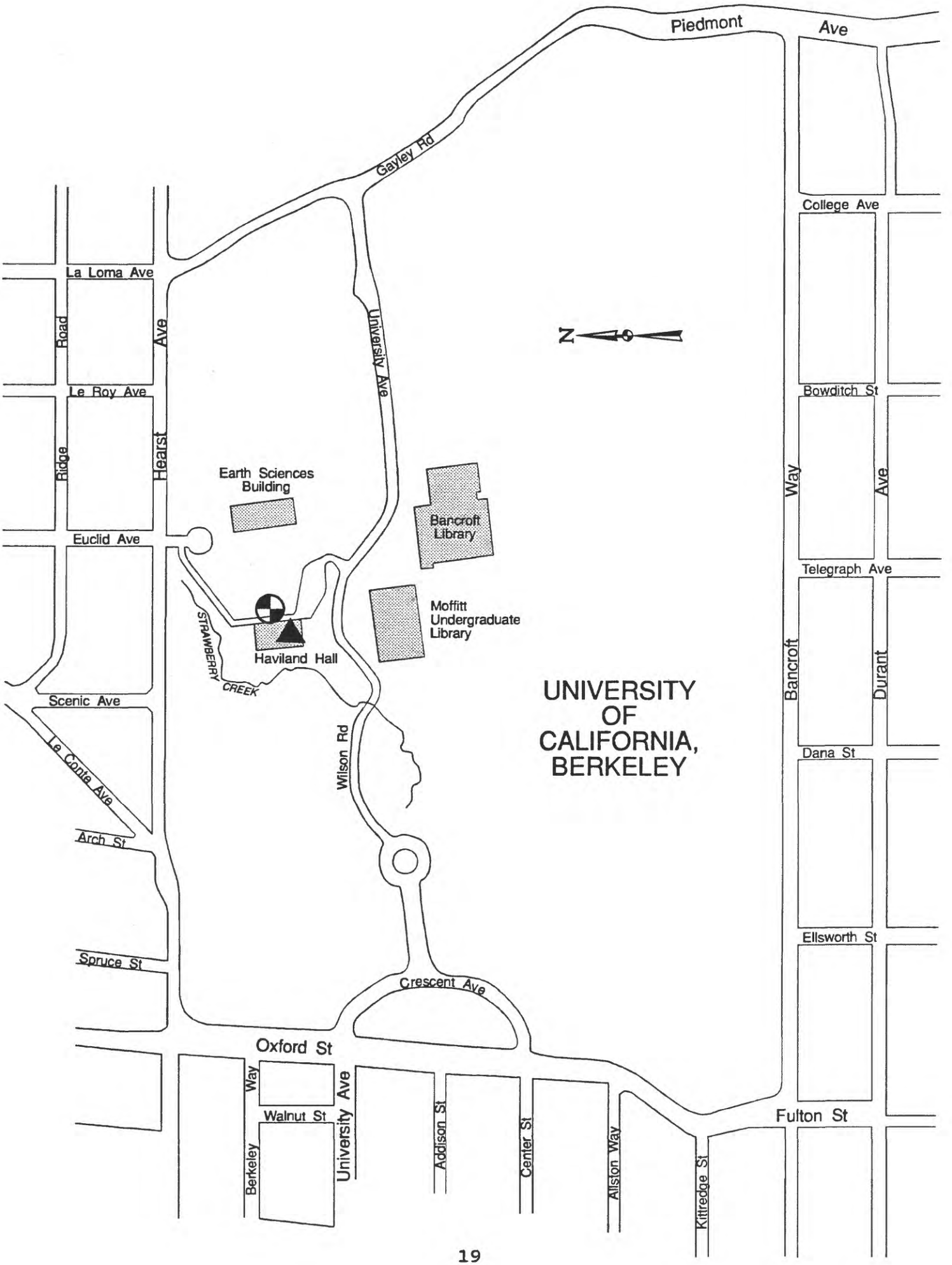
PALEOZOIC (?)

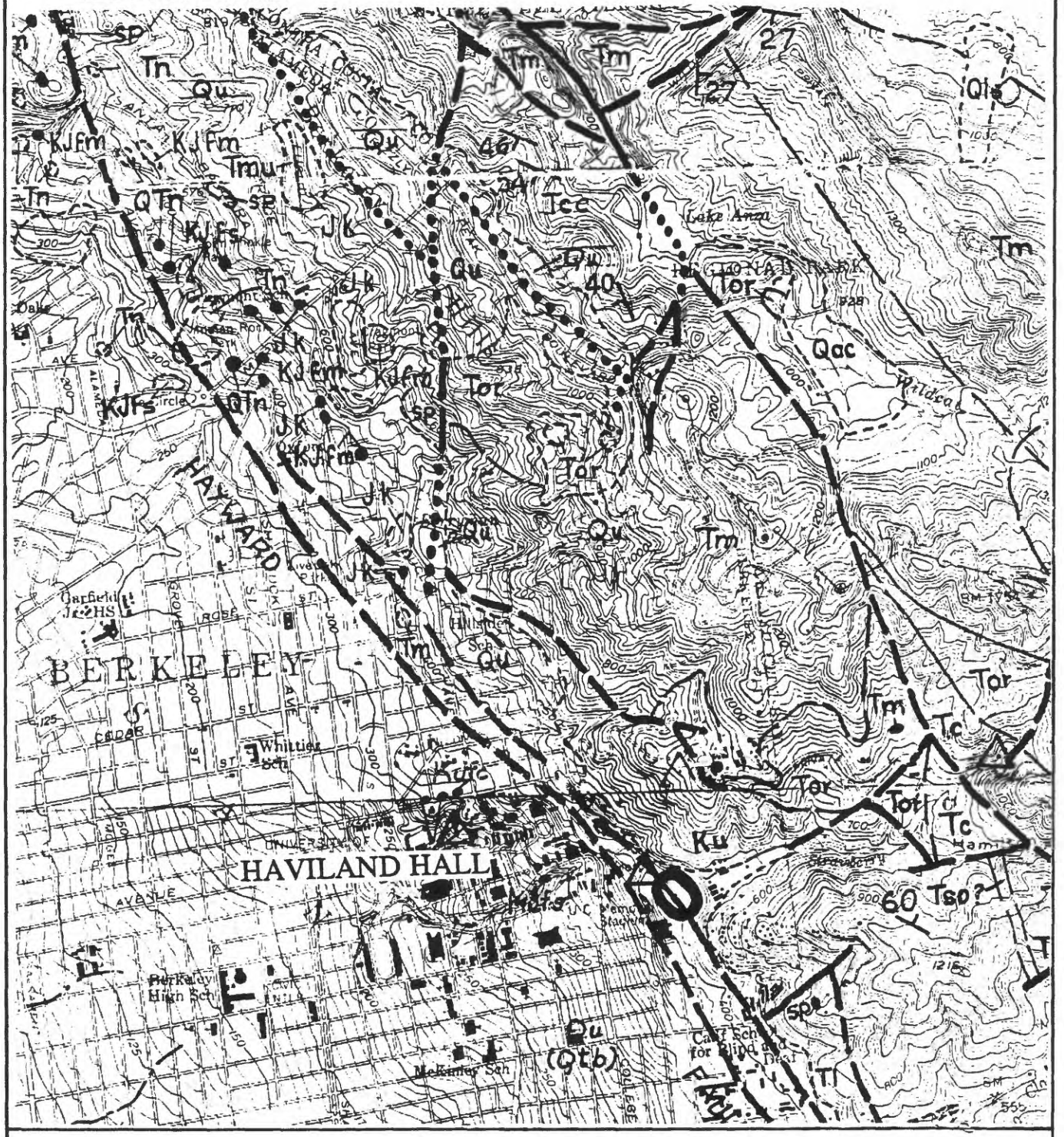
SITE: BERKELEY/HAVILAND HALL DATE: 8/8/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	FILL – medium gravel
			1	SANDSTONE, greyish brown to orange, very weathered, closely fractured, fine to medium grained, soft
			2	
			10 3	very soft, very closely fractured
			4	somewhat hard, grey, fairly weathered, closely fractured
			5	nearly unweathered, progressively harder
			20 6	very hard, unweathered, moderately fractured
			7	
			8	
			30 9	"gouge zone" (grey clay), soft
			10	calcite veins
			11	
			40 12	
			13	closely fractured
				moderately fractured
			14	
			50 15	

SITE: BERKELEY/HAVILAND HALL DATE: 8/8/92




Piedmont Ave
Gayley Rd
College Ave
La Loma Ave
Road
Ave
University Ave
N
Le Roy Ave
Bowditch St
Ridge
Hearst
Earth Sciences Building
Bancroft Library
Way
Ave
Euclid Ave
Telegraph Ave
Moffitt Undergraduate Library
Haviland Hall
STRAWBERRY CREEK
Bancroft
Durant
UNIVERSITY OF CALIFORNIA, BERKELEY
Scenic Ave
Wilson Rd
La Conte Ave
Dana St
Arch St
Ellsworth St
Spruce St
Crescent Ave
Oxford St
Way
Walnut St
University Ave
Fulton St
Berkeley
Addison St
Center St
Alston Way
Kittredge St



SCALE 1:24000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

PRELIMINARY GEOLOGIC MAP AND ENGINEERING GEOLOGIC INFORMATION, OAKLAND AND VICINITY, CALIF.

DOROTHY RADBRUCH & J.E. CASE, 1967

EXPLANATION

Qaf — Artificial fill

Qbm — Bay mud

Qac — Alluvium and colluvium

Qls — Landslide debris

Qu — Undifferentiated Quaternary deposits
Qtc, Qts, and Qtb shown in parentheses where known- may also include Qaf, Qbm, Qac, Qls, Qsu, Qsl and Qg

Qtc (Qts Qtb) — Qtc, Temescal Formation, dark alluvium; (Qts), alluvial material derived from the San Antonio Formation; (Qtb), material contemporaneous with Qtc and Qts deposited by streams flowing from Berkeley Hills

Qtc / Qsu — indicates Temescal Formation overlying upper member of San Antonio Formation.

Qm — Merritt sand

Qsu, Qsl — San Antonio Formation
Qsu, upper member, clay, silt, and sand, and gravel:
Qsl, lower member, gravel with silty clay matrix.

Qg — Unnamed gravel, sand, and clay

Tl, Tn — Tl, Leona Rhyolite: Tn, Northbrae Rhyolite

Recent

Pleistocene and Recent

Pliocene ?

Pliocene

Contra Costa Group

West of Moraga fault

Tbp — Bald Peak Formation
Predominantly basalt

Ts — Siesta Formation
Silty claystone and sandstone

Tm — Moraga Formation
Basalt, andesite, and interbedded clastic rocks

Tor — Orinda Formation
Conglomerate, sandstone, siltstone, claystone

East of Moraga fault

Tcp, Tcc — Contra Costa Group undifferentiated sedimentary rocks younger than formations of the Contra Costa Group recognized west of the Moraga fault, and Pinole tuff, Tcp.

Tsp — San Pablo Formation
Predominantly sandstone
UNCONFORMITY (Pease, 1953)

Tb, Thl — Briones Sandstone, Tb
Hercules Shale member, Thl

Tr — Rodeo Shale

Th — Hambre Sandstone

Tt — Tice Shale

To — Oursan Sandstone

Tc — Claremont Shale

Tso — Sobrante Formation
Sandstone and siltstone

Monterey Group

Miocene

Tk — Kirker Tuff

Tsr — San Ramon Sandstone

Oligocene-Miocene?

Tem — Markley Sandstone
In this area predominantly clay shale (see table)

Teu — Unnamed Eocene sandstone and shale

Eocene

Tmz — Martinez Formation
Sandstone and siltstone

Paleocene

Tp — Siliceous Shale

Kr — Sandstone

TKu — Paleocene siliceous shale and Upper Cretaceous sandstone units, undifferentiated. Predominantly sandstone unit, with minor amounts of siliceous shale too small to show on the map.

Ku — Undifferentiated Upper Cretaceous rocks; may include unrecognized Eocene rocks.

Ks — Shale

Ko — Oakland Conglomerate

Kjm — Sandstone, shale, conglomerate

Upper Cretaceous

Jk — Knoxville Formation
Shale, sandstone, and minor conglomerate

Upper Jurassic

TERTIARY

CRETACEOUS

JURASSIC? AND CRETACEOUS? JURASSIC

sp — Serpentine

gb — Gabbro

KJfs — Sandstone and shale
Includes small amounts of chert, greenstone, serpentine, and metamorphic rocks too small to show on the map, or shown by Lawson (1914) but now covered by streets and buildings.)

KJfc — Chert and shale

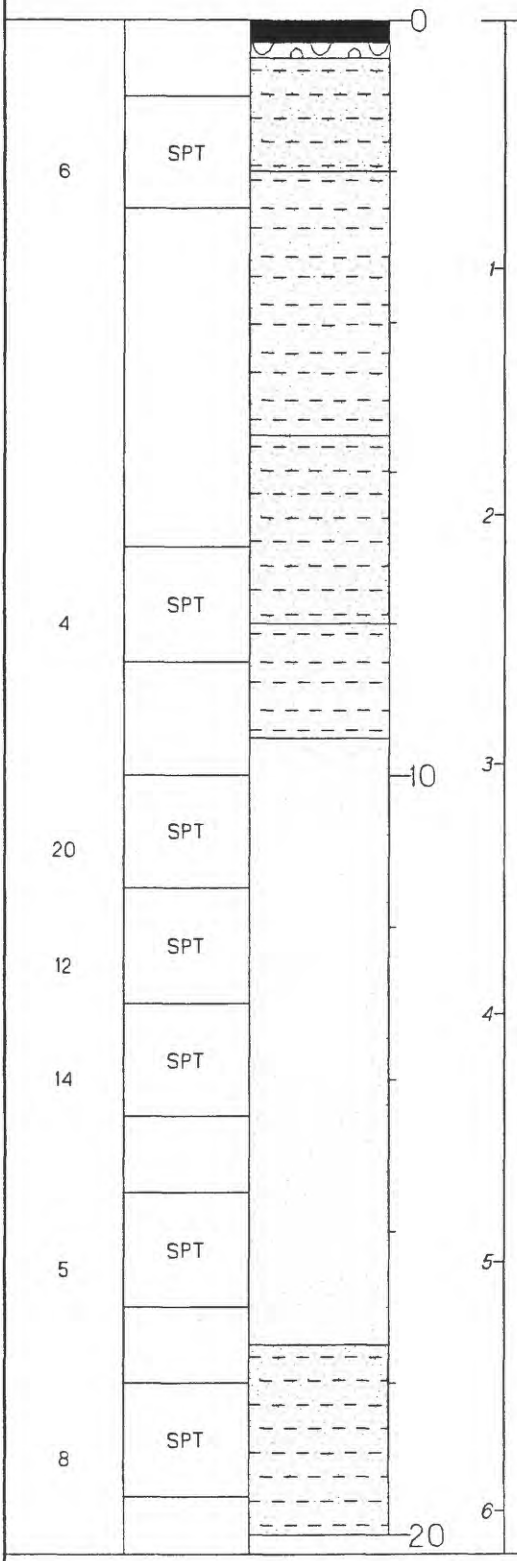
KJfg — Greenstone

KJfm — Metamorphic rocks undifferentiated
(Includes silica-carbonate rock probably derived from serpentine intrusive into rocks of the Franciscan group.)

Jurassic and Cretaceous ?

Franciscan Group

SITE: CAPITOLA FIRE STATION DATE: 8/10-18/92



SITE: CAPITOLA FIRE STATION DATE: 8/10-18/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			20	
20	SPT		7	SAND (SP), medium dense, dk gray, fine to medium grained (SAMPLE 8)
17	SPT			SILTY SAND (SM), medium dense, dk gray, sand is fine grained, trace of clay (SAMPLE 9)
10	SPT		8	SAMPLE 10
				clayey
			9	
			30	
15	SPT			SAMPLE 11
			10	
5	SPT			SAMPLE 12
36	SPT		11	SAND (SP), medium dense, dk grayish brown, medium grained (SAMPLE 13), gradational to
				SILTY SAND (SM), dense, dk gray, sand is fine grained, trace of clay
			12	
			40	

SITE: CAPITOLA FIRE STATION DATE: 8/10-18/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			40	
66	SPT			SANDSTONE (PURISIMA FM), soft to firm, dk gray, fine to medium grained (SAMPLE 14)
			13	CONGLOMERATE, fine-grained
				SANDSTONE, soft to firm, dk gray, medium to coarse grained
62	SPT			SAMPLE 15
			14	SANDSTONE, soft to firm, dk gray, fine to medium grained
				CONGLOMERATE, soft to firm, brownish gray, fine grained
113	SPT		15	SAMPLE 16 (12 in.)
			50	SANDSTONE, soft to firm, dk gray, fine to medium grained
				CONGLOMERATE, fine grained
			16	SANDSTONE, loose, dk gray, fine to medium grained
			17	
			18	
			60	

SITE: CAPITOLA FIRE STATION

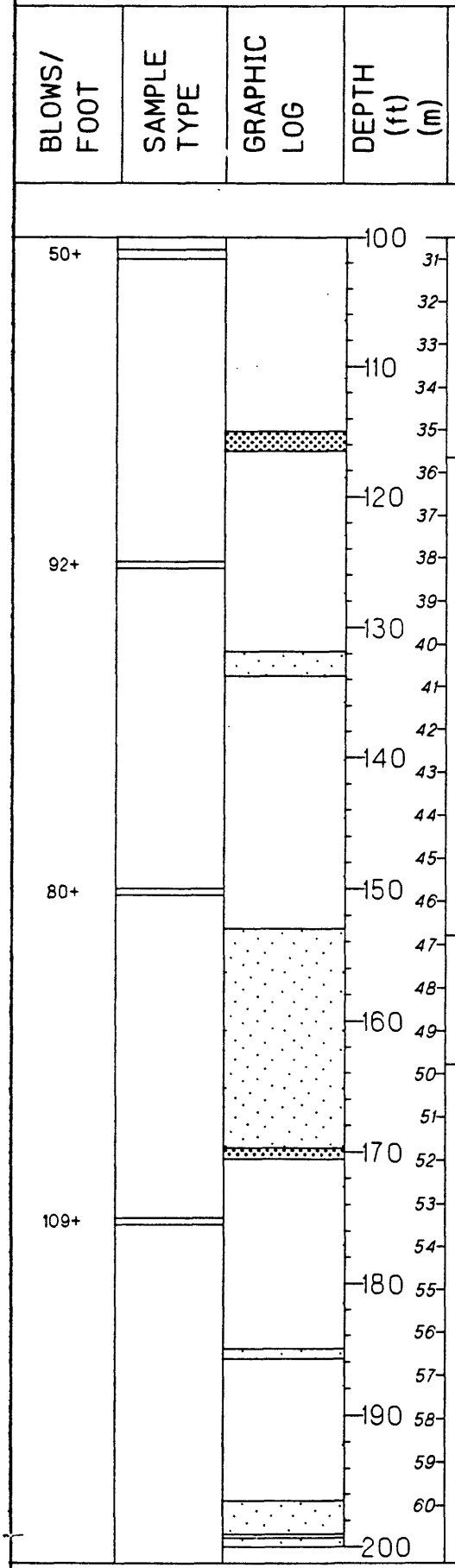
DATE: 8/10-18/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
120	SPT		60	SAMPLE 17 (12 in.)
			19	
			20	
			21	
			70	
			22	
			23	
			24	
			80	

SITE: CAPITOLA FIRE STATION DATE: 8/10-18/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
50+			80	SAMPLE 18 (9 in.)
			25	
			26	
			27	CEMENTED ZONE (SAMPLE 19 (strained spoils))
			90	
			28	
			29	SANDSTONE, loose, dk gray, poorly sorted (silt to medium grained sand)
				SANDSTONE, loose, dk gray, fine to medium grained 101.3 SAMPLE 20 (8.5 in.)
			30	
			100	

SITE: CAPITOLA FIRE STATION DATE: 8/10-18/92



DESCRIPTION

SANDSTONE, fine to coarse sand with gravel; grading to
SANDSTONE, loose, dk gray, silt to medium grained sand

SANDSTONE, loose, dk gray, fine to medium grained (SAMPLE 21 (6 in.))

CEMENTED ZONE

SANDSTONE, loose, dk gray, fine to medium grained, no fines (SAMPLE 22 (6 in.))

SANDSTONE, fine to coarse grained

SANDSTONE, fine to medium grained

SANDSTONE, fine to coarse grained

SANDSTONE, coarse sand to fine gravel

SANDSTONE, loose, dk gray, medium to coarse sand, no fines (SAMPLE 23 (5 in.))

SANDSTONE, loose, dk gray, silt to medium sand

CEMENTED ZONE

CEMENTED ZONE (SAMPLE 24 (strained tailings))

SITE: CAPITOLA FIRE STATION DATE: 8/10-18/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			200 61	CEMENTED ZONE
			62	
			63	SANDSTONE, dk gray, medium sand to fine gravel, grading to
92+			210 64	SANDSTONE, loose, dk gray, fine to coarse sand w/ 25% fine gravel (SAMPLE 25 (5.5 in.))
			65	
			66	
			220 67	
			68	
			69	
			230 70	
			71	
			72	SANDSTONE, loose, gray, silt to medium sand
			240 73	
			74	
			75	CEMENTED ZONE
			250 76	
			77	SANDSTONE, medium to coarse grained
			78	
			260 79	SANDSTONE, fine grained
			80	
			81	
			270 82	
75+			83	SANDSTONE, loose, dk brownish gray, fine to medium grained, no fines (SAMPLE 26 (6 in.))
			84	
			280 85	
			86	
			87	
			290 88	
			89	
			90	
			300 91	

SITE: CAPITOLA FIRE STATION DATE: 8/10-18/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			300 92	SANDSTONE, fine to medium grained
			93	
			94	
			310 95	
			96	
			97	
			320 98	
			99	
			100	
			330 101	
			102	
			103	
			340 104	
80+				SANDSTONE, loose, dk gray, fine to medium grained, no fines (SAMPLE 27 (6 in.))
			105	
			106	
			350 107	SANDSTONE, dk gray, coarse grained
				SANDSTONE, dk gray, fine grained
			108	
			109	
			360 110	
			111	
			112	
			370 113	
			114	
			115	
			380 116	
			117	
			118	
			390 119	
			120	
			121	
			400	

SITE: CAPITOLA FIRE STATION DATE: 8/10-18/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			400 122	SANDSTONE, dk gray, fine grained
			123	
			124	
			410 125	
			126	
			127	
			420 128	CEMENTED ZONE
			129	
			130	
			430 131	
			132	
			133	
			440 134	
			135	
			136	
			450 137	
			138	
			139	
			460 140	
			141	
			142	
			470 143	
			144	
			145	CEMENTED ZONE
			480 146	CEMENTED ZONE
			147	
			148	
			490 149	
			150	
			151	
			500 152	

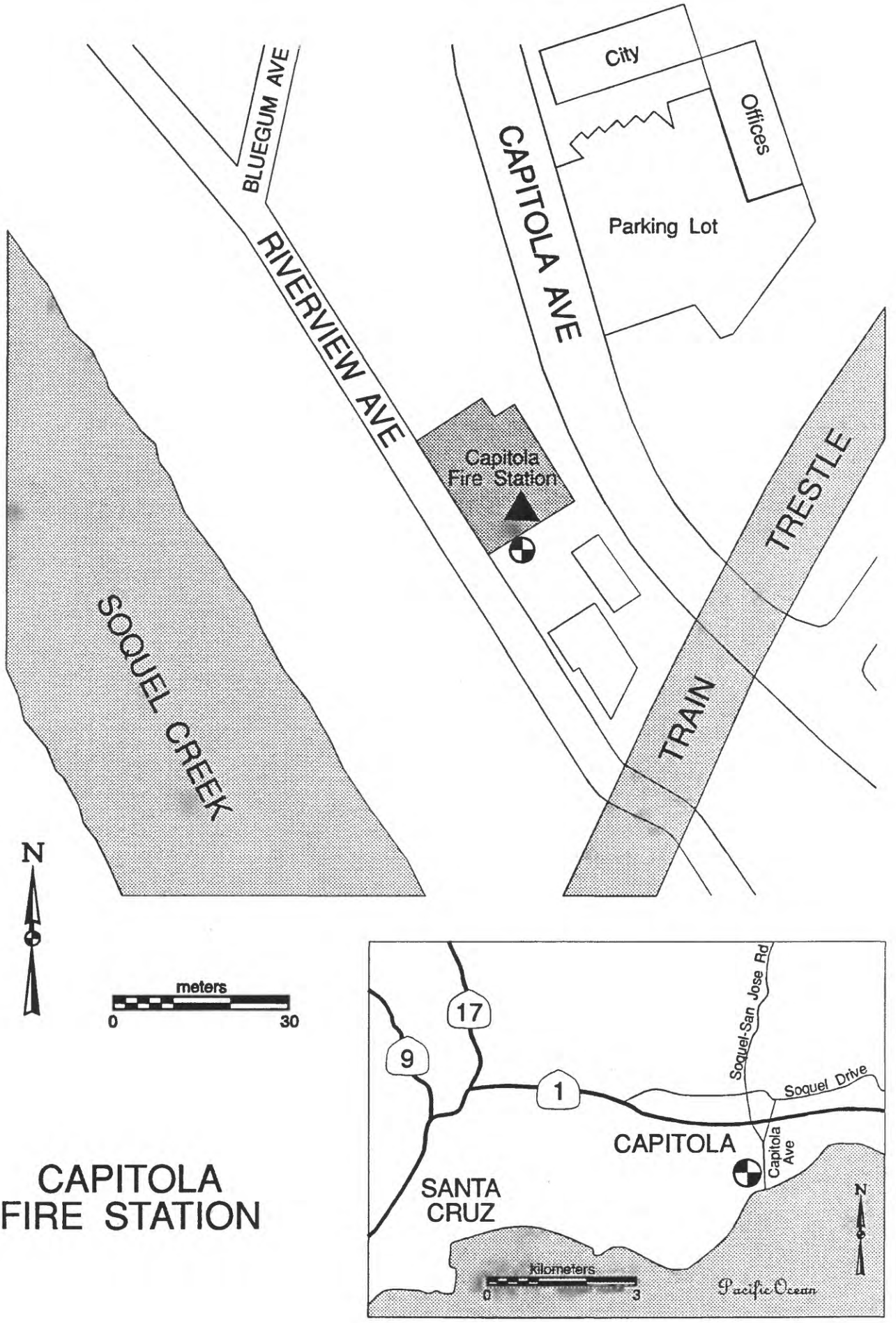
SITE: CAPITOLA FIRE STATION DATE: 8/10-18/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			500 153	SANDSTONE, loose, dk gray, silt to medium sand
			154	SANDSTONE, loose, dk gray, silt to medium sand
			155 510 156	
			157	SANDSTONE, dk gray, fine grained
			158 520 159	
			160 161 530 162	
			163 164	CEMENTED ZONE
			540 165	
			166 167 550 168	
			169 170 560 171	
			172 173 570 174	
			175 176 580 177	
			178 179 590 180	
			181 182 600	

SITE: CAPITOLA FIRE STATION

DATE: 8/10-18/92

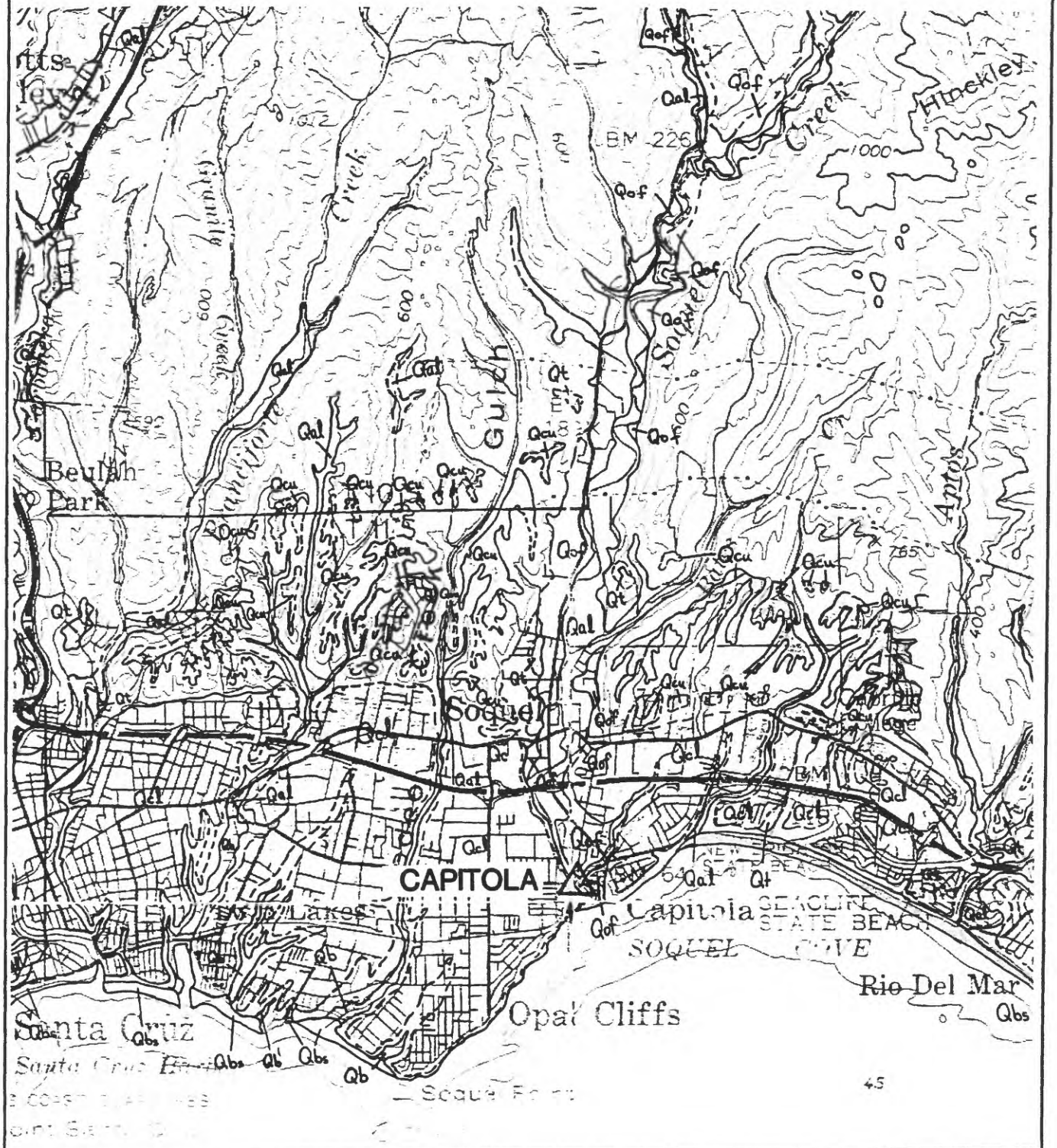
BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			600 183	
			184	
			185	
			610 186	
			187	
			188	
			620 189	
			190	
			191	
			630 192	
			193	
			194	
			640 195	
			196	
			197	
			650 198	
			199	
			200	
			660 201	
			202	
			203	
			670 204	
			205	
			206	
			680 207	
			208	
			209	
			690 210	
			211	
			212	
			700 213	



CAPITOLA FIRE STATION

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF – 648



SCALE 1:62 500

1 ½ 0 1 2 3 4 5 MILES

1 .5 0 1 2 3 4 5 6 7 KILOMETERS

MAPS SHOWING GEOLOGY AND LIQUEFACTION POTENTIAL OF QUATERNARY DEPOSITS IN SANTA CRUZ COUNTY, CALIFORNIA

by

William R. Dupré

1975

DESCRIPTION OF MAP UNITS

EAST OF SOQUEL CREEK

Qc — COLLUVIUM
For description, see West of Soquel Creek column

Qal — ALLUVIAL DEPOSITS, UNDIFFERENTIATED
For description, see West of Soquel Creek column

Qyf — YOUNGER FLOOD-PLAIN DEPOSITS (Holocene): Unconsolidated, relatively fine grained, heterogeneous deposits of sand and silt, commonly with relatively thin, discontinuous layers of clay. Gravel content increases toward the Santa Cruz Mountains and is locally abundant within channel and lower point bar deposits in natural levees and channels of meandering streams. Thickness generally less than 20 ft. Moderate permeability and porosity. Depth to water table commonly less than 5 ft. Relatively high susceptibility to flooding except in areas protected by artificial levees. Gravel-rich layers may be used for artificial ground-water recharge (Muir, 1972). High liquefaction potential. Includes Metz, Mocho, and Corralitos Soil Series (Storie and others, 1944)

Qof — OLDER FLOOD-PLAIN DEPOSITS (Holocene): Unconsolidated, relatively fine grained sand, silt, and clay. More than 200 ft thick beneath parts of the Pajaro and San Lorenzo River flood plain. Lower parts of these thick fluvial aggradational deposits are highly graveliferous, and serve as major ground-water aquifers beneath the Pajaro Valley (Muir, 1972). Rivers are presently entrenched as much as 20 ft below surface of these deposits except along coast. Moderate permeability and porosity. Depth to water table variable; generally more than 10 ft, commonly less than 5 ft near coast. High susceptibility to flooding only near the coast. High liquefaction potential in areas where water table high, elsewhere moderately high to moderately low. Includes Pajaro, Soquel, Salinas, and Botella Soil Series

Qf — ALLUVIAL FAN DEPOSITS (Holocene): Unconsolidated, moderately to poorly sorted sand, silt, and gravel, with layers of silty clay. Generally coarsest nearest the mountain front. Thickness uncertain, but may locally be greater than 50 ft. Present streams entrenched along entire fan. Depth to water table ranges from 10 to 20 ft; locally perched water tables may occur. Moderate permeability. Relatively low susceptibility to flooding. Possible area for ground-water recharge. Mostly moderately low liquefaction potential but moderately high where water saturated and well-sorted sand and silt present. Includes Soquel and Salinas Soil Series, and locally may include Elder Soil Series

Qb — BASIN DEPOSITS
For description, see West of Soquel Creek column

Qds — DUNE SAND (Holocene) Unconsolidated, well-sorted, fine- to medium-grained sand. Deposited as linear strip of coastal dunes. May be as much as 80 ft thick. High porosity and permeability. Well drained. Low susceptibility to flooding. Moderately high liquefaction potential. Soils poorly developed or absent. Accelerated erosion likely in areas where vegetation disturbed or removed

Qbs — BEACH SAND
For description, see West of Soquel Creek column

Qcf — ABANDONED CHANNEL FILL DEPOSITS (Holocene): Unconsolidated, plastic, poorly sorted clay, silty clay, and silt. Deposited within abandoned channels on younger and older flood-plain deposits. Thickness generally less than 10 ft. Low permeability. Poor drainage. High susceptibility to flooding. High liquefaction potential. May include Alviso, Clear Lake, and Soquel Soil Series

Qes — EOLIAN DEPOSITS OF SUNSET BEACH
For description, see West of Soquel Creek column

Qt — TERRACE DEPOSITS, UNDIFFERENTIATED
For description see, West of Soquel Creek column

QTc — CONTINENTAL DEPOSITS, UNDIFFERENTIATED (Pliocene? and Pleistocene): Semiconsolidated, relatively fine grained, oxidized sand and silt. Generally underlie fluvial lithofacies (Qaf). May represent highly weathered eolian deposits formed on Pliocene marine deposits (Purisima Formation). Moderate permeability and porosity. Low liquefaction potential. Erosion problems in areas where poorly consolidated parts of unit are exposed. Includes Moro Cojo Soil Series

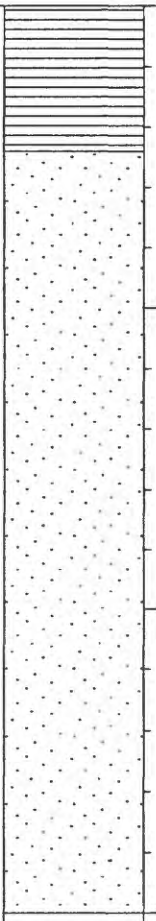
SITE: CORRALITOS DATE:

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	CLAY LOAM, dark reddish brown (5YR 3/2), some rock fragments (LANDSLIDE DEPOSITS)
			1	brown (7.5YR 4/4)
				FINE GRAVELLY CLAY LOAM, dark brown (7.5YR 3/4)
			2	
				VERY GRAVELLY CLAY LOAM, dark brown (7.5YR 3/4)
			10 3	
				strong brown (7.5YR 4/6)
			4	
			5	
				SHALE, black, hard, very closely fractured (LANSLIDE DEPOSITS)
			20 6	numerous seams of very dark grey (7.5YR 3/1) sandy clay
			7	
			8	
				harder, close to moderately fractured shale
			30 9	
			10	softer, very closely fractured shale, some clay seams
			11	
			12	
			40	
			13	harder
				soft, very closely fractured
			14	
			15	harder, closely to moderately fractured
			50	

SITE: CORRALITOS DATE:

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50	soft
			16	harder, closely to moderately fractured, some thin seams of sandy clay
				soft, very closely fractured with some moderately fractured knots, some seams of brownish yellow (10YR 6/6) sandy clay
			17	
			18	
			60	
			19	
			20	
			21	
			70	hard, closely to moderately fractured
			22	
			23	
			24	
			80	
			25	Clay seam, very soft (SLIDE PLANE?)
				SHALE, black, hard, closely to moderately fractured
			26	soft, very closely fractured
				hard, closely to moderately fractured
			27	
			90	
			28	softer, very closely to closely fractured
			29	hard
			30	softer, very closely to closely fractured, some clay seams
			100	

SITE: CORRALITOS DATE:

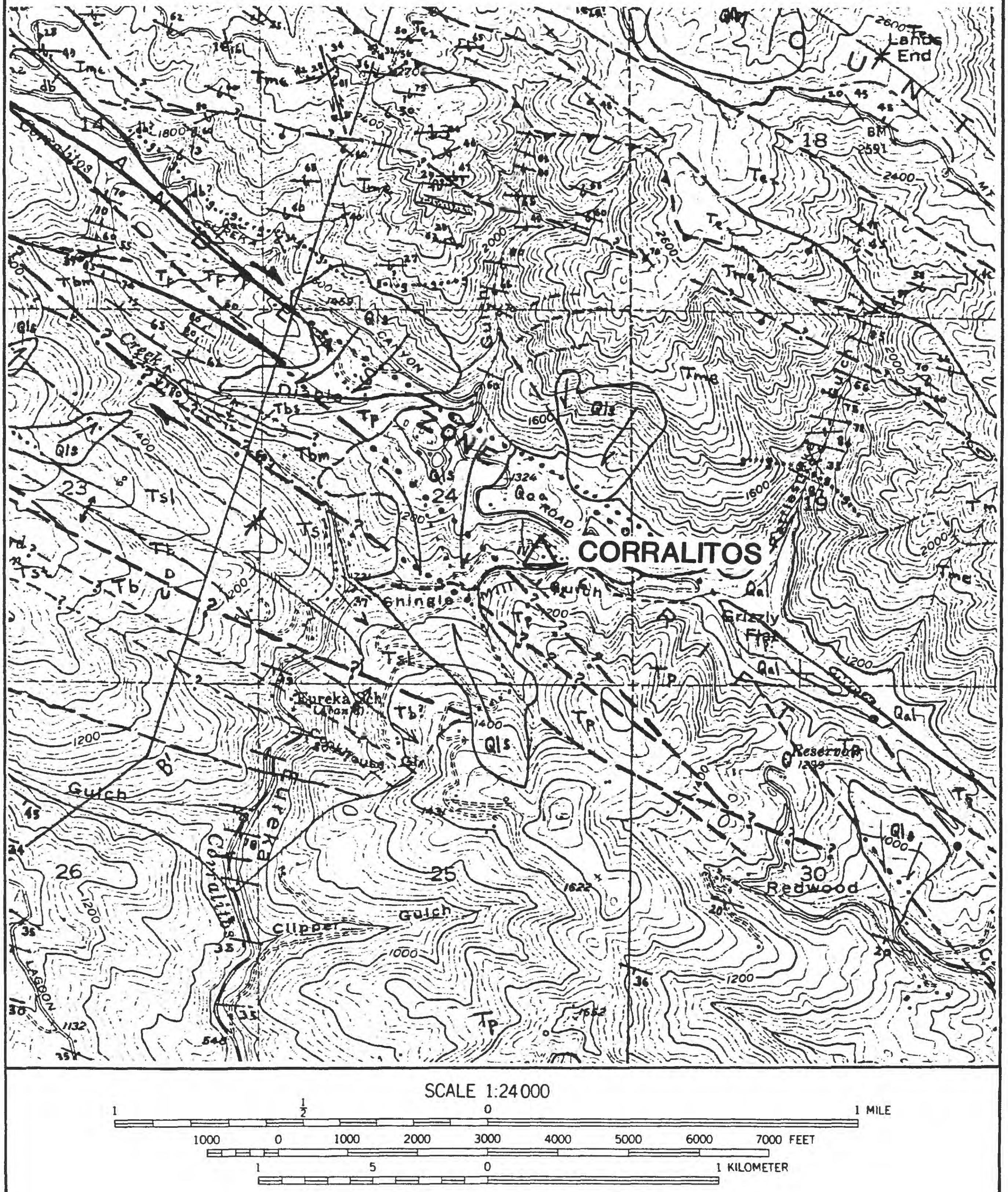
BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			100 31	hard, closely to moderately fractured
				softer, very closely to closely fractured (SLIDE PLANE?)
			32	SANDSTONE, grey, fine-grained, very hard, moderately fractured
			33	
			110 34	
			35	
			36	
			120 37	
			38	
			39	
			130 40	
			41	
			42	
			140 43	
			44	
			45	
			150	

DEPARTMENT OF INTERIOR

OPEN FILE MAP 88-752

GEOLOGICAL SURVEY

SHEET 1 OF 2



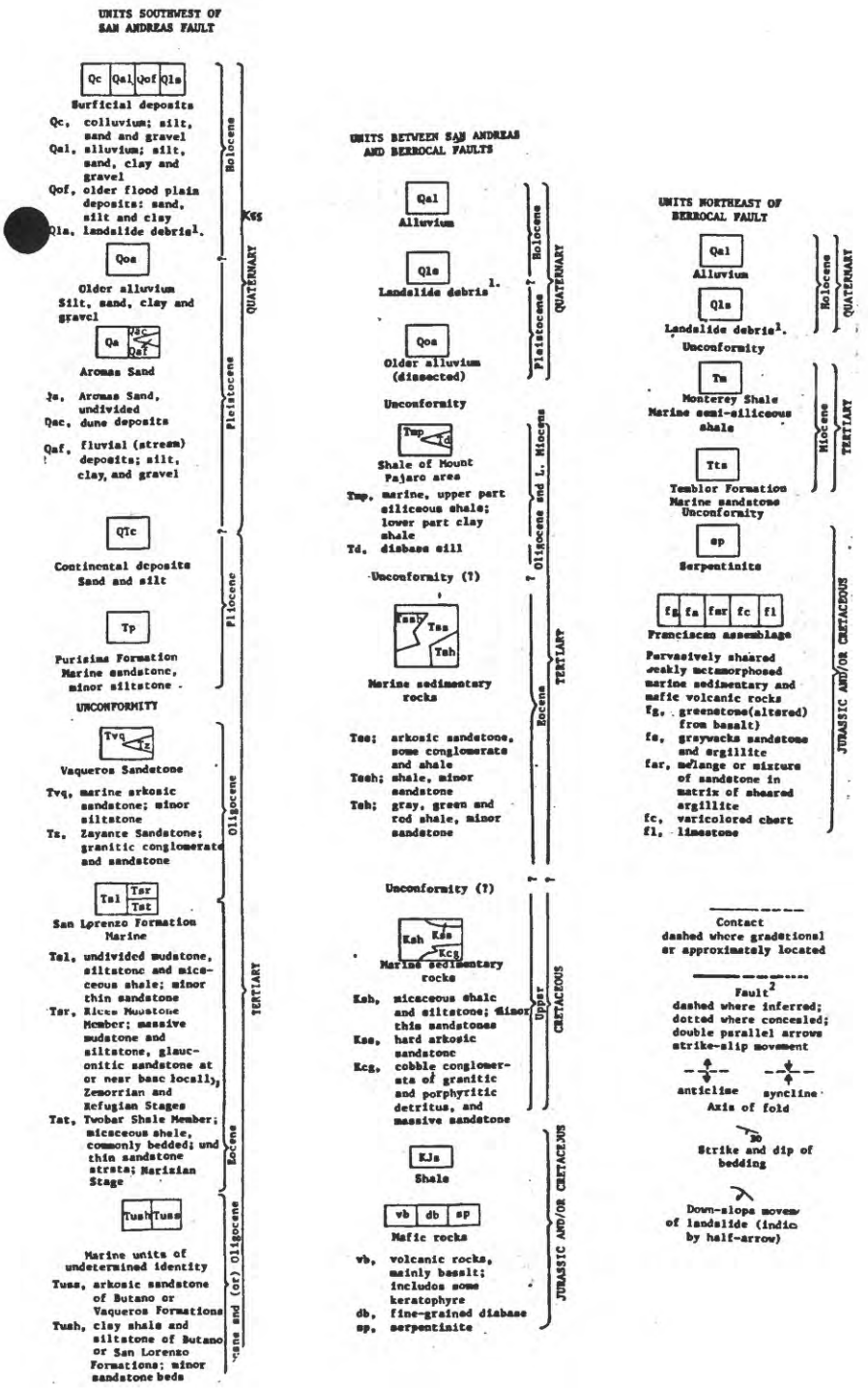
GEOLOGIC MAP AND STRUCTURE SECTIONS

OF THE LOMA PRIETA 7 1/2' QUADRANGLE,

SANTA CLARA AND SANTA CRUZ COUNTIES, CALIFORNIA

BY R. J. McLaughlin, J. C. Clark, and E. E. Brabb

1988

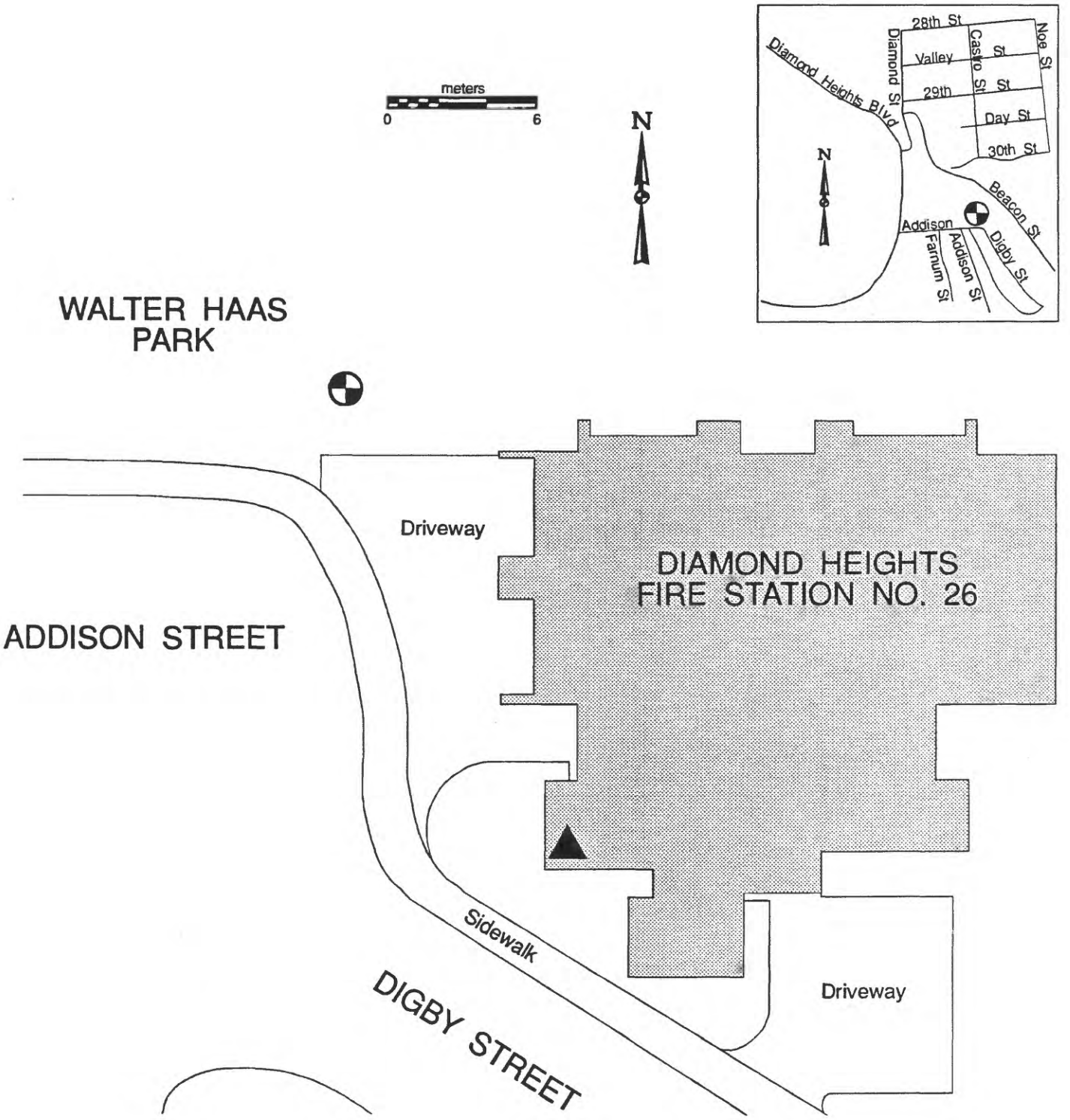

UNITS SOUTHWEST OF SAN ANDREAS FAULT
Qc Qal Qof Qls
Surficial deposits
Qc, colluvium; silt, sand and gravel
Qal, alluvium; silt, sand, clay and gravel
Qof, older flood plain deposits: sand, silt and clay
Qls, landslide debris[1].
Qoa
Older alluvium
Silt, sand, clay and gravel
Qa Qac Qaf
Aromas Sand
Qa, Aromas Sand, undivided
Qac, dune deposits
Qaf, fluvial (stream) deposits; silt, clay, and gravel
QTc
Continental deposits
Sand and silt
Tp
Purisima Formation
Marine sandstone, minor siltstone
UNCONFORMITY
Tvq Ts
Vaqueros Sandstone
Tvq, marine arkosic sandstone; minor siltstone
Ts, Zayante Sandstone; granitic conglomerate and sandstone
Tsl Tsr Tst
San Lorenzo Formation
Marine
Tsl, undivided mudstone, siltstone and micaceous shale; minor thin sandstone
Tsr, Rices Mudstone Member; massive mudstone and siltstone, glauconitic sandstone at or near base locally, Zemorrian and Refugian Stages
Tst, Twobar Shale Member; micaceous shale, commonly bedded; and thin sandstone strata; Narizian Stage
Tush Tuss
Marine units of undetermined identity
Tuss, arkosic sandstone of Butano or Vaqueros Formations
Tush, clay shale and siltstone of Butano or San Lorenzo Formations; minor sandstone beds
Holocene
Pleistocene
Pliocene
QUATERNARY
TERTIARY
Oligocene
Eocene
(or) Oligocene
UNITS BETWEEN SAN ANDREAS AND BERROCAL FAULTS
Qal
Alluvium
Qls
Landslide debris[1].
Qoa
Older alluvium (dissected)
Unconformity
Tmp Td
Shale of Mount Pajaro area
Tmp, marine, upper part siliceous shale; lower part clay shale
Td, diabase sill
Unconformity (?)
Tsa Tsh
Marine sedimentary rocks
Tsa; arkosic sandstone, some conglomerate and shale
Tsah; shale, minor sandstone
Tsh; gray, green and red shale, minor sandstone
Unconformity (?)
Ksh Ksa Kcg
Marine sedimentary rocks
Ksh, micaceous shale and siltstone; minor thin sandstones
Ksa, hard arkosic sandstone
Kcg, cobble conglomerata of granitic and porphyritic detritus, and massive sandstone
KJs
Shale
vb db sp
Mafic rocks
vb, volcanic rocks, mainly basalt; includes some keratophyre
db, fine-grained diabase
sp, serpentinite
Holocene
Pleistocene
QUATERNARY
Oligocene and L. Miocene
Eocene
TERTIARY
Upper CRETACEOUS
JURASSIC AND/OR CRETACEOUS
UNITS NORTHEAST OF BERROCAL FAULT
Qal
Alluvium
Qls
Landslide debris[1].
Unconformity
Tm
Monterey Shale
Marine semi-siliceous shale
Tts
Temblor Formation
Marine sandstone
Unconformity
sp
Serpentinite
fg fa far fc fl
Franciscan assemblage
Pervasively sheared weakly metamorphosed marine sedimentary and mafic volcanic rocks
fg, greenstone(altered from basalt)
fa, graywacke sandstone and argillite
far, melange or mixture of sandstone in matrix of sheared argillite
fc, varicolored chert
fl, limestone
Holocene
QUATERNARY
Miocene
TERTIARY
JURASSIC AND/OR CRETACEOUS
Contact
dashed where gradational or approximately located
Fault[2]
dashed where inferred; dotted where concealed; double parallel arrows strike-slip movement
anticline
syncline
Axis of fold
30
Strike and dip of bedding
Down-slope movement of landslide (indicated by half-arrow)

SITE: DIAMOND HEIGHTS FIRE STATION DATE: 8/4/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	CHERT, dark brown, closely to very closely fractured, with quartz veins (<1 cm), very weathered, soft
			1	
			2	harder, slightly less weathered
				CLAYSTONE, red, very weathered, very soft
			10 3	SANDSTONE, grayish green, medium grained, closely fractured, moderately weathered, firm
			4	CLAYSTONE, red, very soft
				CHERT, dark brown, closely fractured, moderately weathered, soft
			5	CLAYSTONE, red, soft
			20 6	CHERT, dark grey to red, closely fractured, moderately weathered, soft
			7	SANDSTONE, dark greenish brown, medium grained, moderately fractured, moderately weathered, hard
				CLAYSTONE, reddish-brown, soft
			8	
			30 9	
			10	
			11	SHALE, black, closely fractured, barely weathered, with quartz veins, hard
				soft, closely to very closely fractured
			40 12	
				very hard, unweathered
			13	
			14	
			15	
			50	

SITE: DIAMOND HEIGHTS FIRE STATION DATE: 8/4/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50 16	
			17	
			18 60	
			19	
			20	
			21 70	
			22	
			23	
			24 80	SANDSTONE, grey, fine grained, moderately fractured, harder
			25	
			26	
			27 90	
			28	
			29	
			30 100	



DIAMOND HEIGHTS FIRE STATION

SCALE 1:24000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

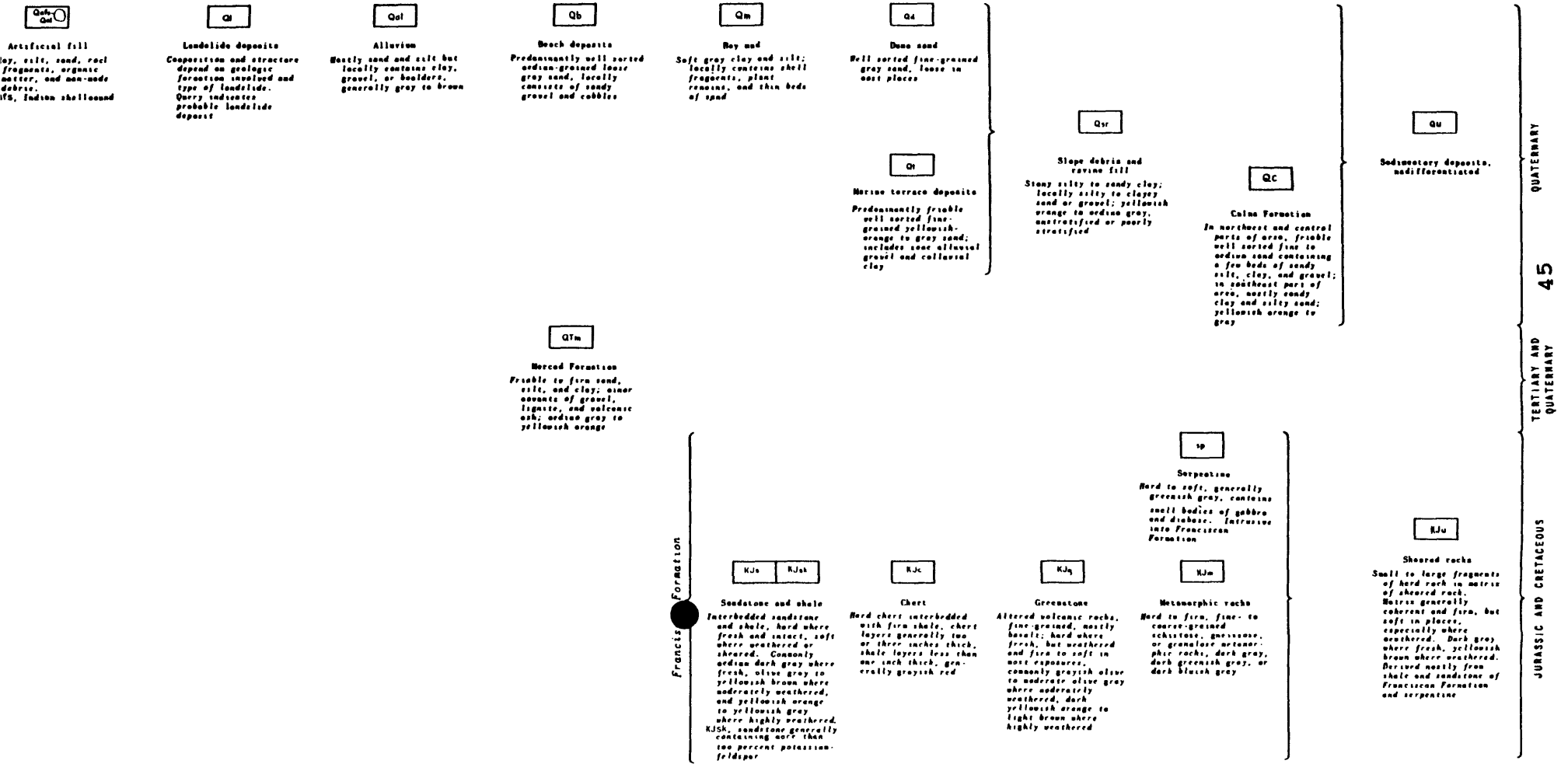
PRELIMINARY GEOLOGIC MAP OF THE SAN FRANCISCO SOUTH QUADRANGLE AND PART OF THE HUNTERS POINT QUADRANGLE, CALIFORNIA

by

M. G. Bonilla

1971

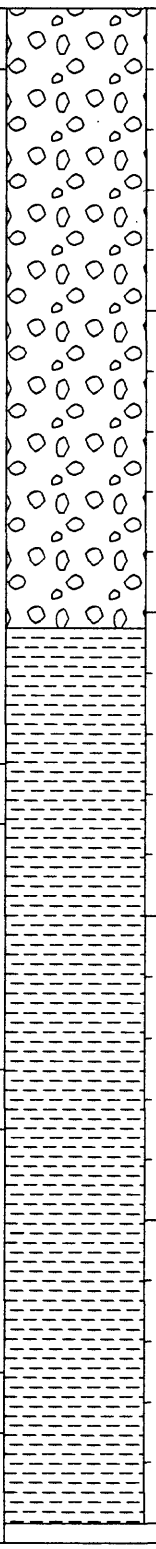
EXPLANATION



SITE: GILROY #2 (EPRI #1) DATE: 9/21/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	SANDY LOAM, dk. yellowish brown (HOLOCENE ALLUVIUM)
			1	
			2	dk. gray to dk. grayish brown
			3	
	S		10	
			4	
			5	
			6	SILTY CLAY LOAM, dk. grayish brown to brown
	S		20	
			7	
			8	
			9	
	S		30	LOAMY FINE SAND, brown, medium to coarse grained
			10	
			11	
			12	
	S		40	SAND, well sorted, v. coarse grained, some gravel
			13	
				CLAY, pale brown, v. stiff (PLEISTOCENE ALLUVIUM)
			14	
			15	SAND
			50	

SITE: GILROY #2 (EPRI #1) DATE: 9/21/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
	P		50 16	SANDY FINE GRAVEL, brown, mostly graywacke fragments
			17	
			60 18	
			19	
			20	
			70 21	
			22	CLAY, yellowish brown (PLEISTOCENE LAKE DEPOSITS)
	P		23	dk. greenish gray, v. stiff
			24	
			80 25	
			26	
	P		27	
			90 28	
			29	
	P		30	
			100	

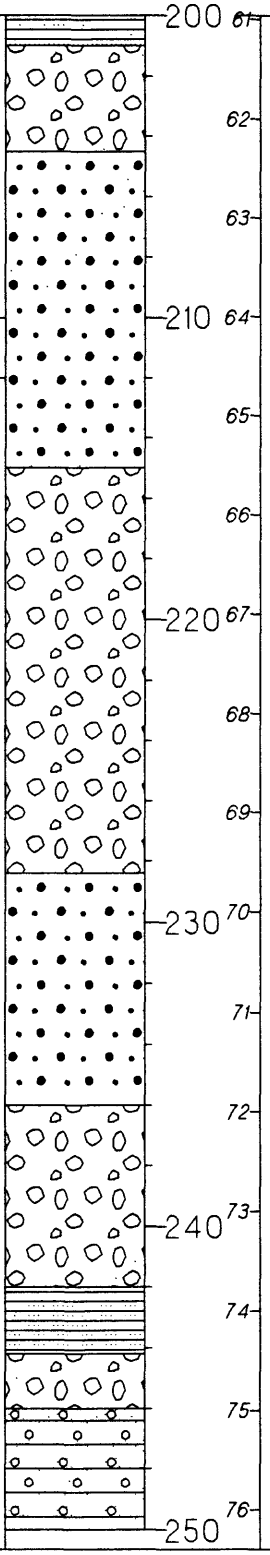
SITE: GILROY #2 (EPRI #1) DATE: 9/21/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
	P		100 31	FINE SANDY LOAM, dk. greenish gray
			32	
			110 33	
			34	SILTY CLAY, v. dk. greenish gray
	P		120 35	
			36	
			37	
			38	
			39	SANDY LOAM
			130 40	GRAVELLY SANDSTONE, strong brown, soft (SANTA CLARA FORMATION)
	P		41	
			140 42	
			43	
			44	
			45	
			150	

SITE: GILROY #2 (EPRI #1) DATE: 9/21/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			150 46	CONGLOMERATE
			47	
				GRAVELLY SANDSTONE, yellowish brown
			48	
			160 49	
			50	
			51	CONGLOMERATE
	P		170 52	
			53	
			54	
			180 55	
			56	
				GRAVELLY SANDSTONE, yellowish brown
			57	
			190 58	
			59	
				SANDY CLAYSTONE, brown to strong brown
			60	
			200	

SITE: GILROY #2 (EPRI #1) DATE: 9/21/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			200 61	
			62	CONGLOMERATE
			63	GRAVELLY SANDSTONE, yellowish brown
	P		210 64	
			65	
			66	CONGLOMERATE
			220 67	
			68	
			69	
			230 70	GRAVELLY SANDSTONE
			71	
			72	CONGLOMERATE
			240 73	
			74	SANDY CLAYSTONE
			75	CONGLOMERATE
				PEBBLY MUDSTONE, olive brown, v. poorly sorted
			250 76	

SITE: GILROY #2 (EPRI #1) DATE: 9/21/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			250 77	
			78	
			79 260	
	P		80	
			81	
			82 270	
			83	
			84	
			85 280	
			86	
			87	CONGLOMERATE
			88 290	CONGLOMERATE
			89	
			90	
	P		91 300	

SITE: GILROY #2 (EPRI #1) DATE: 9/21/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			300 92	
			93	SANDY MUDSTONE
			94	
			310 95	CONGLOMERATE
			96	SANDY MUDSTONE
			97	
			320 98	
			99	
			100	
			330 101	
			102	
			103	
			340 104	
			105	
	DH		106	SANDY CLAYSTONE, strong brown
			350	

SITE: GILROY #2 (EPRI #1) DATE: 9/21/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			350 107	
			108	SANDY CLAYSTONE, occasional thin lenses of gravel
			109	
			360 110	
			111	
			112	
			370 113	
			114	
			115	
	DH		380 116	SANDY MUDSTONE, v. dense, v. poorly sorted
			117	CONGLOMERATE
				SANDY CLAYSTONE
			118	
			390 119	GRAVELLY SANDY MUDSTONE, brown, v. dense
			120	
			121	
			400	

SITE: GILROY #2 (EPRI #1) DATE: 9/21/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
	DH		400 122 123 124 410 125 126 127 420 128 129 130 430 131 132 133 440 134 135 136 450 137	

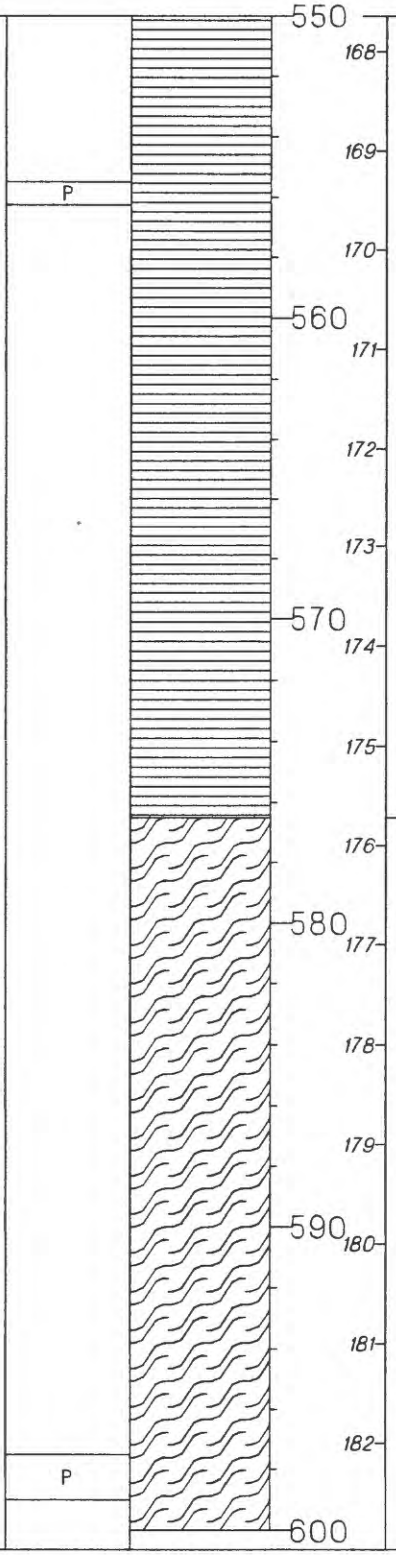
SITE: GILROY #2 (EPRI #1) DATE: 9/21/90

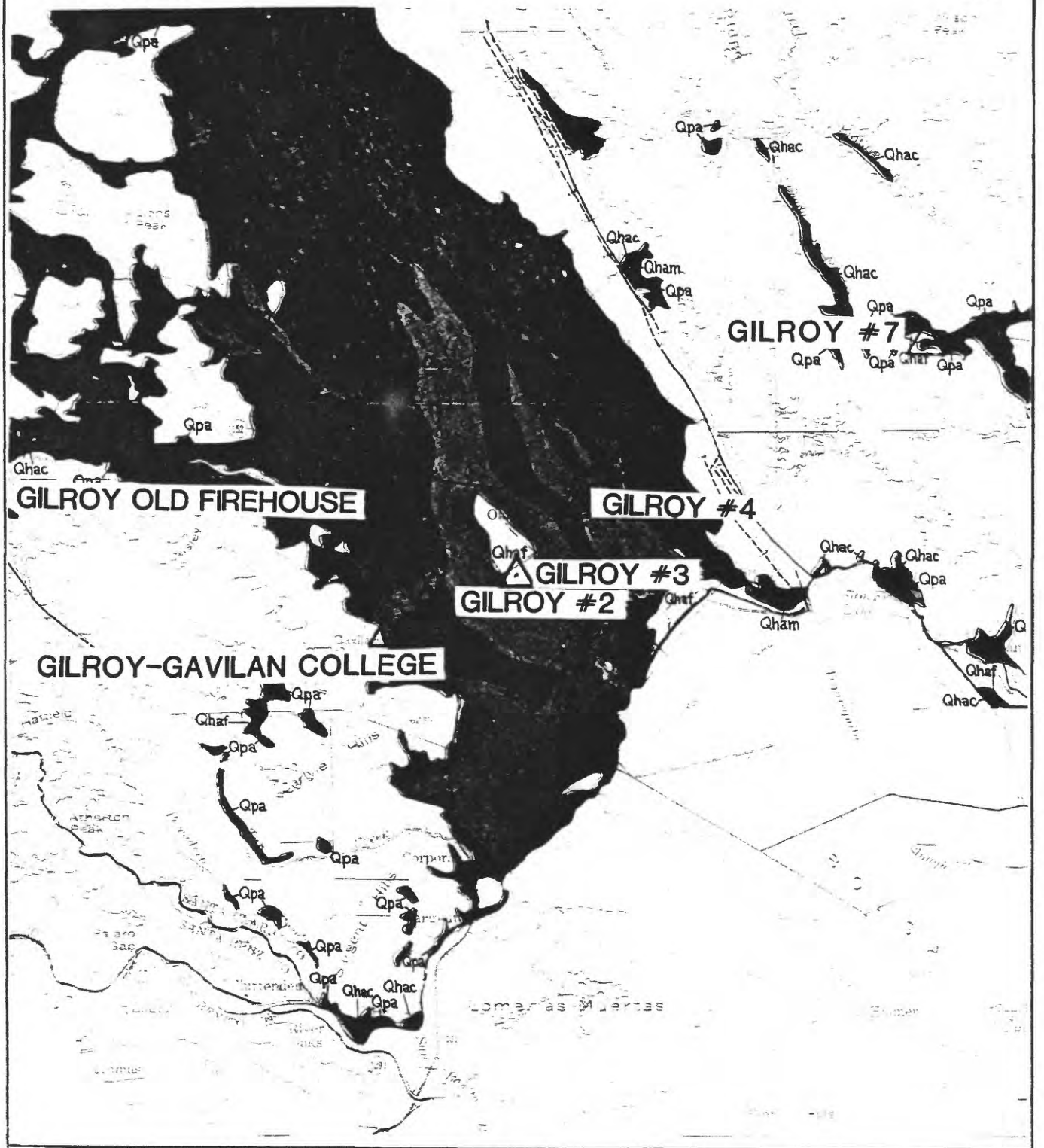
BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			450	
			138	
			139	
			140	
			460	
			141	
			142	
			143	
			470	
			144	CONGLOMERATE
			145	
			146	
			480	
	P		147	
			148	
			149	
			490	
			150	
			151	
			152	
			500	

SITE: GILROY #2 (EPRI #1) DATE: 9/21/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
	P		500 153 154 155 510 156 157 158 520 159 160 161 530 162 163 164 540 165 166 167 550	CONGLOMERATE

SITE: GILROY #2 (EPRI #1) DATE: 9/21/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
	P		550 168 169 170 560 171 172 173 570 174 175 176 580 177 178 179 590 180 181 182 600	SILTSTONE, brown, deeply weathered, v. close to close fracture spacing (MONTEREY SHALE)
	P			SERPENTINITE, v. dk. greenish gray, sheared, texture is SANDY CLAY



SCALE 1:125 000

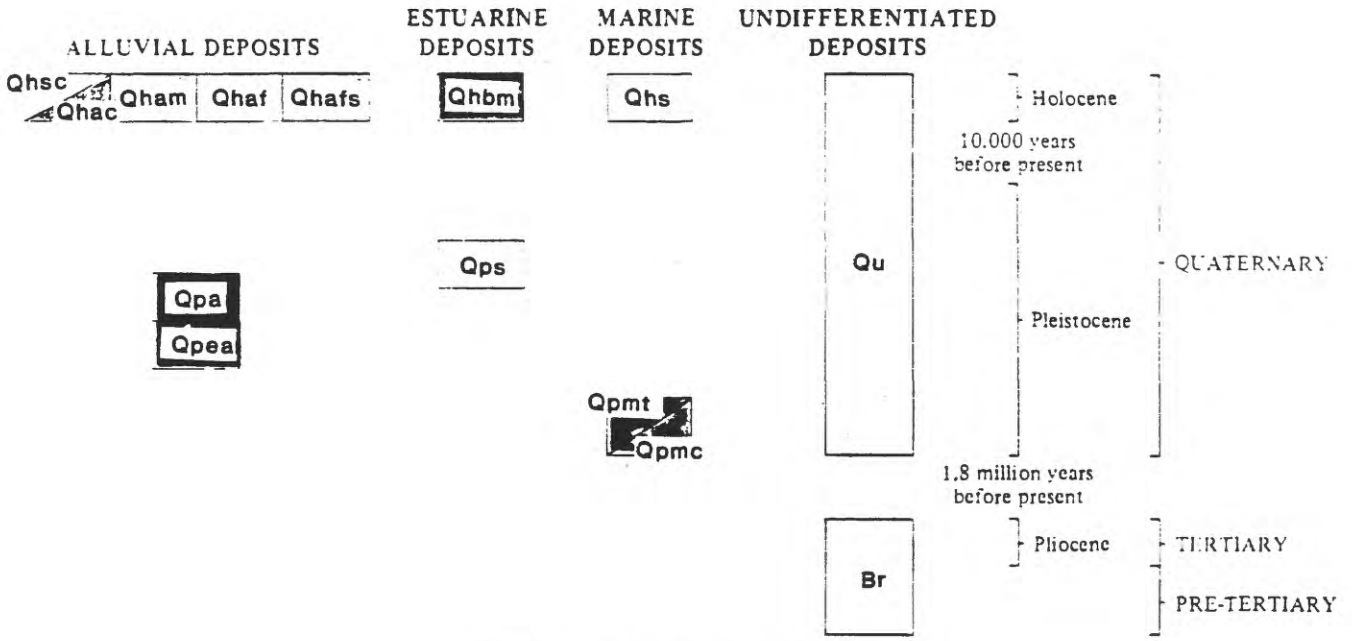
2 1 0 2 4 6 8 10 MILES

2 1 0 2 4 6 8 10 KILOMETERS

GEOLOGIC MAP OF THE FLATLAND DEPOSITS OF THE SOUTHERN PART OF THE SAN FRANCISCO BAY REGION

Geology by D. B. Burke, E. J. Helley, K. R. LaJoie, J. C. Tinsley, and G. E. Weber, 1972 - 74

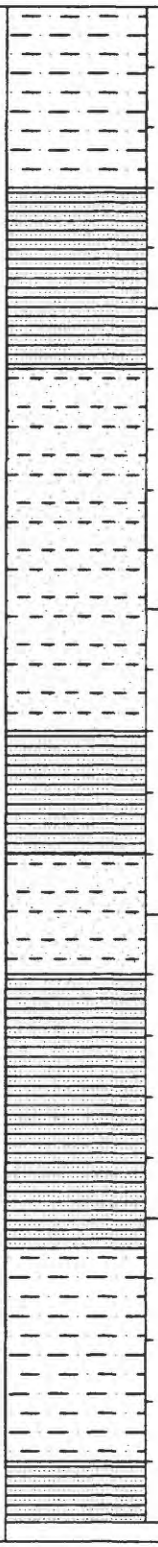
CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

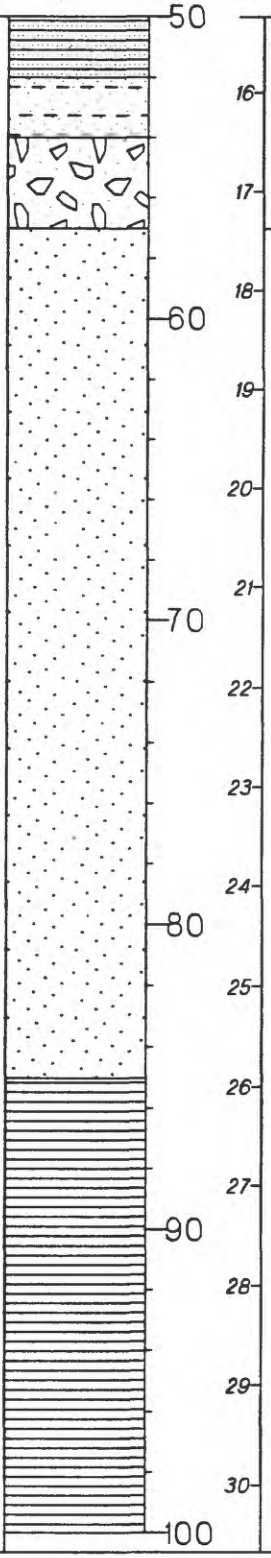
	Qhsc	STREAM CHANNELS – Open alluvial channels with movable beds, mapped where scale permits
G2,GOF ●	Qhac	COARSE-GRAINED ALLUVIUM – Unconsolidated, moderately sorted permeable sand and silt with coarse sand and gravel; more abundant toward fan heads
G4 ●	Qham	MEDIUM-GRAINED ALLUVIUM – Unconsolidated moderately sorted moderately sorted permeable fine sand, silt, and clayey silt with a few thin beds of coarse sand
G3 ●	Qhaf	FINE-GRAINED ALLUVIUM – Unconsolidated plastic moderately to poorly sorted carbonaceous silt and clay
	Qhafs	FINE-GRAINED SALT - AFFECTED ALLUVIUM – Unconsolidated plastic moderately to poorly sorted carbonaceous silt and clay. Irregularly bedded with carbonate nodules
	Qhbm	BAY MUD – Unconsolidated water-saturated dark plastic carbonaceous clay and silty clay
	Qhs	BEACH AND DUNE SAND DEPOSITS – Loose well-sorted fine- to medium-grained sand
G7,GGC ●	Qpa	LATE PLEISTOCENE ALLUVIUM – Weakly consolidated slightly weathered poorly sorted irregularly interbedded clay, silt, sand, and gravel
	Qps	PLEISTOCENE BEACH AND DUNE SAND DEPOSITS (MERRIT SAND) – Loose well-sorted fine to medium sand
	Qpea	EARLY PLEISTOCENE ALLUVIUM – Moderately consolidated deeply weathered poorly sorted irregularly interbedded clay, silt, sand, and gravel
	Qpmt	MARINE TERRACE DEPOSITS – Weakly consolidated slightly weathered sand and gravel
	Qpmc	COLMA FORMATION – Pale, loose or friable well-sorted fine- to medium-grained sandstone with subordinate gravel, sandstone, siltstone, and claystone
	Qu	UNDIVIDED QUATERNARY DEPOSITS – Not recognizable as discrete map units because original form obliterated by urbanization
	Br	UNDIVIDED BEDROCK – Older than Pleistocene

SITE: GILROY 7 – MONTELLI RANCH DATE:

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	CLAY LOAM, very dark greyish brown (10YR 3/2)
			1	
			2	GRAVELLY SANDY CLAY LOAM, dark brown (7.5YR 3/2), very poorly sorted, sandstone pebbles to 3 cm
			10 3	
			4	GRAVELLY CLAY LOAM, dark brown (7.5YR 3/2), 10–20% gravel (mostly sandstone, some shale), very stiff
			5	sandier
			20 6	
			7	
			8	SANDY CLAY LOAM, dark brown (7.5YR 3/4), sand to very coarse
			9	GRAVELLY CLAY LOAM very poorly sorted, 10–15% fine gravel (mostly shale
			30	
			10	SANDY CLAY LOAM, dark brown, very poorly sorted, some gravel, very stiff
			11	
			12	
			40	
			13	CLAY LOAM, dark brown (10YR 3/3)
			14	
			15	GRAVELLY SANDY LOAM
			50	

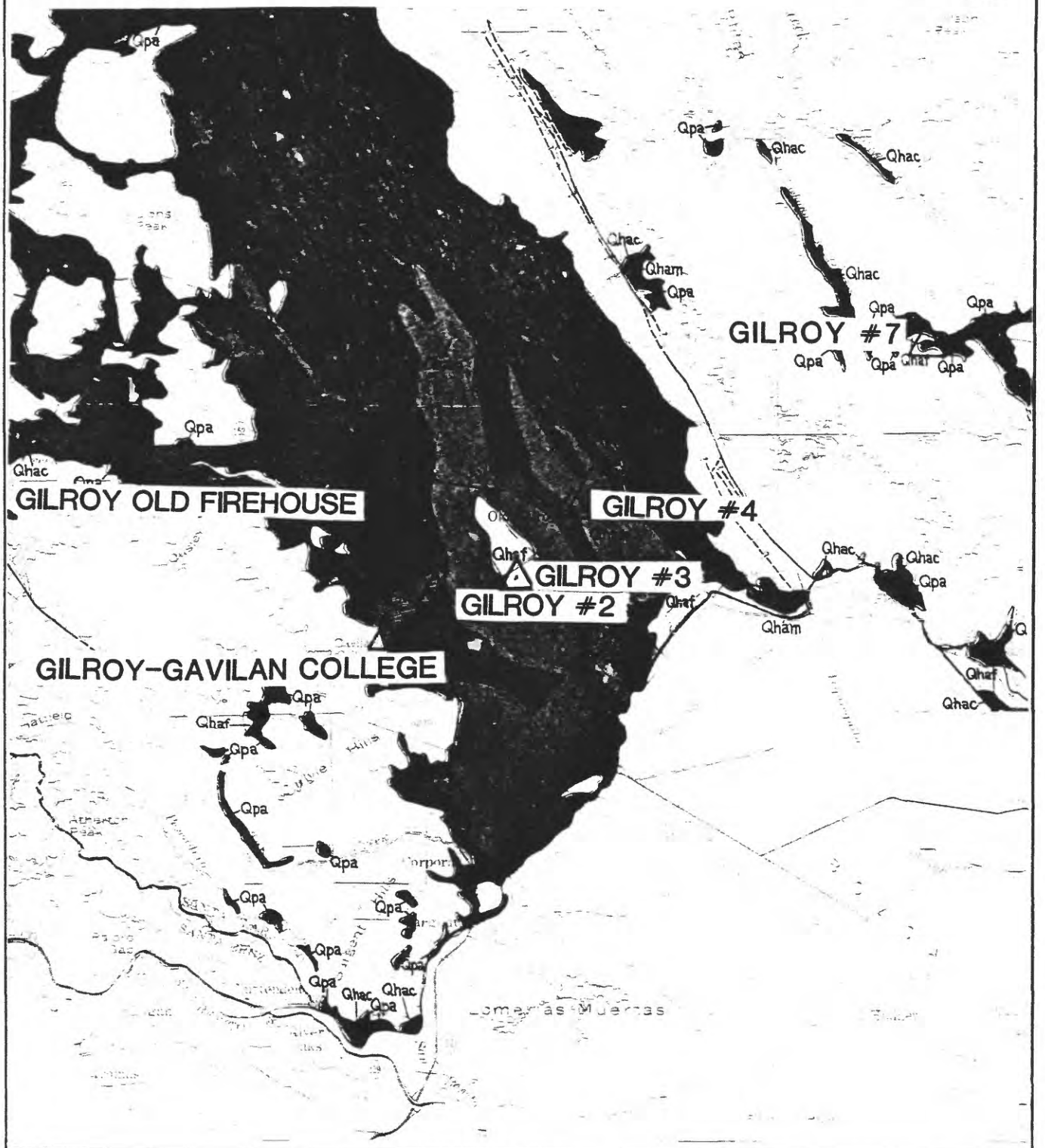
SITE: GILROY 7 – MONTELLI RANCH DATE:

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50 16	GRAVELLY CLAY LOAM, very poorly sorted
			17	SANDY GRAVEL, mostly sandstone, some shale, very dense
			18	SANDSTONE, grey, very fine grained, very firm
			60	hard
			19 20	
			21 70	
			22 23	
			24 80	
			25 26	SHALE, grey, with some siltstone and sandstone interbeds, slightly softer
			27 90	
			28 29	
			30 100	



SITE: GILROY 7 – MONTELLI RANCH DATE:

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			100 31	
			32	
			33	
			110 34	
			35	
			36	
			120 37	
			38	
			39	
			130 40	
			41	
			42	
			140 43	
			44	
			45	
			150	



SCALE 1:125 000

2 1 0 2 4 6 8 10 MILES

2 1 0 2 4 6 8 10 KILOMETERS

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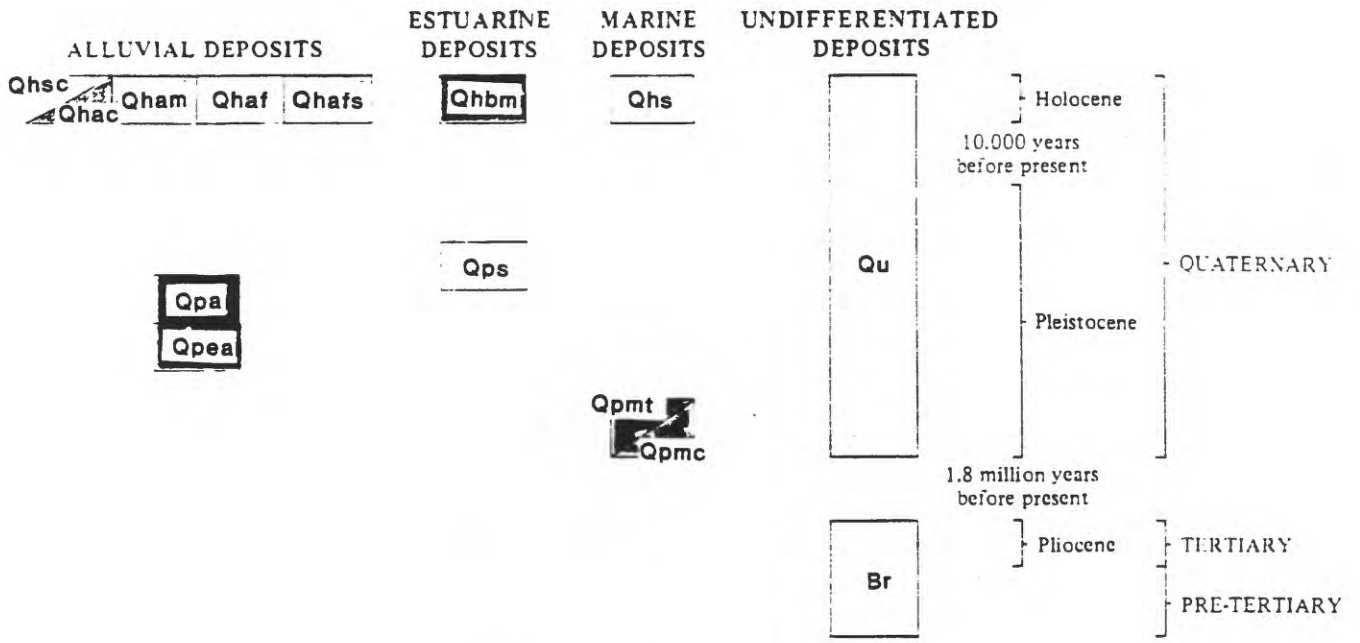
CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

	Qhsc	STREAM CHANNELS – Open alluvial channels with movable beds, mapped where scale permits
G2,GOF ●	Qhac	COARSE-GRAINED ALLUVIUM – Unconsolidated, moderately sorted permeable sand and silt with coarse sand and gravel; more abundant toward fan heads
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	Qhs	BEACH AND DUNE SAND DEPOSITS – Loose well-sorted fine- to medium-grained sand
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	Qps	PLEISTOCENE BEACH AND DUNE SAND DEPOSITS (MERRIT SAND) – Loose well-sorted fine to medium sand
	Qpea	EARLY PLEISTOCENE ALLUVIUM – Moderately consolidated deeply weathered poorly sorted irregularly interbedded clay, silt, sand, and gravel
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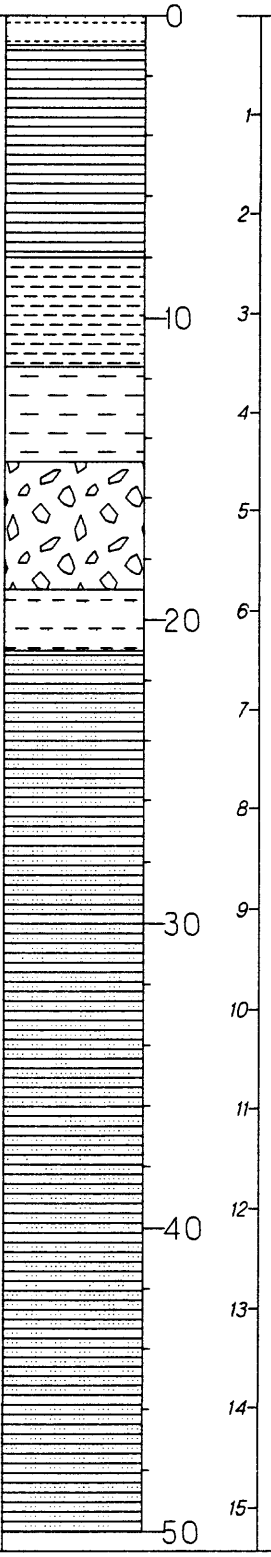
	Br	UNDIVIDED BEDROCK – Older than Pleistocene

SITE: HALLS VALLEY

DATE: 11/16/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0 1 2 10 3 4 5 20 6 7 8 9 30 10 11 12 40 13 14 15 50	CLAY, grey SILTY CLAY, greenish grey SANDY SILTY CLAY, reddish yellow GRAVEL, black, fine grained SANDY CLAY, gray dk greenish gray

SITE: HALLS VALLEY

DATE: 11/16/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50	
			16	
			17	SHALE, dk brownish gray, extremely weathered, very closely fractured, soft
				reddish yellow, very weathered
			18	
			60	black, somewhat weathered
			19	
			20	
			21	
			70	
			22	
			23	
			24	
			80	
			25	
			26	
			27	
			90	
			28	
			29	
			30	
			100	

SITE: HALLS VALLEY

DATE: 11/16/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			100 31	SANDY CLAYSTONE, dk greenish gray, slightly harder
			32	
			33	
			110 34	
			35	slightly harder, some coarse sand
			36	
			120 37	
			38	
			39	SILTSTONE, greenish white, somewhat weathered, closely fractured, hard
			130	greenish gray, unweathered
			40	
			41	
			42	
			140 43	
			44	SANDSTONE, grey, unweathered, moderately fractured, hard
			45	
			150	

SITE: HALLS VALLEY

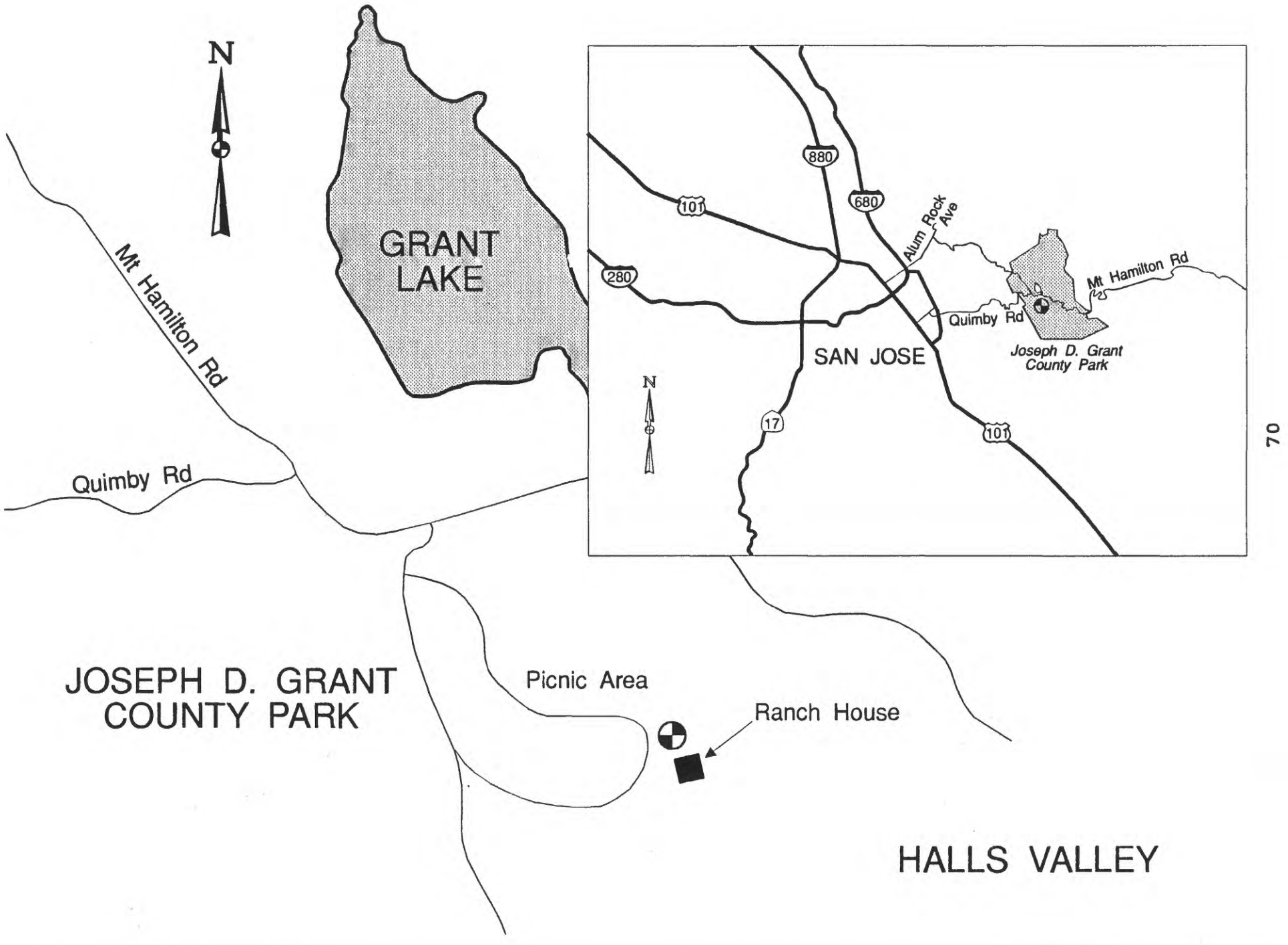
DATE: 11/16/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			150 46	
			47	
			48	
			160 49	
			50	
			51	
			170 52	
			53	
			54	SHALE, black, moderately fractured, hard
			180 55	
			56	
			57	
			190 58	
			59	
			60	
			200	

SITE: HALLS VALLEY

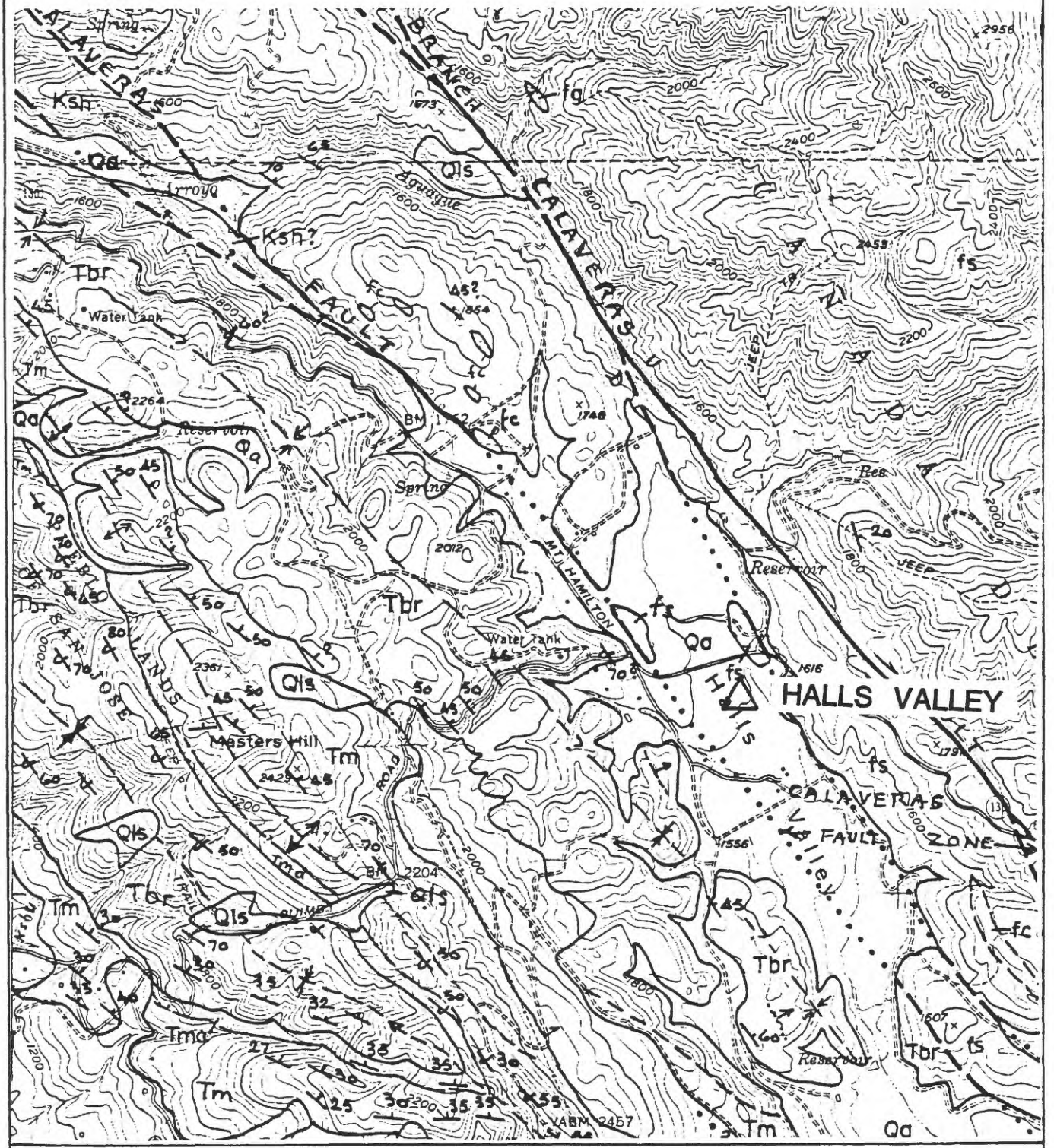
DATE: 11/16/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			200 61	
			62	
			63	
			210 64	
			65	
			66	
			220 67	
			68	
			69	
			230 70	
			71	
			72	
			240 73	
			74	
			75	
			250 76	


N
GRANT
LAKE
Mt Hamilton Rd
Quimby Rd
JOSEPH D. GRANT
COUNTY PARK
Picnic Area
Ranch House
HALLS VALLEY
880
680
101
280
17
Alum Rock Ave
Mt Hamilton Rd
Quimby Rd
SAN JOSE
Joseph D. Grant
County Park

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

OPEN FILE MAP



SCALE 1:24 000

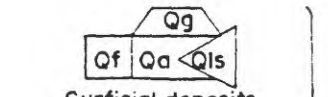
0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

PRELIMINARY GEOLOGIC MAP OF THE LICK OBSERVATORY QUADRANGLE, SANTA CLARA COUNTY, CALIFORNIA

By Thomas W. Dibblee Jr., 1972



Surficial deposits

Qg, stream gravel and sand
Qf, alluvial fan gravel
Qa, alluvium (gravel, sand and clay)
Qls, landslide debris

Qoa

Older alluvium

UNCONFORMITY

Qsc

Santa Clara Formation (valley sediments, gravel and clay)

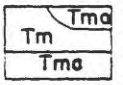
UNCONFORMITY

a

Andesitic rock

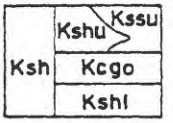
Tbr

Briones Sandstone (marine, Upper Miocene)



Monterey Shale (Claremont Shale Member)
Tm, siliceous shale
Tma, clay shale

UNCONFORMITY



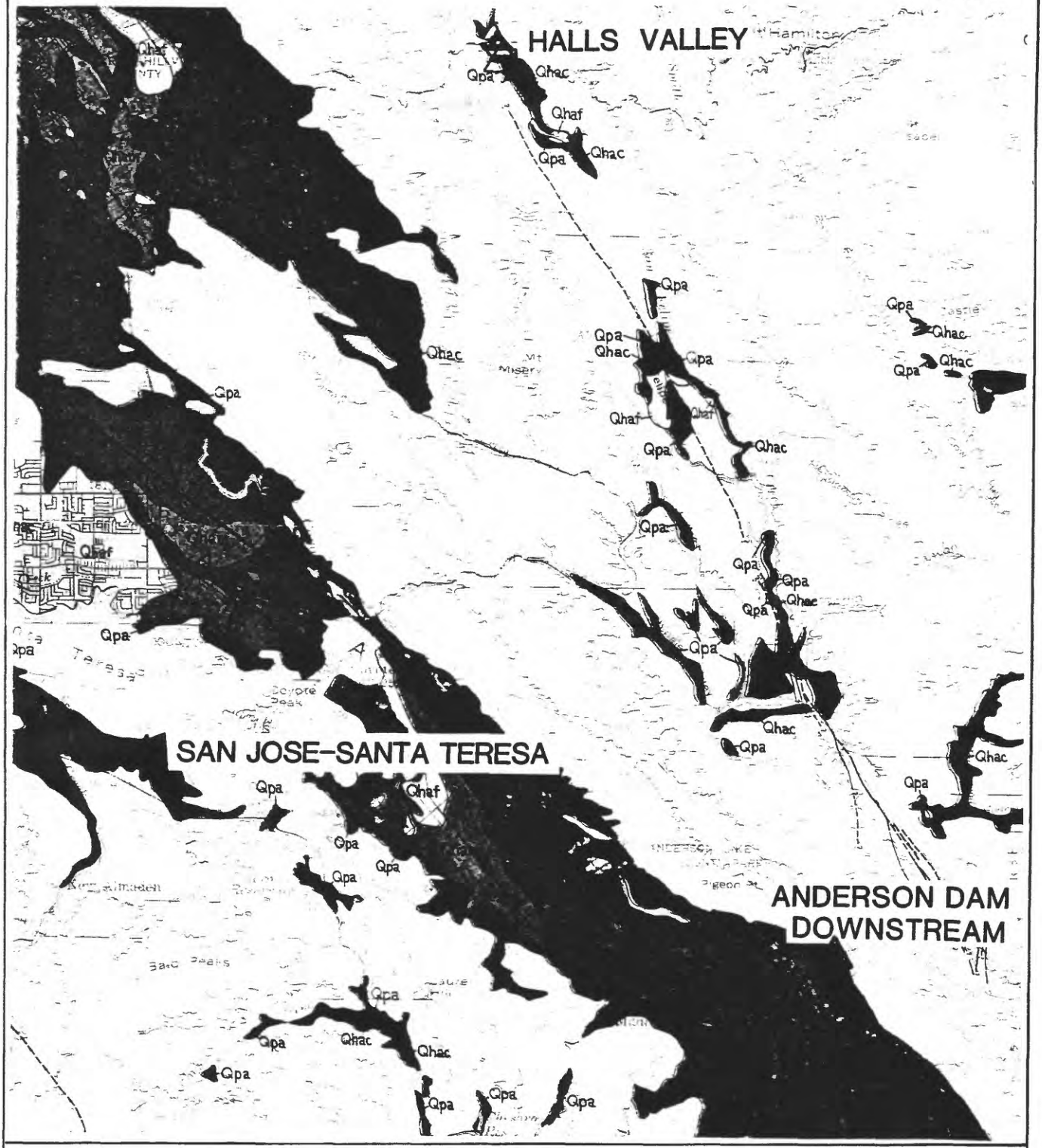
Marine sedimentary rocks
Ksh, micaceous shale, undivided
Kshu and Kssu, Berryessa Form. of Crittenden, 1950
Kshu, shale
Kssu, sandstone
Kcgo, Oakland conglomerate of Crittenden, 1950
Kshl, Knoxville Formation of Crittenden, 1950. micac. shale

sp

Serpentine

Franciscan rocks
fs, sandstone (graywacke) and micac. phyllitic shale
fg, greenstone
fc, chert
f, mixed rocks, mostly graywacke and shale pervasively sheared
gl, glaucophane blueschist

Holocene
Pleistocene
QUATERNARY
Miocene
TERTIARY
CRETACEOUS
JURASSIC AND/OR CRETACEOUS



SCALE 1:125 000

2 1 0 2 4 6 8 10 MILES

2 1 0 2 4 6 8 10 KILOMETERS

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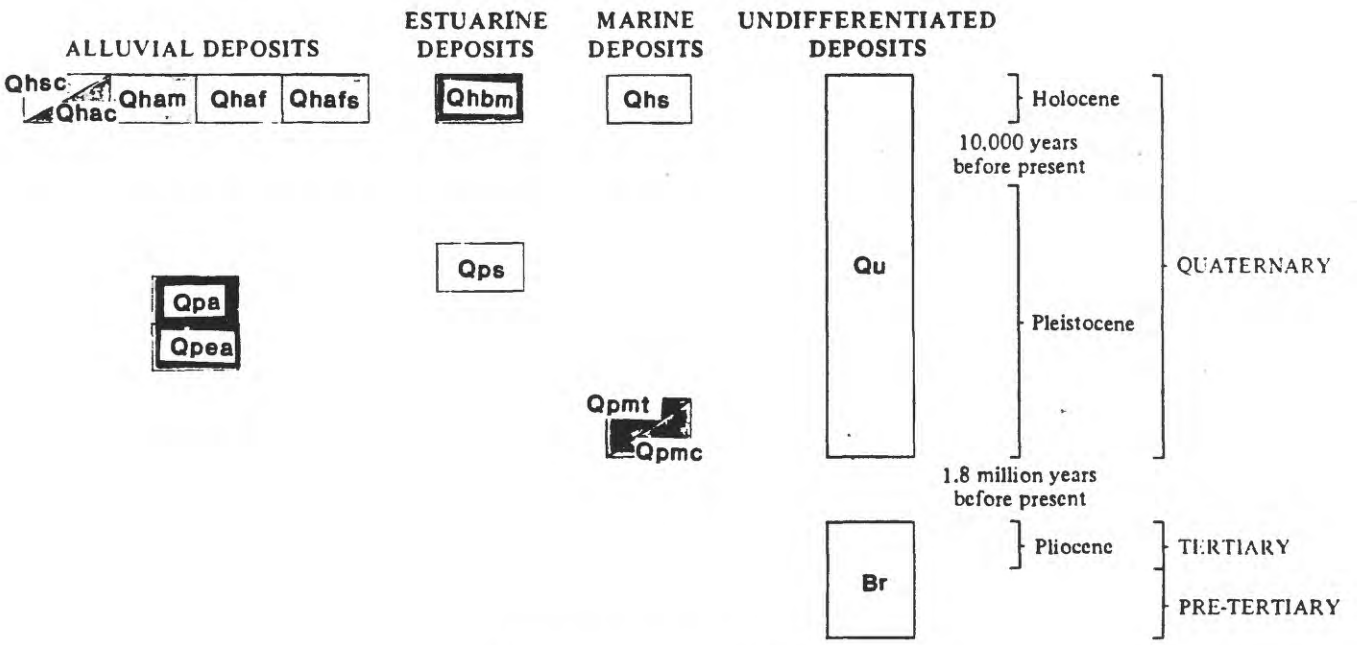
CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qhsc	STREAM CHANNELS – Open alluvial channels with movable beds, mapped where scale permits
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Qhafs	FINE-GRAINED SALT - AFFECTED ALLUVIUM – Unconsolidated plastic moderately to poorly sorted carbonaceous silt and clay. Irregularly bedded with carbonate nodules
Qhbm	BAY MUD – Unconsolidated water-saturated dark plastic carbonaceous clay and silty clay
Qhs	BEACH AND DUNE SAND DEPOSITS – Loose well-sorted fine- to medium-grained sand
Qpa	LATE PLEISTOCENE ALLUVIUM – Weakly consolidated slightly weathered poorly sorted irregularly interbedded clay, silt, sand, and gravel
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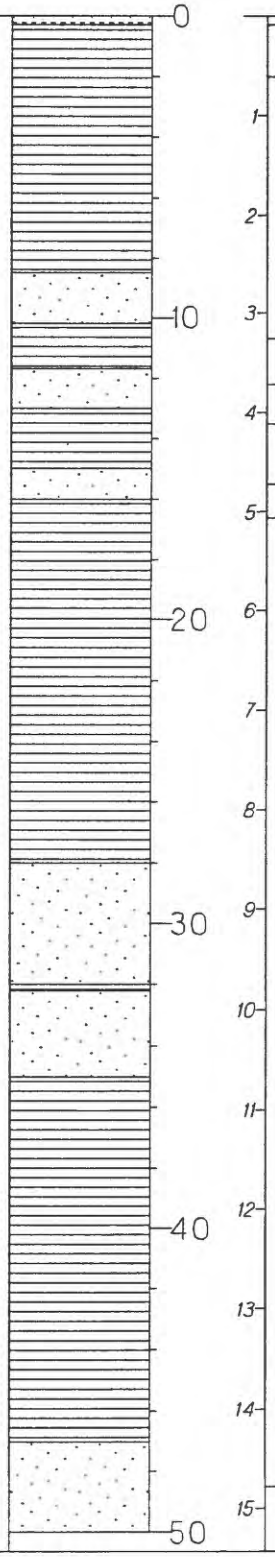
Qpmt	MARINE TERRACE DEPOSITS – Weakly consolidated slightly weathered sand and gravel
Qpmc	COLMA FORMATION – Pale, loose or friable well-sorted fine- to medium-grained sandstone with subordinate gravel, sandstone, siltstone, and claystone
Qu	UNDIVIDED QUATERNARY DEPOSITS – Not recognizable as discrete map units because original form obliterated by urbanization
Br	UNDIVIDED BEDROCK – Older than Pleistocene

SITE: LEXINGTON DAM

DATE: 7/22/92

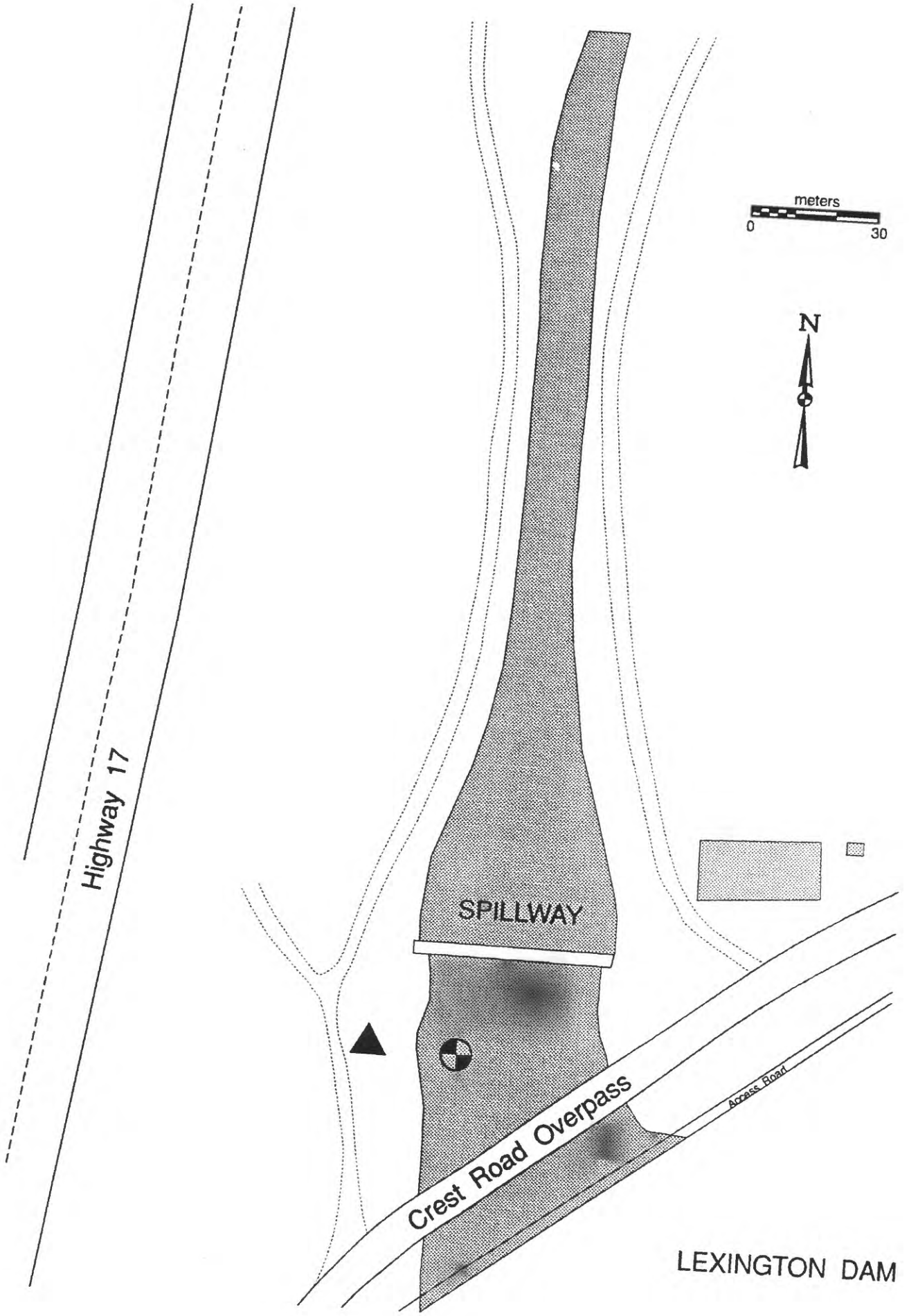


BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	SILTY LOAM, brown
				SHALE, dark grey, thinly bedded (< 5cm), very slightly weathered, stiff
			1	interbeds of dark greyish green medium sandstone
			2	very stiff
			3	SANDSTONE, dark greyish green, fine to medium grained, unweathered, hard
				SHALE, dark grey, softer
			4	SANDSTONE, dark greyish green, harder
				SHALE, dark grey, softer
			5	SANDSTONE, greenish grey, medium grained, harder
				SHALE, dark grey, softer
			6	
			7	
			8	
			9	SANDSTONE, greenish grey to dark greenish grey, medium grained, widely (> 30cm) bedded, harder
			10	
			11	SHALE, dark grey, softer
			12	
			13	seams of light greenish grey silty clay
			14	
				SANDSTONE, dark greenish grey, fine grained, harder
			15	harder, calcite veins (< 2cm thick)

SITE: LEXINGTON DAM

DATE: 7/22/92

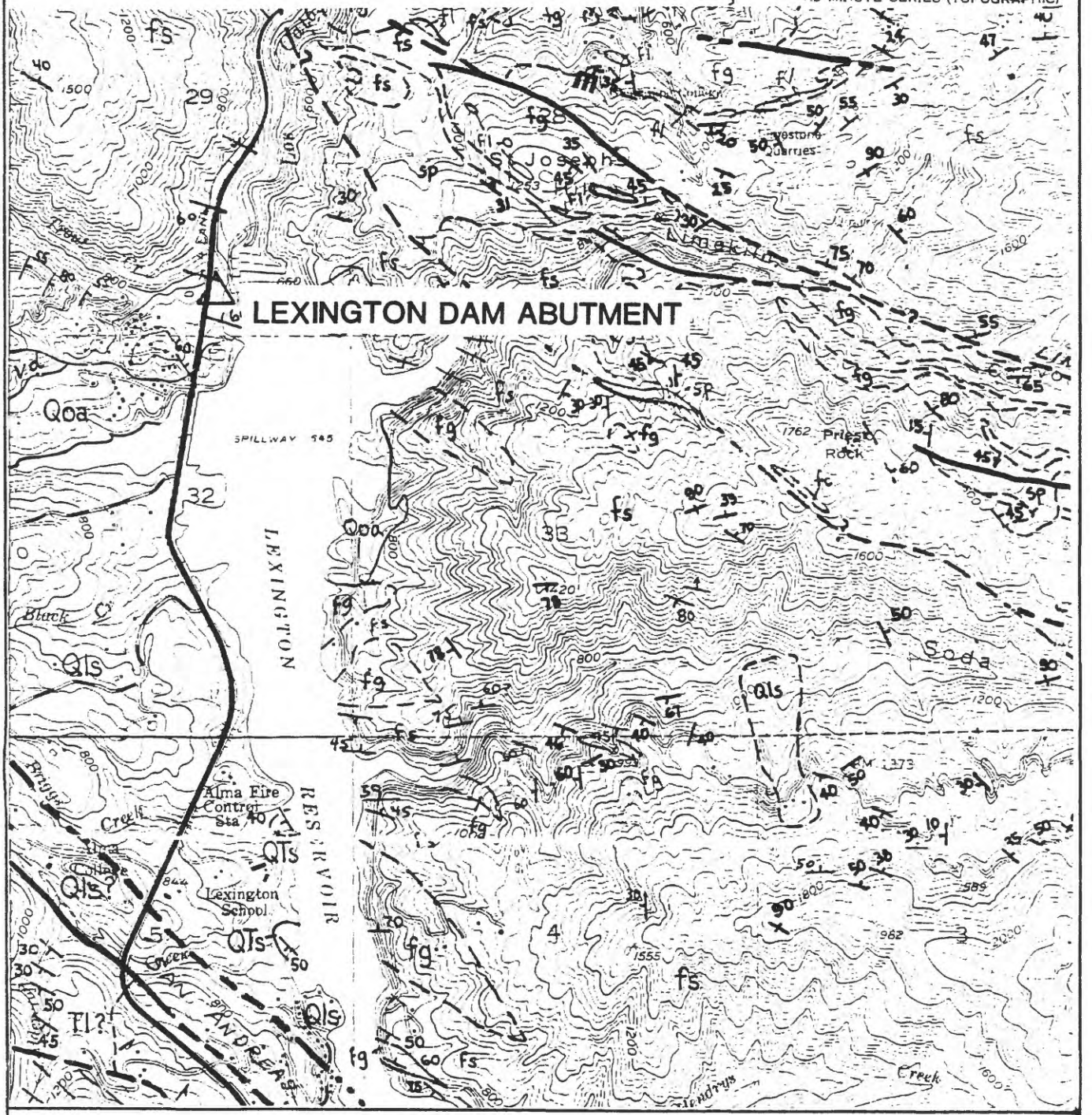
BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50	
				SILTSTONE, dark grey, softer
			16	SHALE, dark grey with calcite veins, slightly harder
				SILTSTONE, dark grey, softer
			17	
				SHALE, dark grey, with seams of light greenish grey silty clay; softer
			18	
			60	SILTSTONE, dark grey
			19	
			20	
				SANDSTONE, light greenish grey, medium grained, harder
			21	SILTSTONE, dark grey, softer
			70	
				SANDSTONE, dark greenish grey, medium grained, harder
			22	
			23	
				SILTSTONE, dark grey, softer
			24	
			80	
			25	
			26	
				SANDSTONE, dark greenish grey, medium grained, harder
			27	
			90	
			28	SILTSTONE, dark grey, softer
			29	
				very hard
			30	SANDSTONE, dark greenish grey, fine grained, very hard
			100	


meters
0
30
N
Highway 17
SPILLWAY
Crest Road Overpass
Access Road
LEXINGTON DAM

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

OPEN FILE REPORT 78-453

LOS GATOS QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)



SCALE 1:24000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

PRELIMINARY

GEOLOGIC MAP OF THE LOS GATOS QUADRANGLE, SANTA CLARA & SANTA CRUZ COUNTIES, CALIFORNIA

BY

Thomas W. Dibblee, Jr and Earl E. Brabb

1978

UNITS SOUTHWEST OF SAN ANDREAS FAULT

Qls
Landslide debris

Tp
Purisima Formation
Marine sandstone

UNCONFORMITY

Tl
Lambert ? Shale
Marine semi-siliceous shale

Tvq
Vaqueros Sandstone
Marine arkosic sandstone

Tsl | Tsr / Tst
San Lorenzo Formation
Marine
Tsl, undivided siltstone and claystone
Tsr, Rices Mudstone Member
mudstone and siltstone; includes glauconitic sandstone at and near base; Zemorrian and Refugian Stages
Tst, Twobar Shale Member
bedded micaceous shale and claystone; Narizian Stage

Tbs / Tb
Butano Sandstone
Marine arkosic sandstone and micaceous shale
Narizian Stage
Tbs, predominantly sandstone
Tb predominantly shale

QUATERNARY
Oligocene
TERTIARY
Eocene

UNITS NORTHEAST OF SAN ANDREAS FAULT

Qal
Surficial deposits

Qls
Landslide and mudflow deposits

Qoa
Older alluvium
Gravel, sand and clay

UNCONFORMITY

QTs
Santa Clara Formation
Valley gravel, clay and sand

UNCONFORMITY

Tm
Monterey Shale
Marine siliceous shale

Tvd
~~Dacite—rhyolite and dacite~~
breccia

Tt
Temblor (?) Formation
Marine arkosic sandstone

UNCONFORMITY

Tss / Tls
Sedimentary rocks
Tss, sandstone and shale
Tls, limestone

TKsh / TKss
Marine sedimentary rocks
TKsh, micaceous shale, minor thin sandstone strata
TKss, arkosic sandstone

Ksh / Kcg
Marine sedimentary rocks
Ksh, micaceous shale
Kcg, cobble conglomerate

Ka
Argillite

vb vd
Mafic igneous rocks, partly altered to greenstone
vb, basalt
vd, fine grained diorite

SD SC
Ultramafic rocks
SD, serpentinite
SC, silica-carbonate rock, altered from serpentinite

fm fg fs fc fl fsr
Franciscan rocks
Pervasively sheared weakly metamorphosed marine sedimentary and volcanic rocks
fm, metamorphic rocks schist
fg, greenstone, after basalt
fs, graywacke sandstone
fc, varicolored chert
fl, limestone
fsr, shear zone or melange of above rocks

Holocene
Pleistocene
QUATERNARY
Pliocene and Pleistocene
TERTIARY AND QUATERNARY
Miocene
Eocene
TERTIARY
Upper
CRETACEOUS
JURASSIC AND/OR CRETACEOUS

SITE: MARTINEZ V. A. HOSPITAL

DATE: 9/15/92

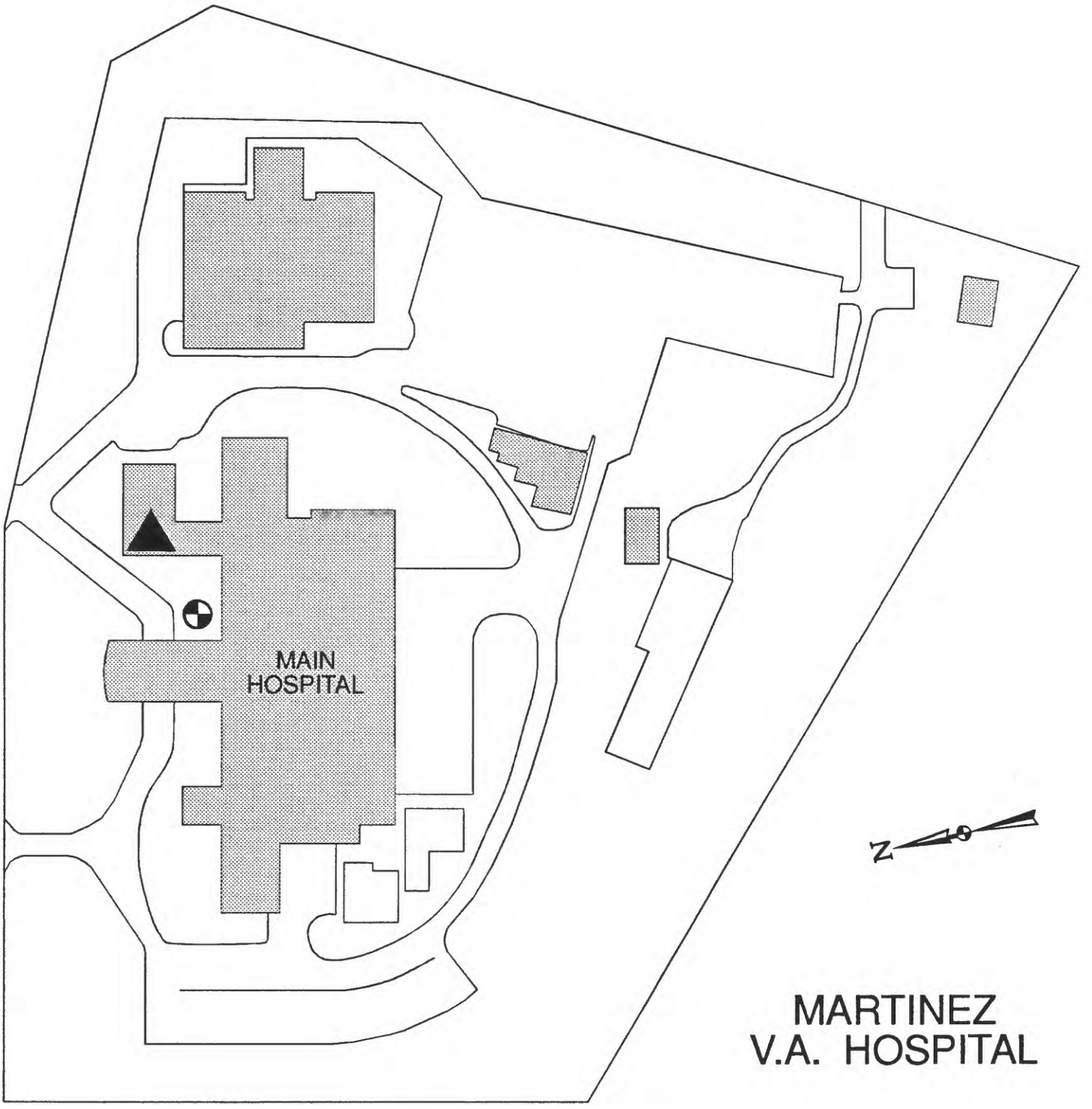
BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	SOIL, black
				CLAY, orange
			1	SANDY CLAY, orange, sand is fine grained
				CLAY, dk gray
			2	deep brown
			10	3 CLAY WITH GRAVEL, lt brown, gravel is fine grained
				CLAY, lt gray
			4	
				mottled lt grey and orange
			5	
			20	6
				orange
			7	
			8	SANDY CLAY, gray, sand is fine grained
			30	9
			10	slightly harder, sandier
			11	
			12	
			40	
			13	softer, less sandy
			14	
			15	
			50	

SITE: MARTINEZ V. A. HOSPITAL DATE: 9/15/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50 16	
			17	greyer, sand is fine to coarse grained
			18 60	
			19	
			20	
			21 70	
			22	
			23	sand is fine grained
			24 80	
			25	
			26	
			27 90	
			28	
				lt brown
			29	
			30	
				gray
			100	

SITE: MARTINEZ V. A. HOSPITAL DATE: 9/15/92

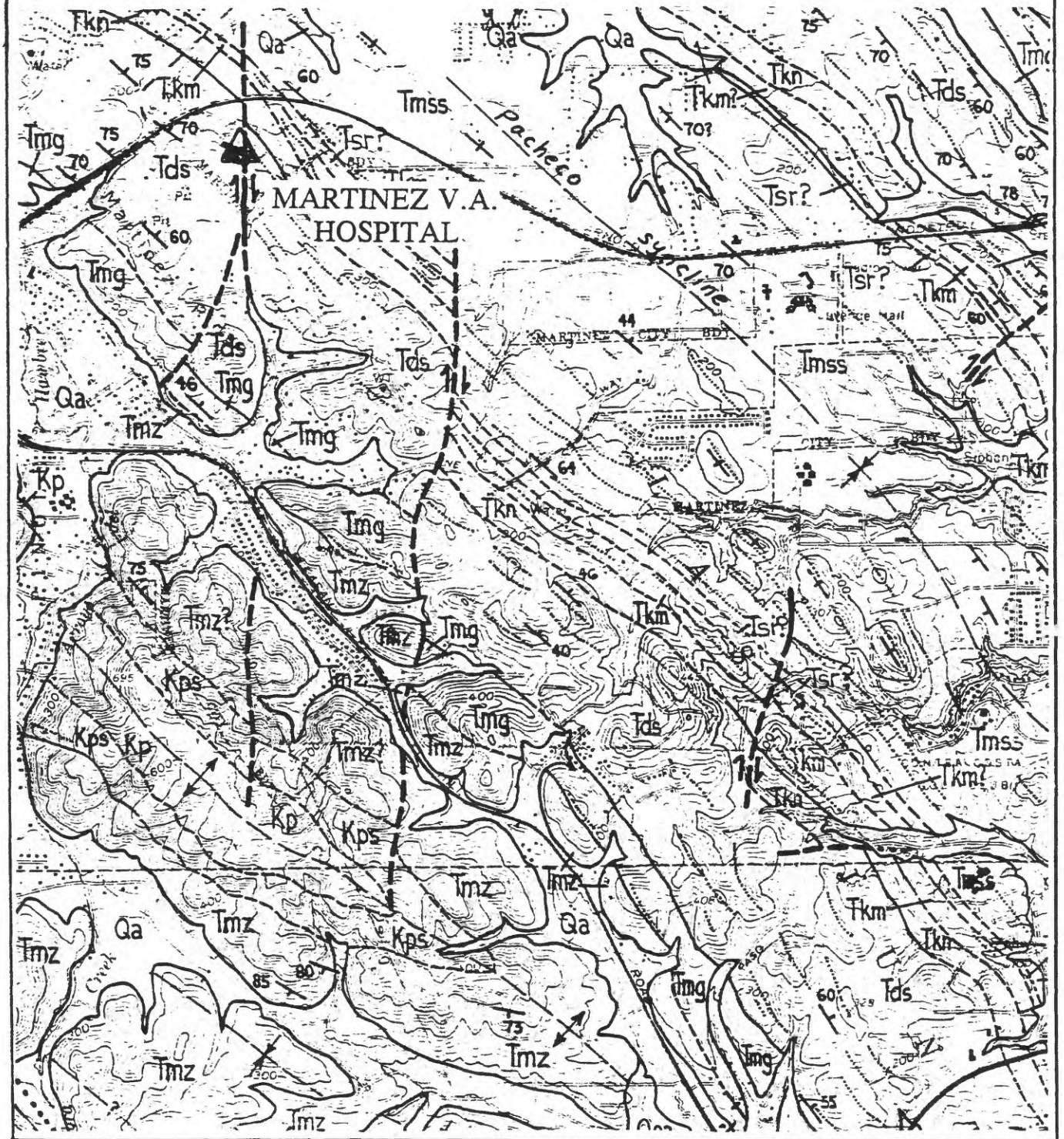
BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			100 31	
			32	
			33	
			110 34	
			35	
			36	
			120 37	
			38	
			39	
			130 40	
			41	
			42	
			140 43	
			44	
			45	
			150	



MARTINEZ
V.A. HOSPITAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

U.S. GEOLOGICAL SURVEY
OPEN FILE MAP



SCALE 1:24 000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

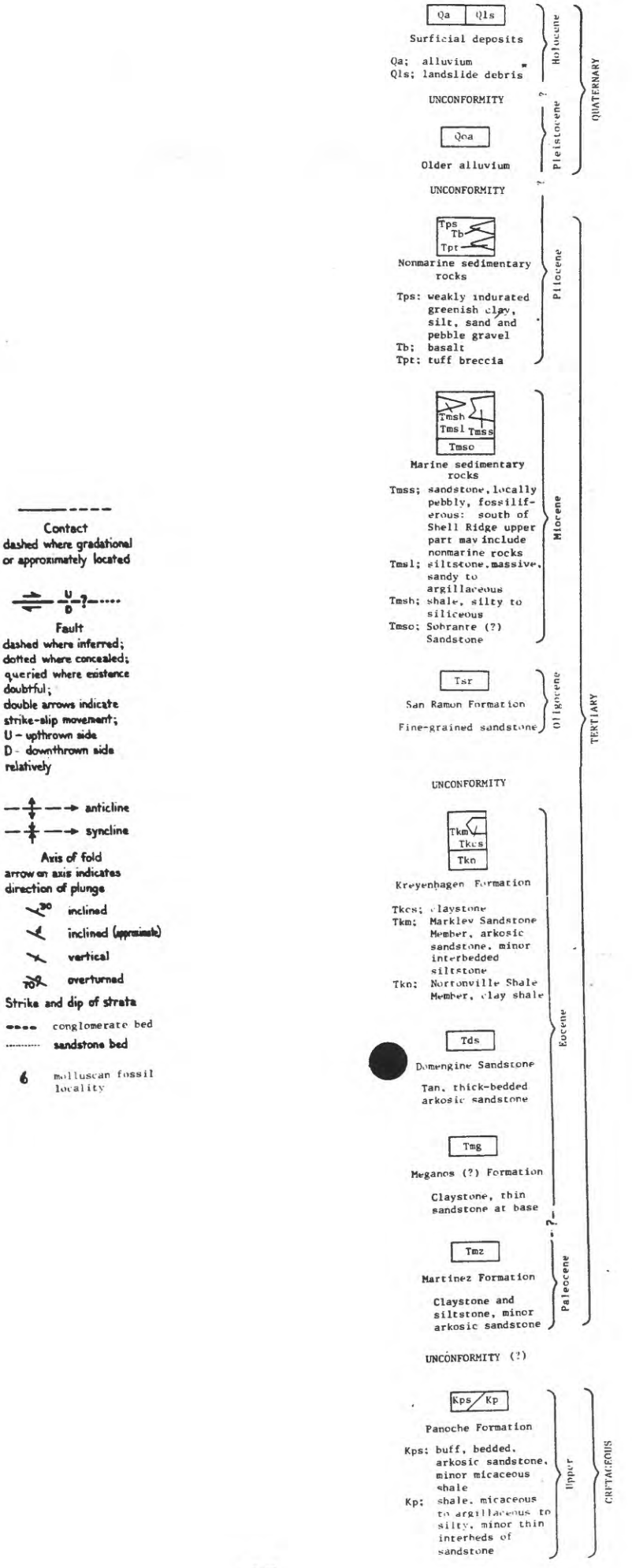
1 5 0 1 KILOMETER

PRELIMINARY GEOLOGIC MAP OF THE WALNUT CREEK QUADRANGLE, CONTRA COSTA COUNTY, CALIFORNIA

by

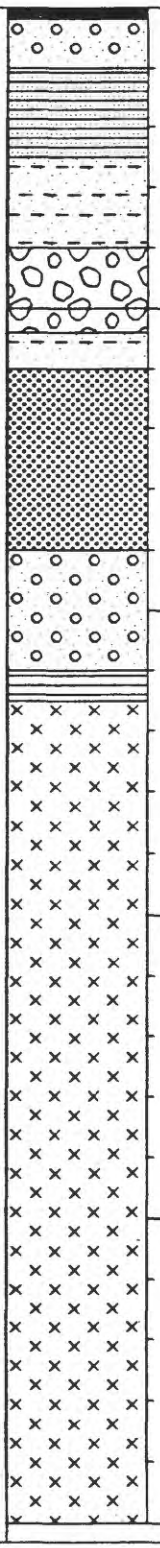
Thomas W. Dibblee, Jr.

1980


Qa
Qls
Surficial deposits
Qa; alluvium
Qls; landslide debris
Holocene
UNCONFORMITY
?
Qoa
Older alluvium
Pleistocene
QUATERNARY
UNCONFORMITY
Tps
Tb
Tpt
Nonmarine sedimentary rocks
Tps: weakly indurated greenish clay, silt, sand and pebble gravel
Tb; basalt
Tpt; tuff breccia
Pliocene
Tmsh
Tmsl
Tmss
Tmso
Marine sedimentary rocks
Tmss; sandstone, locally pebbly, fossiliferous: south of Shell Ridge upper part may include nonmarine rocks
Tmsl; siltstone, massive, sandy to argillaceous
Tmsh; shale, silty to siliceous
Tmso; Sobrante (?) Sandstone
Miocene
Tsr
San Ramon Formation
Fine-grained sandstone
Oligocene
TERTIARY
UNCONFORMITY
Tkm
Tkcs
Tkn
Kreyenhagen Formation
Tkcs; claystone
Tkm; Markley Sandstone Member, arkosic sandstone, minor interbedded siltstone
Tkn; Nortonville Shale Member, clay shale
Tds
Domengine Sandstone
Tan, thick-bedded arkosic sandstone
Tmg
Meganos (?) Formation
Claystone, thin sandstone at base
Eocene
Tmz
Martinez Formation
Claystone and siltstone, minor arkosic sandstone
Paleocene
UNCONFORMITY (?)
Kps
Kp
Panoche Formation
Kps; buff, bedded, arkosic sandstone, minor micaceous shale
Kp; shale, micaceous to argillaceous to silty, minor thin interbeds of sandstone
Upper
CRETACEOUS
Contact
dashed where gradational or approximately located
U
D
Fault
dashed where inferred;
dotted where concealed;
queried where existence doubtful;
double arrows indicate strike-slip movement;
U – upthrown side
D – downthrown side relatively
anticline
syncline
Axis of fold
arrow on axis indicates direction of plunge
30
inclined
inclined (approximate)
vertical
overturned
TOP
Strike and dip of strata
conglomerate bed
sandstone bed
6
molluscan fossil locality

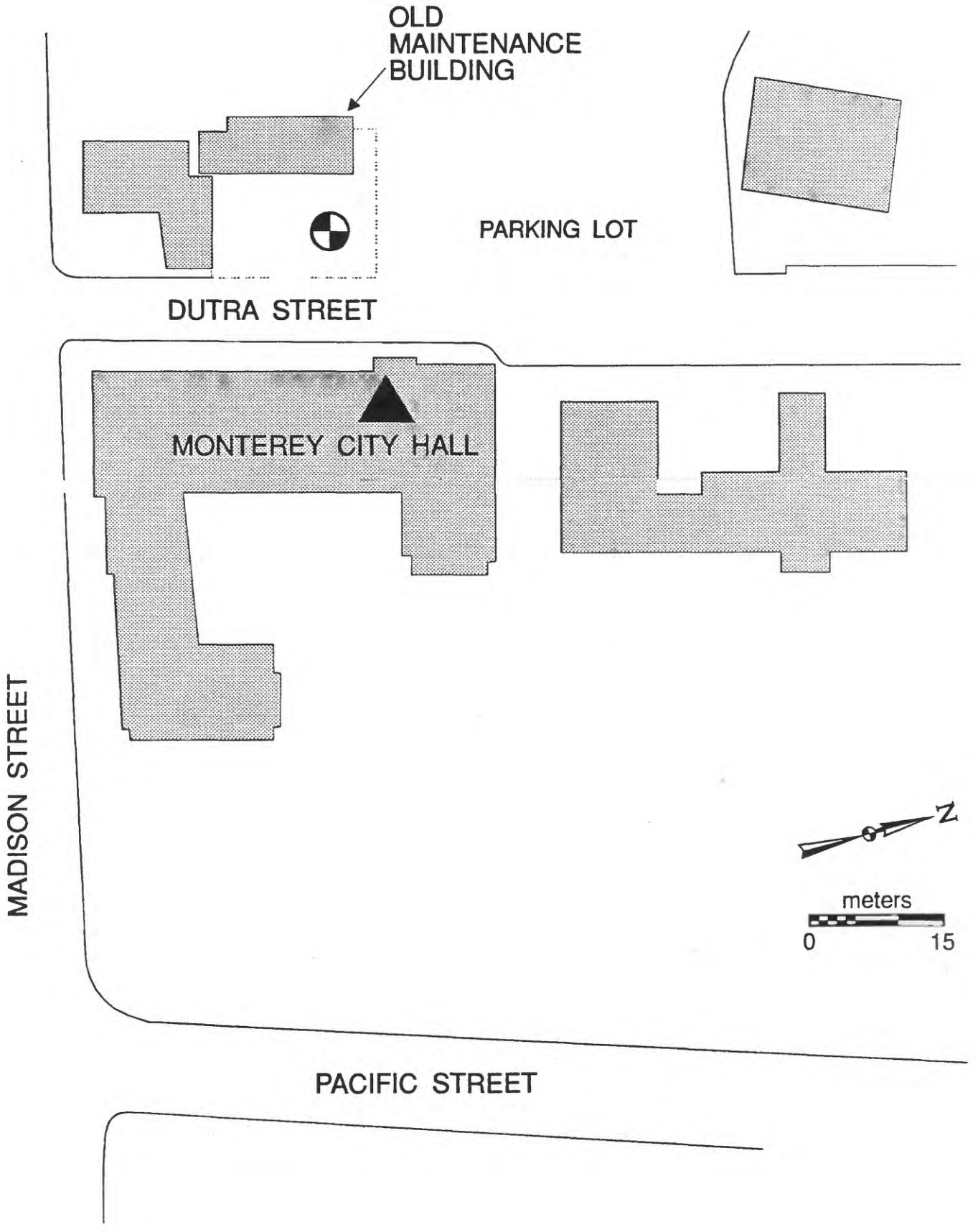
SITE: MONTEREY CITY HALL

DATE: 7/20/92

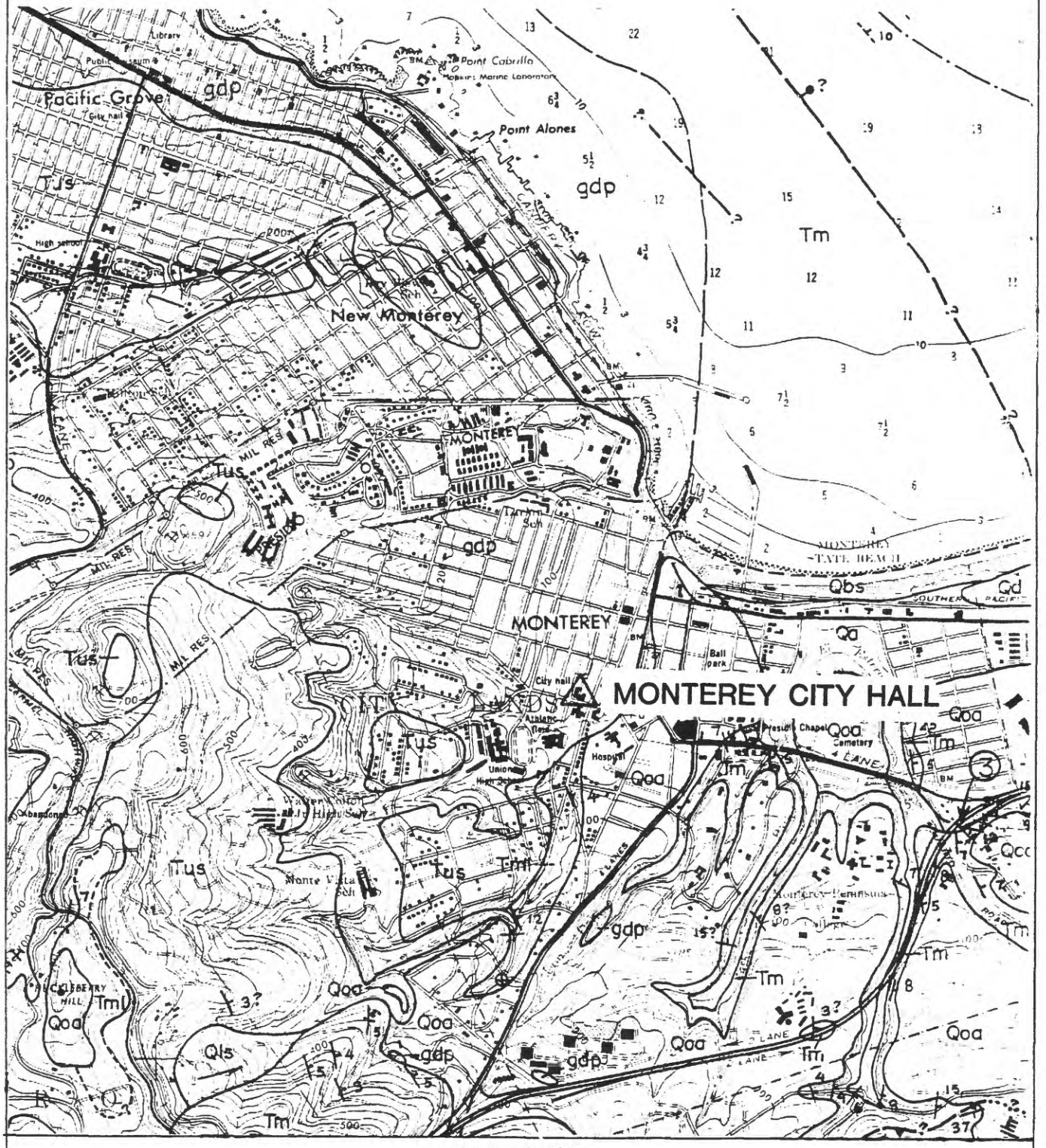
BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	ASPHALT
				GRAVELLY SAND (fill), yellowish brown, granitic, loose
			1	SANDY LOAM, very dark greyish brown
				SANDY CLAY, light greyish brown
			2	
				GRAVEL, yellow, siltstone fragments
			10 3	GRAVEL, grey, quartz fragments, firmer
				SANDY CLAY, greyish brown, softer
			4	SAND, light greyish brown, very coarse
			5	
				GRAVELLY SAND, light grey, weathered granite
			20 6	
			7	CLAY (gouge), light clay
				GRANITE, strong brown, very weathered, very closely fractured, firm
			8	light grey, moderately weathered, very firm
				very closely to closely fractured
			30 9	hard, occasional thin gouge seams
			10	
			11	
			12	closely fractured
			40 13	
			14	
			15	
			50	

SITE: MONTEREY CITY HALL DATE: 7/20/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50 16	very closely to closely fractured
				some gouge seams up to 15 cm thick
			17	
			18 60	
			19	
			20	
			21 70	
			22	
			23	
			24 80	closely to moderately fractured
			25	
			26	
			27 90	
			28	
			29	
			30 100	



MONTEREY CITY HALL



SCALE 1:24000

1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

PRELIMINARY GEOLOGIC MAP OF THE MONTEREY AND SEASIDE 7.5-MINUTE QUADRANGLES, MONTEREY COUNTY, CALIFORNIA WITH EMPHASIS ON ACTIVE FAULTS

By

J.C. Clark, T.W. Dibblee Jr., H.G. Greene, and D.E. Bowen, Jr.

1974

DESCRIPTION OF MAP UNITS

SURFICIAL SEDIMENTS

Qbs	Beach sand; near Carmel Beach includes (near-shore) sands just offshore
Qg	River sand and gravel
Qd	Dune sand
Qa	Alluvium
Qls	LANDSLIDE DEBRIS Some or parts of some may be very young and possibly actively moving. Half arrows show direction of downslope movement

OLDER SURFICIAL SEDIMENTS (DISSECTED)

Qod	Older dune sand
Qoa	Older alluvium and terrace gravel and sand; at Monterey contains Pholas-bored pebbles at base and into underlying Monterey Shale
Qm	Marine terrace sand and gravel
Qar	AROMAS SAND (Pleistocene) Aromas Red Sands of Allen (1946) and Bowen (1965). Nonmarine; yellowish-brown to grayish-orange fine sand
QTp	PASO ROBLES FORMATION (Pliocene(?) and Pleistocene) Old alluvium deposited in a valley. Light-gray gravel, sand, and clay
QTs	*SEDIMENTARY DEPOSITS Seismic characteristics suggest poorly bedded sands and gravels; stratigraphic position unknown
Ts	*SEDIMENTARY ROCKS Mudstone and coarse-grained, arkosic sandstone; marine; middle or late Tertiary
Tsm	SANTA MARGARITA(?) SANDSTONE (Miocene) Marine and brackish-marine, white, friable, fine- to coarse-grained, arkosic sandstone; upper Miocene, possibly lower Pliocene

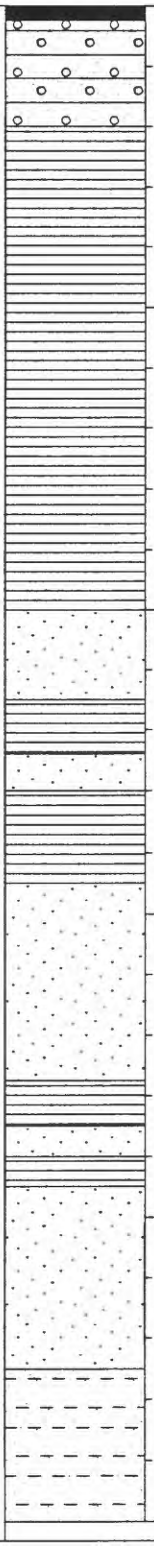
MONTEREY SHALE (Miocene) Siliceous marine deposits

Tmd	Diatomite (Canyon del Rey Diatomite Member of Bowen, 1965), white, soft, punky, commonly silty; Delmontian Stage[1] (type) of Kleinpell (1938), upper Miocene
Tm	Siliceous shale (Aquajito Shale Member of Bowen, 1965), light-brown to white, hard, brittle, platy; Mohnian Stage, upper Miocene
Tml	Semi-siliceous shale, thin-bedded, yellowish-brown, foraminiferal; includes interbedded yellowish-brown siltstone; Luisian Stage, middle Miocene
Tss	MARINE SANDSTONE Buff to light-gray, friable arkosic sandstone; locally pebbly; in San Jose Canyon area contains interbedded conglomerate; middle Miocene; possibly in part upper and lower Miocene
Tus	Sandstone as above, upper part (mapped as Los Laureles Sandstone Member of Monterey Formation by Bowen, 1965)
Tvb	Volcanic rocks. Flows and flow-breccias of basalt and basaltic andesite (carmeloite of Lawson, 1893)
Tls	Sandstone as above, lower part (mapped as Los Tularcitos Member of Chamisal Formation by Bowen, 1965)
Trc	RED BEDS OF ROBINSON CANYON Robinson Canyon Member of Chamisal Formation of Bowen (1965). Terrestrial; red to gray arkosic sandstone, siltstone, and conglomerate; middle and possibly lower Miocene
Tc	CARMELO FORMATION OF BOWEN (1965) (Paleocene) Carmelo Series of Lawson (1893); marine; interbedded sandstone, siltstone, mudstone, and cobble-pebble conglomerate
Tcg	Cobble and boulder conglomerate, mostly of granitic detritus

GRANITIC ROCKS Light-gray crystalline rocks composed of about 2/3 feldspars, 1/3 quartz, and small amounts of biotite and hornblende; age, Cretaceous(?)

gdp	granodiorite, porphyritic
gd	Granodiorite
*qd	Quartz diorite
ms	METAMORPHIC ROCKS Biotite schist-gneiss and mixtures of granitic rocks

SITE: PACIFIC HEIGHTS FIRE STATION DATE: 7/31/92

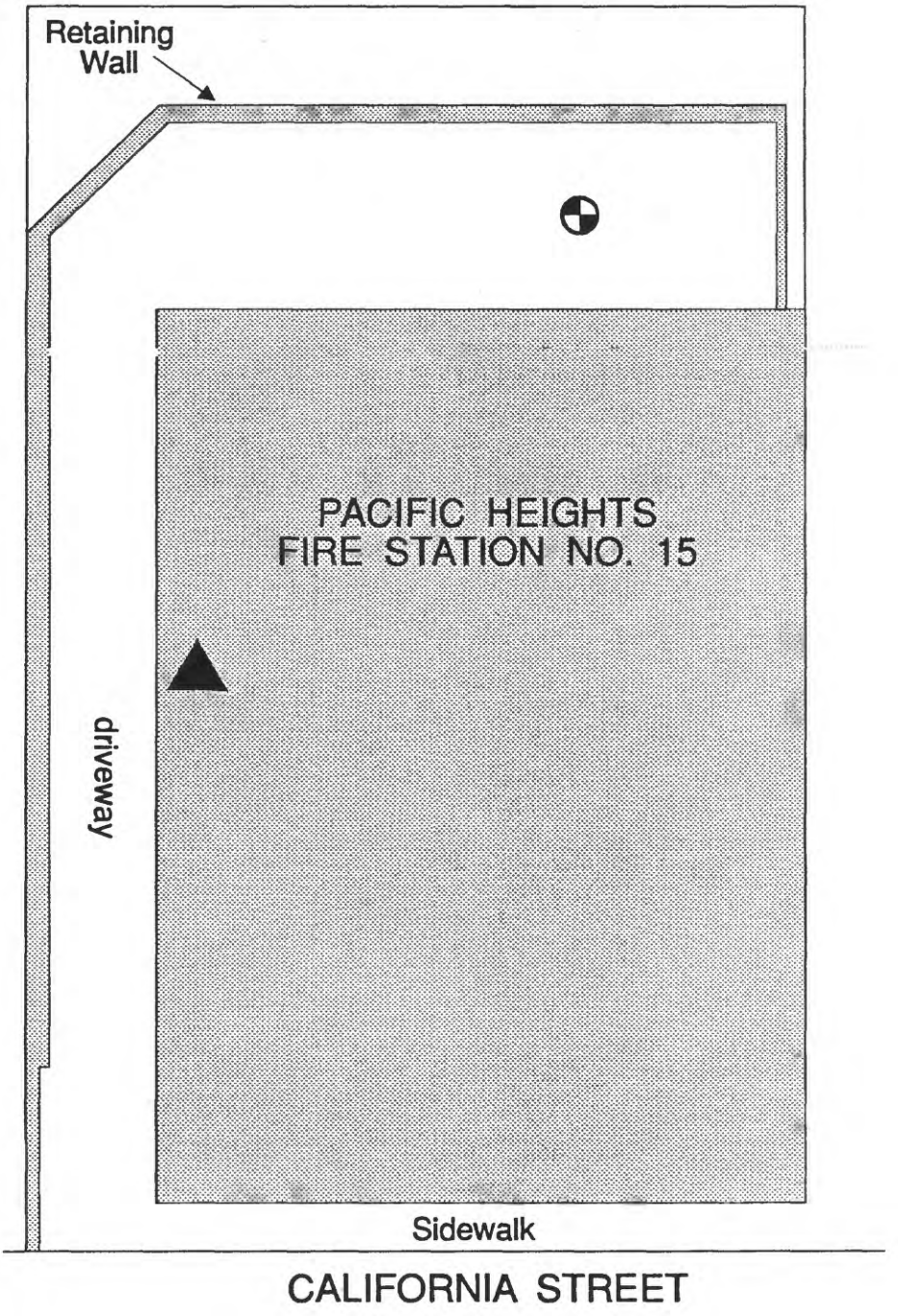
BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	CONCRETE
			1	LOAMY CLAY, reddish brown to reddish grey with medium to fine gravel-sized fragments of grey weathered shale, soft
				SHALE, dark reddish grey to grey, extremely weathered, with varying amounts of clay, progressively (downward) firmer
			2	
			10 3	very firm, very closely fractured, very weathered
			4	
			5	
			20 6	SANDSTONE, strong brown, medium grained, closely to very closely fractured, moderately weathered, hard
			7	SHALE, black to brown, moderately weathered
			8	SANDSTONE, strong brown, medium grained, closely to very closely weathered, moderately weathered, hard
				SHALE
			30 9	SANDSTONE, strong brown to grey, medium grained moderately fractured, slightly weathered, hard
			10	
				fine grained
			11	SHALE, black, moderately fractured, slightly weathered, firm
				SANDSTONE
			12	SHALE
			40	GRAYWACKE, grey, moderately fractured, nearly unweathered, very hard
			13	
			14	SANDY CLAYSTONE, dark bluish-grey, firm
			15	
			50	

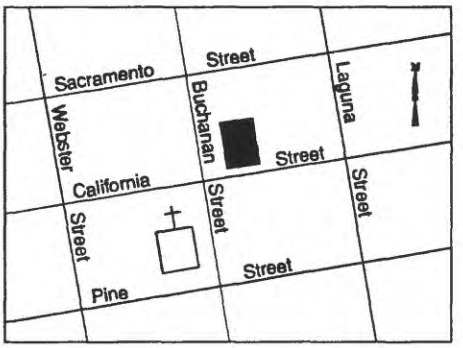
SITE: PACIFIC HEIGHTS FIRE STATION DATE: 7/31/92

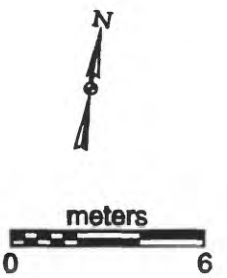
BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50	
			16	
			17	GRAYWACKE, dark grey, moderately fractured, unweathered, hard
				very hard
				INTERBEDDED SANDSTONE AND SHALE, hard
			18	
			60	GRAYWACKE, dark grey, moderately fractured, very hard
			19	
				SHALE, moderately fractured, hard
			20	
				GRAYWACKE, very hard
			21	SHALE, hard
			70	GRAYWACKE, very hard
			22	
			23	
			24	SHALE, hard
			80	
			25	GRAYWACKE, very hard
				SHALE, hard
			26	GRAYWACKE, very hard
			27	
				SHALE, very hard
			90	
			28	GRAYWACKE
			29	
				SANDY CLAY, grey, firm, with pieces of graywacke (gouge)
			30	GRAYWACKE, hard
			100	

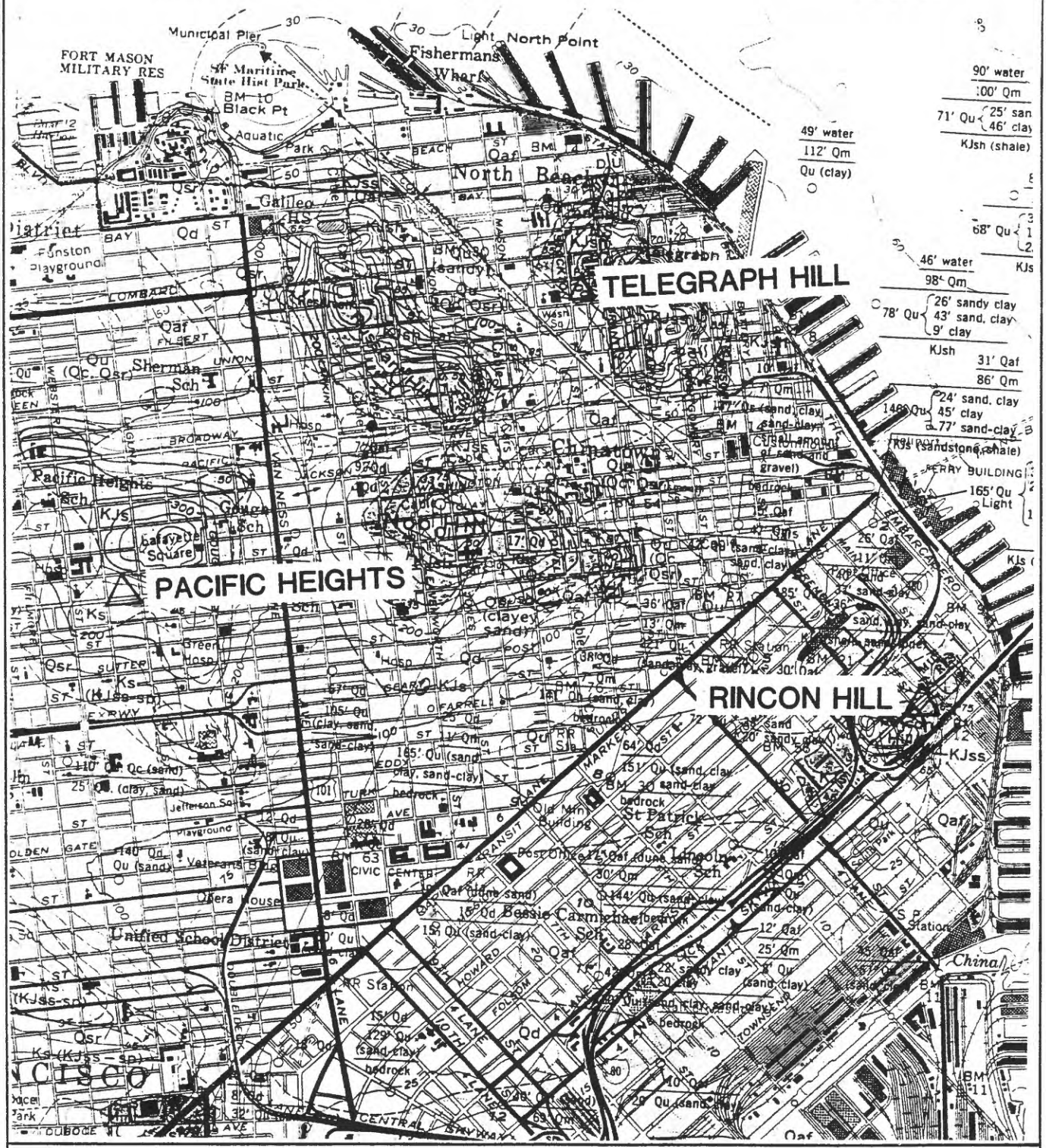
SITE: PACIFIC HEIGHTS FIRE STATION DATE: 7/31/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			100 31	SHALE, hard
				GRAYWACKE
			32	SANDY CLAY, grey, firm, with pieces of shale (gouge)
				SHALE, hard
			33	very hard
			110 34	
			35	
			36	
			120 37	
			38	
			39	
			130 40	GRAYWACKE
			41	
			42	
			140 43	
			44	
			45	
			150	


Retaining
Wall
PACIFIC HEIGHTS
FIRE STATION NO. 15
driveway
Sidewalk
CALIFORNIA STREET


Sacramento
Street
Webster
Buchanan
Laguna
Street
California
Street
Street
Street
Street
Pine
Street


N
meters
0
6



GEOLOGIC MAP OF THE SAN FRANCISCO NORTH QUADRANGLE, SAN FRANCISCO AND MARIN COUNTIES, CALIFORNIA

Geology mapped in 1948–61 by Julius Schlocker, M. G. Bonilla, D. H. Radbruch, D. A. Kaye, and W. I. Konkoff

EXPLANATION

SURFICIAL DEPOSITS

QUATERNARY

Holocene

Qaf — Artificial fill
Predominantly dune sand but includes silt, clay, rock waste from excavations, manmade debris, and organic waste. Probable fill material indicated in parentheses. Maximum thickness approximately 80 feet

Qb — Modern beach deposits
Predominantly well sorted medium to coarse gray sand, coarse gravel and large cobbles in some places. Maximum thickness approximately 40 feet

Holocene and Pleistocene(?)

Ql, Qly, Qlo — Landslide deposits
Generally unstratified mixtures of bedrock, sand, silt, and clay in varying proportions
Qly, younger landslide deposits
Qlo, older landslide deposits

Qal — Alluvium
Predominantly clayey silty sand and clayey silt, some pebbles, locally clean medium sand, generally gray to brown. Maximum thickness approximately 95 feet, observed thickness 15 feet

Qsr — Slope debris and ravine fill
Angular rock fragments in sand, silt, and clay matrix; generally light yellow to reddish brown. Maximum thickness approximately 80 feet

Qd — Dune sand
Clean, well-sorted fine to medium sand, yellowish brown to light gray. Maximum thickness approximately 150 feet

Qm — Bay mud and clay
Plastic gray silty clay, some lenses of sand, peat, and shell fragments, fluid to soft upper layers, moderately stiff clay at depth. Concealed except for exposures north of Corinthian Island and north of Sausalito Point. Maximum thickness approximately 140 feet

Qu — Surficial deposits, undivided

Pleistocene

Qob — Older beach deposits
Predominantly well sorted medium to coarse gray sand. Maximum thickness approximately 30 feet

Qc — Colma Formation
Unconsolidated fine to medium sand with small to moderate amounts of silt and clay, in places includes clay beds, 6 inches to 5 ft thick, cobble-size rubble rare; commonly light brown to gray. Observed thickness 75 feet; probably maximum thickness approximately 300 feet

BEDROCK

CRETACEOUS

Upper Cretaceous

Ks — Sheared rocks, undifferentiated
Coherent blocks and pieces of hard rock as much as several hundred feet in diameter, in a matrix of intensely sheared shale and serpentine. Clasts predominantly sandstone, shale, and serpentine, but also include all other rock types known in Franciscan Formation. Matrix gray to greenish gray, moderately firm to soft and clayey, generally expansive and plastic when wet

JURASSIC(?) AND CRETACEOUS

Intrusive into Franciscan Formation

Serpentine
Mostly soft sheared rock containing hard knobs of unsheared serpentine, rodingite, and rocks of the Franciscan Formation. Derived from peridotites (mostly harzburgite, some dunite)
sph, hard serpentine, slightly sheared. Shown separately on Potrero Hill only. Variously colored, but generally greenish gray, blue, or brown. Includes sheared rocks (Ks) where that unit is mostly serpentine

gb — Gabbro
Fine- to coarse-grained gabbro, includes diabase where texture is subophitic. Occurs as inclusions or segregations in serpentine

Jurassic(?) and Lower and Upper Cretaceous — Franciscan Formation

KJss, KJsh, KJs — Clastic sedimentary rocks
KJss, sandstone, thick-bedded and massive graywacke sandstone interbedded with thin layers of shale and fine-grained sandstone, some thick conglomerate lenses
KJsh, shale and thin-bedded sandstone, predominantly interbedded and laminated shale and fine-grained graywacke sandstone, beds generally 2 to 5 inches thick
KJs, sandstone and shale, undifferentiated, consists of units KJss or KJsh so poorly exposed that predominant lithology could not be determined
Sandstone and shale at Point Lobos and vicinity west of City College fault zone is probably Great Valley sequence of Bailey, Irwin, and Jones (1964, p. 123)

KJc — Radiolarian chert and shale
Reddish-brown; alternate beds of hard brittle chert, 1 to 5 inches thick, and firm brittle shale, ½ to ¼ inch thick. Locally includes bodies of massive chert

KJg — Greenstone
Greenish-gray aphanitic to medium-grained altered volcanic rocks; predominantly basalt. Includes flows, agglomerate, and tuff; pillow lavas common, less commonly massive; interbedded with radiolarian chert and sandstone

KJm — Metamorphic rocks
Fine- to coarse-grained slate, schist, and granofels of the blueschist facies

---

Contact
Long dashed where approximately located, short dashed where indefinite, dotted where concealed

Fault, showing dip and relative movement
Long dashed where approximately located, short dashed where inferred; dotted where concealed. Query indicates greater uncertainty as to existence of fault than does dashed line. U, upthrown side; D, downthrown side

Shear zone
Showing average dip — Approximately horizontal

Folds (Anticline, Syncline)
Showing axis and direction of plunge. Dashed where approximately located, dotted where concealed

Strike and dip of beds

Strike and dip of foliation

X — Fossil locality

Top of landslide scarp

Approximate boundary of transverse sand bars in San Francisco Bay (Modified from Gilson, 1951, p. 6)

Quarry

Abbreviated columnar section
Stratigraphic sequence and approximate thickness in feet of geologic map unit based on logs of boreholes and excavation. Sand-clay may include one or both of the following: sand, silt, and clay in various proportions, alternating thin beds of sand and silty clay

SITE: PALO ALTO 2-STORY OFFICE BLDG DATE:

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	CLAY LOAM TO SANDY CLAY LOAM (fill), very dark greyish brown (10YR 3/2), very poorly sorted
			10	CLAY, very dark greenish grey (5GY 3/1), soft (BAY MUD)
				greenish grey (5GY 5/1), stiffer
			20	SILTY CLAY LOAM TO SILTY CLAY, olive (5Y 4/3), stiff to very stiff (LATE PLEISTOCENE? ALLUVIUM)
			30	some carbonate nodules
				some fine sandy lenses
			40	SANDY CLAY LOAM, dark olive brown (2.5Y 3/4), poorly sorted
				FINE GRAVELLY SAND
			50	CLAY LOAM, dark olive brown (2.5Y 3/4)

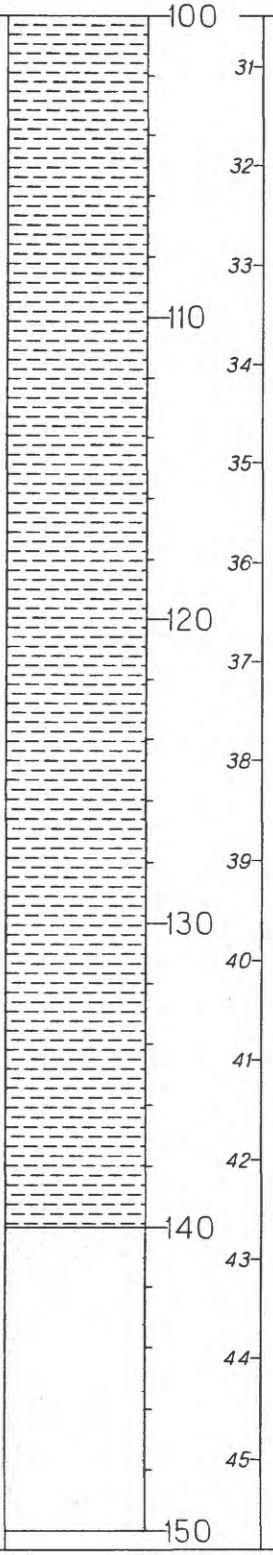
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

SITE: PALO ALTO 2-STORY OFFICE BLDG DATE:

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50 16	
			17	
			18 60	
			19	
			20	
			21 70	
			22	SAND
			23	SILTY CLAY, olive with grey mottling, stiff
			24 80	olive grey (5Y 5/2), very stiff
			25	
			26	
			27 90	SILTY CLAY LOAM, olive
			28	
			29	
			30 100	

SITE: PALO ALTO 2-STORY OFFICE BLDG DATE:

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION



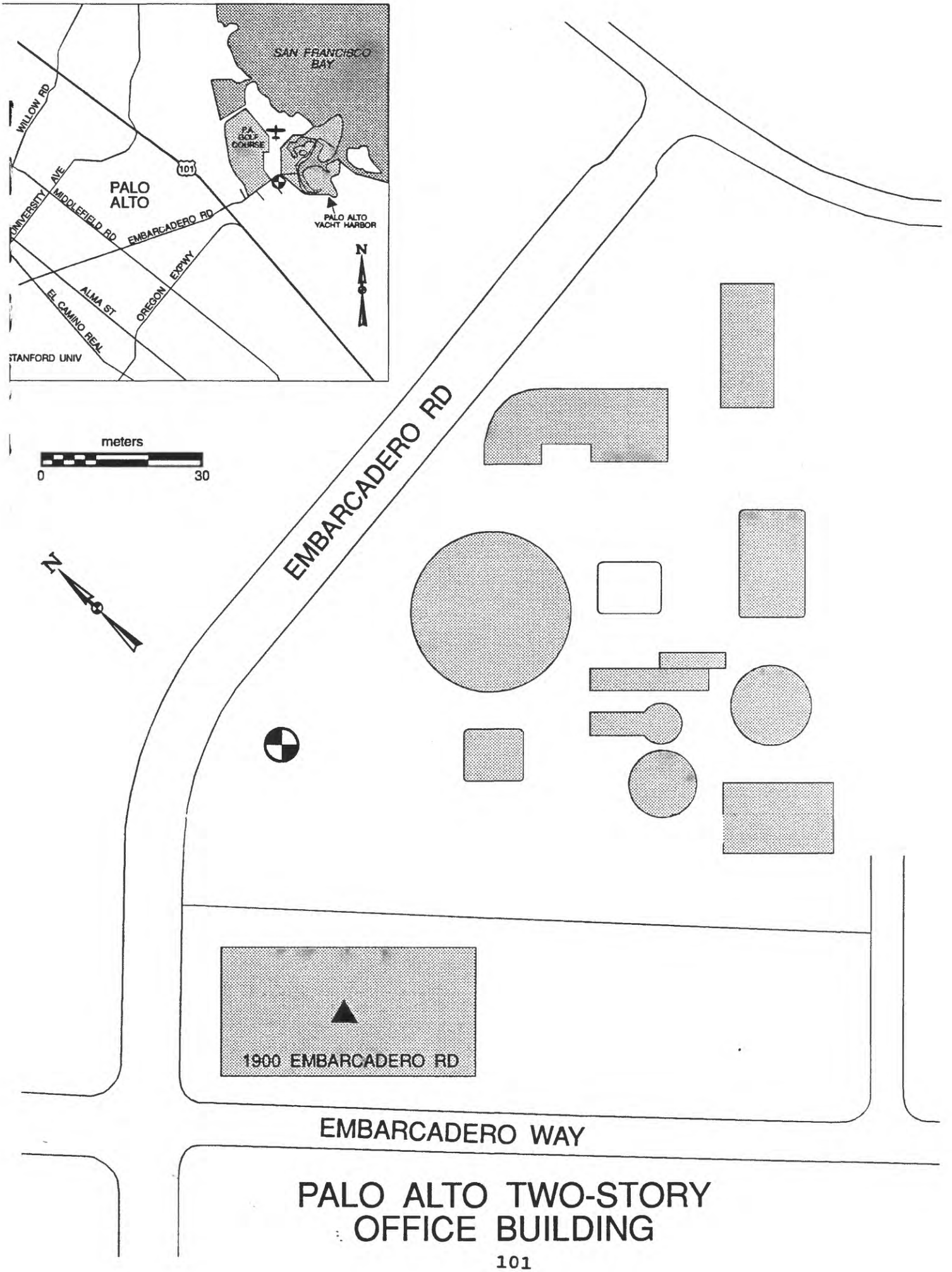
CLAY, mottled olive grey (5Y 5/2) and greenish grey (5GY 5/1), slightly less stiff

SILTY CLAY, olive grey

SAND, fine to medium-grained

SITE: PALO ALTO 2-STORY OFFICE BLDG DATE:

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			150 46	
			47	CLAY, stiff
			48	
			160 49	
			50	
			51	
			170 52	
			53	
			54	
			180 55	
			56	
			57	
			190 58	
			59	
			60	
			200	



PALO ALTO TWO-STORY OFFICE BUILDING

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF – 976

SCALE 1:125 000

2 0 2 4 6 8 10 MILES

2 0 2 4 6 8 10 KILOMETERS

MAP SHOWING THICKNESS OF YOUNG BAY MUD, SOUTHERN SAN FRANCISCO BAY, CALIFORNIA

BY

SANDRA D. McDONALD, DONALD R. NICHOLS, NANCY A. WRIGHT, AND BRIAN ATWATER

1978

EXPLANATION

Generalized thickness contours, in feet, of young bay mud. Contour interval is 10 ft (3 m) or 20 ft (6 m). Hachures point towards areas where mud is thinner than the value of the surrounding contour.

———— Uncertainty in thickness generally less than or equal to one-half the local contour interval

— — — Uncertainty in thickness generally less than or equal to the local contour interval

– – – – – Uncertainty in thickness may be greater than the local contour interval

Soft gray clay, probably young mud, located landward of historic tidal marshes

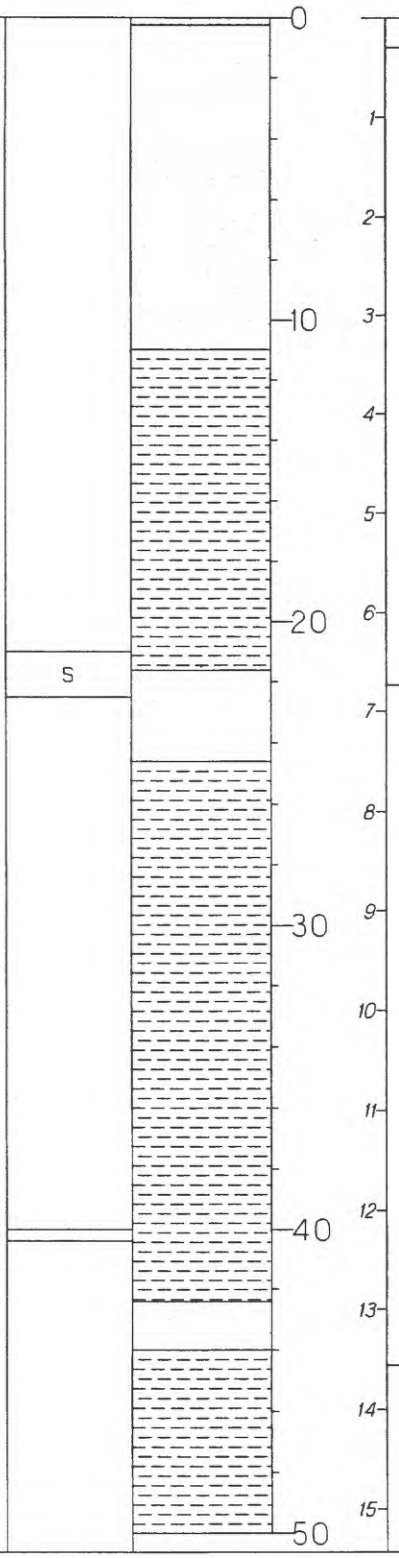
Locations of boreholes

• Borehole from which young bay mud was not reported

• Borehole from which top and bottom of young bay mud was reported

• Borehole from which top, but not bottom, of young bay mud was reported

SITE: PATTERSON PASS ROAD DATE: 9/14/92



SITE: PATTERSON PASS ROAD

DATE: 9/14/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50 16	
			17	
			18 60	
			19	
			20	
			21 70	
			22	
			23	
			24 80	
			25	SHALE, dk grey, closely fractured, soft
			26	slightly harder
			27 90	
			28	
			29	
			30 100	

SITE: PATTERSON PASS ROAD

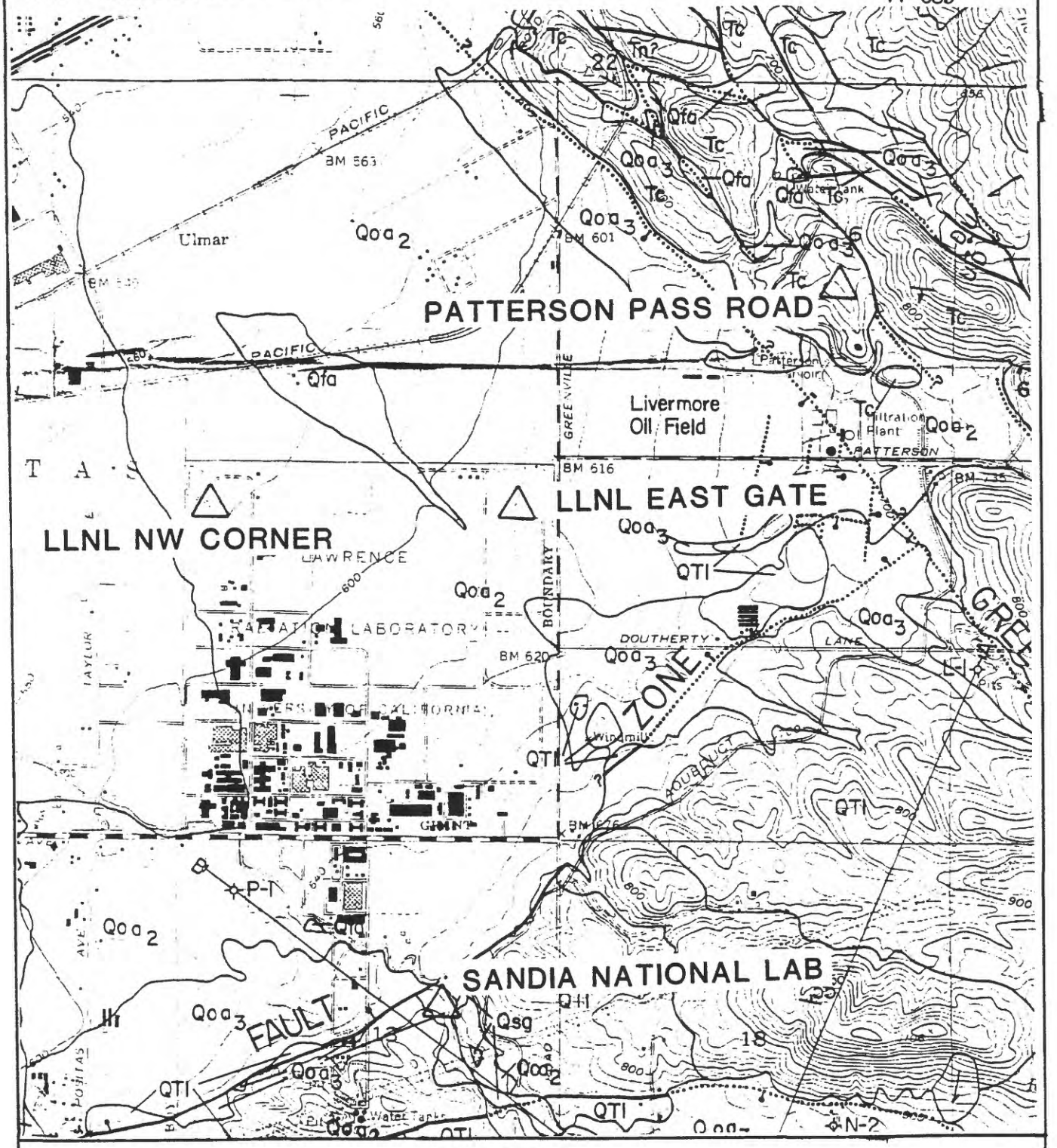
DATE: 9/14/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			100 31	slightly softer
			32	
			33	
			110 34	
			35	
			36	
			120 37	
			38	
			39	
			130 40	
			41	
			42	
			140 43	
			44	
			45	
			150	

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN FILE MAP

77-689



SCALE 1:24000

0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

0 1 KILOMETER

GEOLOGIC MAP OF THE LAS POSITAS, GREENVILLE, AND VERONA FAULTS, EASTERN ALAMEDA COUNTY, CALIFORNIA

BY

DARRELL G. HERD

1977

Description of Map Units

Qsg RECENT STREAM GRAVEL

Qfa RECENT FLOOD-PLAIN ALLUVIUM

OLDER ALLUVIUM, divided into:

Qoa_1 Unit 1

Qoa_2 Unit 2

Qoa_3 Unit 3

Qoa_4 Unit 4

QTl LIVERMORE GRAVELS OF CLARK (1930) (Pliocene and Pleistocene)--Brown to light gray [illegible] and greenish-blue silty clay or claystone. Contains scattered vertebrate fossils

QTgt GREEN VALLEY AND TASSAJARA FORMATIONS, UNDIVIDED, OF CLARK (1943) (Pliocene and Pleistocene)--Red and maroon conglomerate, brown sandstone, blue, gray, brown, and red siltstone and claystone with minor gray limestone, lignite, and tuff

Tn NEROLY SANDSTONE (Miocene)--Blue sandstone, brown shale, and minor brown siltstone, andesitic tuff, and conglomerate

Tc CIERBO SANDSTONE (Miocene)--Gray, brown, and white sandstone with minor conglomerate, brown tuff, and carbonaceous brown shale. Ostrea and Modiolus shells common near base

Tb BRIONES SANDSTONE (Miocene)--Gray, calcareous sandstone with pebbly shelly conglomerate near middle and minor yellow limestone. Abundant Ostrea shells in conglomerates

Tor OURSAN(?) SANDSTONE (Miocene)--Brown sandstone with minor shelly and pebbly conglomerates

Tt TESLA FORMATION (Paleocene and Eocene)--White and buff sandstone and carbonaceous shale with minor lignite and white to light-blue clay

KJg GREAT VALLEY SEQUENCE (Jurassic and Cretaceous)--Brown, massive, places concretionary sandstone, brown thinly bedded siltstone and shale with scattered conglomerate lenses, grayish-brown carbonaceous shale, and dark-gray to black concretionary shale with minor fossiliferous sandstone

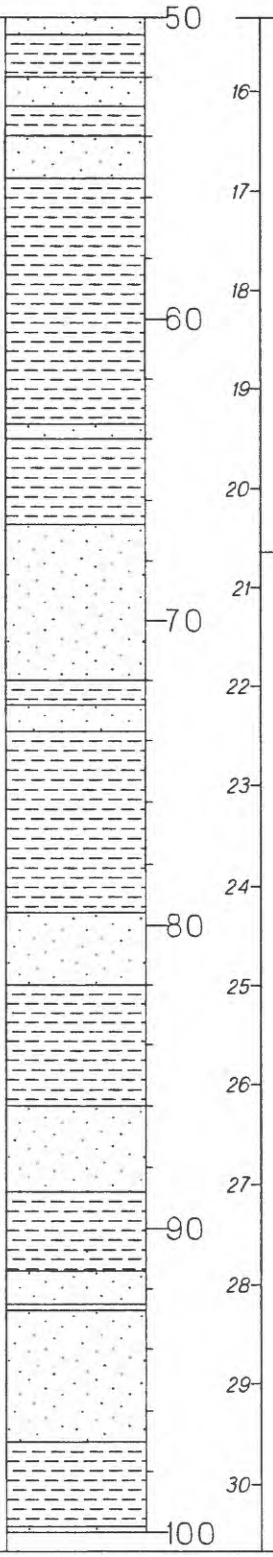
KJf FRANCISCAN ASSEMBLAGE (Jurassic and Cretaceous)--Gray-green sandstone and shale and red and green chert with minor greenstone, conglomerate, diabase, serpentinite, limestone, and blueschist

SITE: PEIDMONT JUNIOR HIGH SCHOOL DATE: 7/27-28/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	SANDY LOAM, dark brown, approx. 2cm thick
			1	INTERBEDDED SANDSTONE AND CLAYSTONE: sandstone is fine to medium grained; claystone is yellow to grey; sandstone is typically harder than claystone
				SANDSTONE is yellow, very highly weathered, soft
			2	CLAYSTONE is dark grey, highly weathered, soft
				firm
			10 3	
				SANDY CLAYSTONE is yellow, very weathered, firm
			4	very firm, yellowish grey, fairly weathered
				harder
			5	hard
				softer
			20 6	
			7	dark grey to grey, slightly weathered
			8	grey, unweathered
			30 9	
			10	
			11	
			40 12	
			13	
			14	
			50 15	

SITE: PEIDMONT JUNIOR HIGH SCHOOL DATE: 7/27-28/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION



moderately to closely fractured

16 moderately fractured

17

18

19

20

closely fractured

21 very hard, moderately fractured

22

23

24

25

26

27

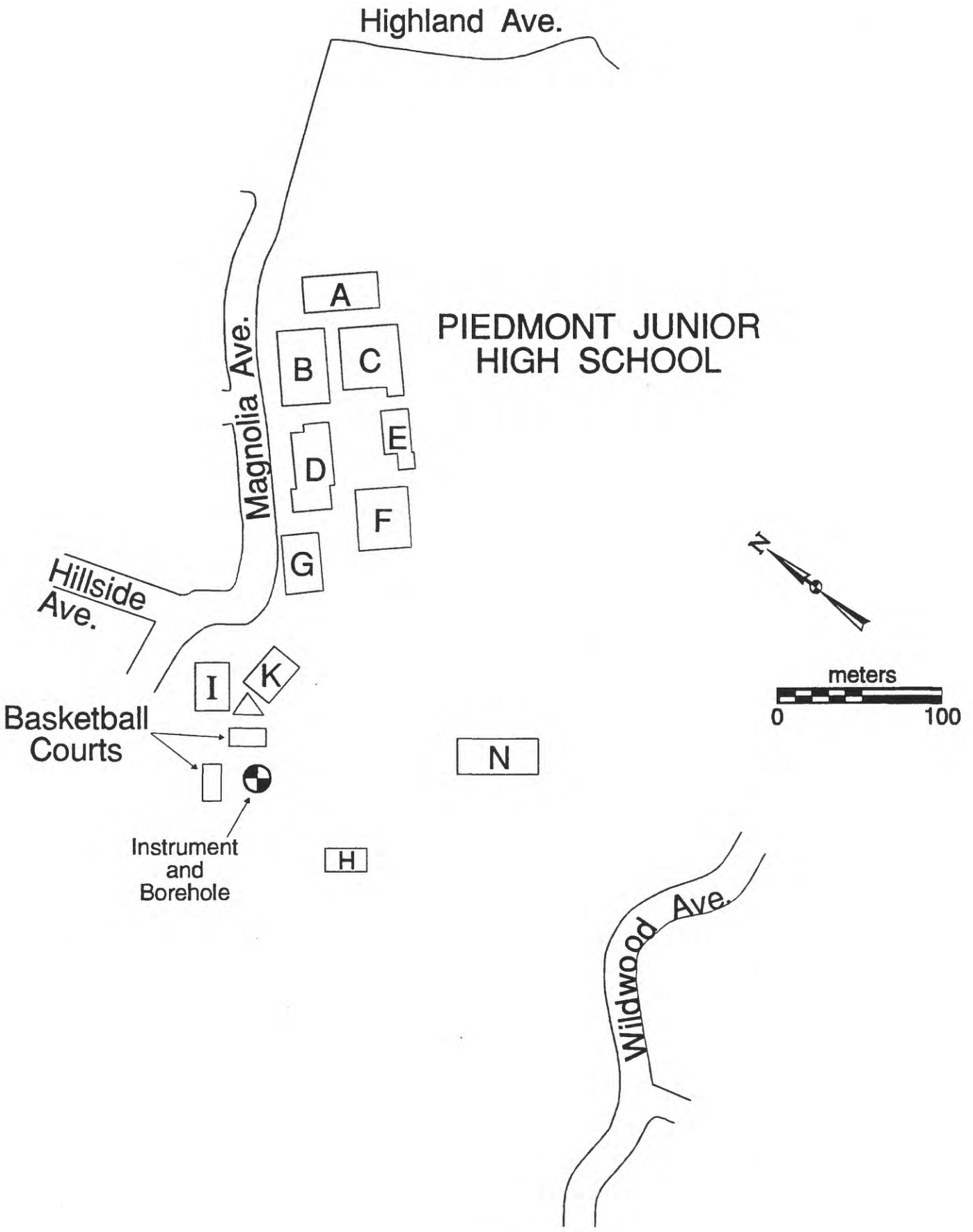
28

29

30

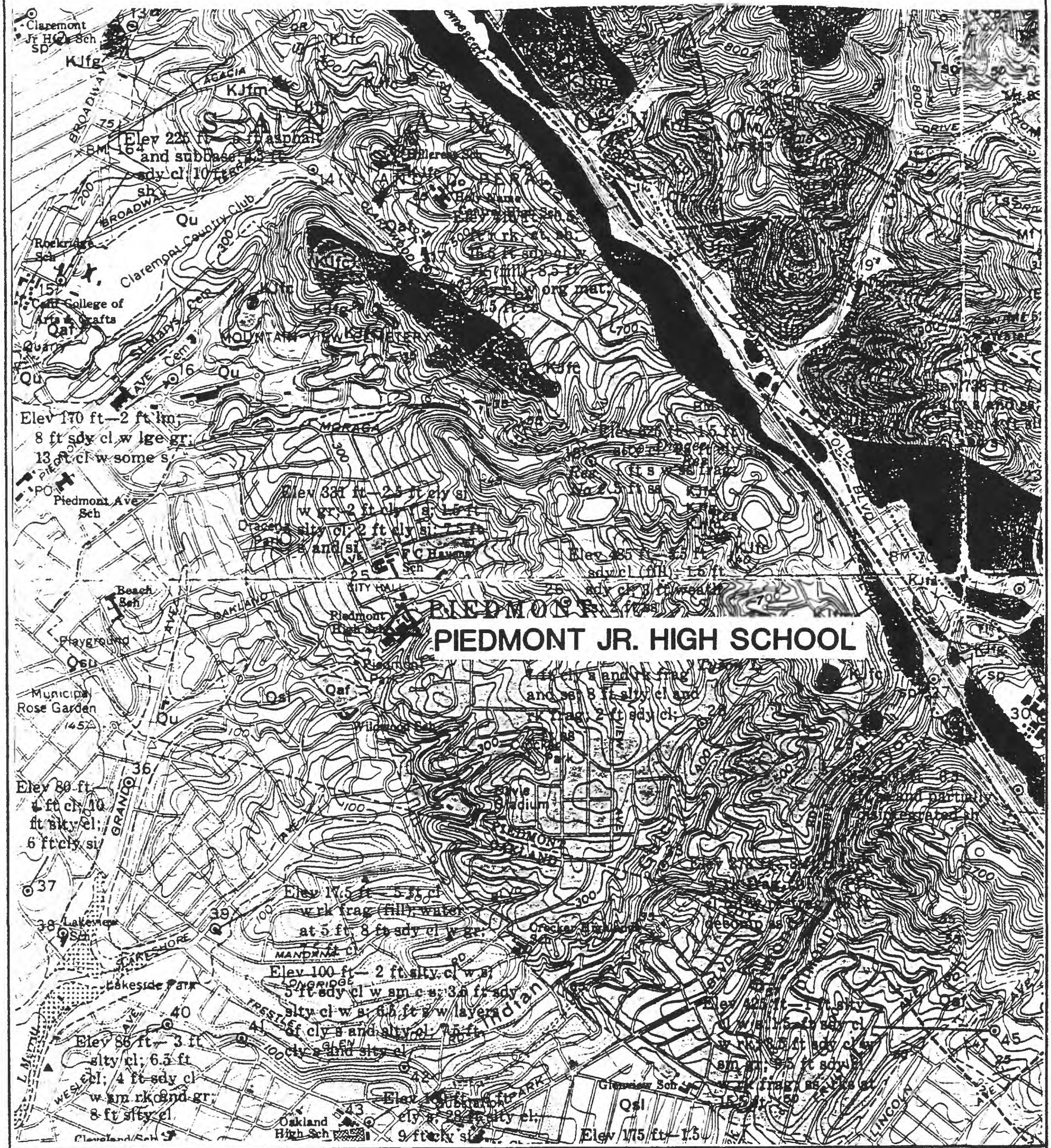
SITE: PEIDMONT JUNIOR HIGH SCHOOL DATE: 7/27-28/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			100 31	
			32	
			33	
			110 34	
			35	
			36	
			120 37	
			38	
			39	
			130 40	
			41	
			42	
			140 43	
			44	
			45	
			150	


Highland Ave.
PIEDMONT JUNIOR
HIGH SCHOOL
Magnolia Ave.
Hillside
Ave.
A
B
C
D
E
F
G
I
K
N
H
Basketball
Courts
Instrument
and
Borehole
Wildwood Ave.
N
meters
0
100

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

AREAL AND ENGINEERING GEOLOGY OF THE
OAKLAND EAST QUADRANGLE, CALIFORNIA
GQ-769



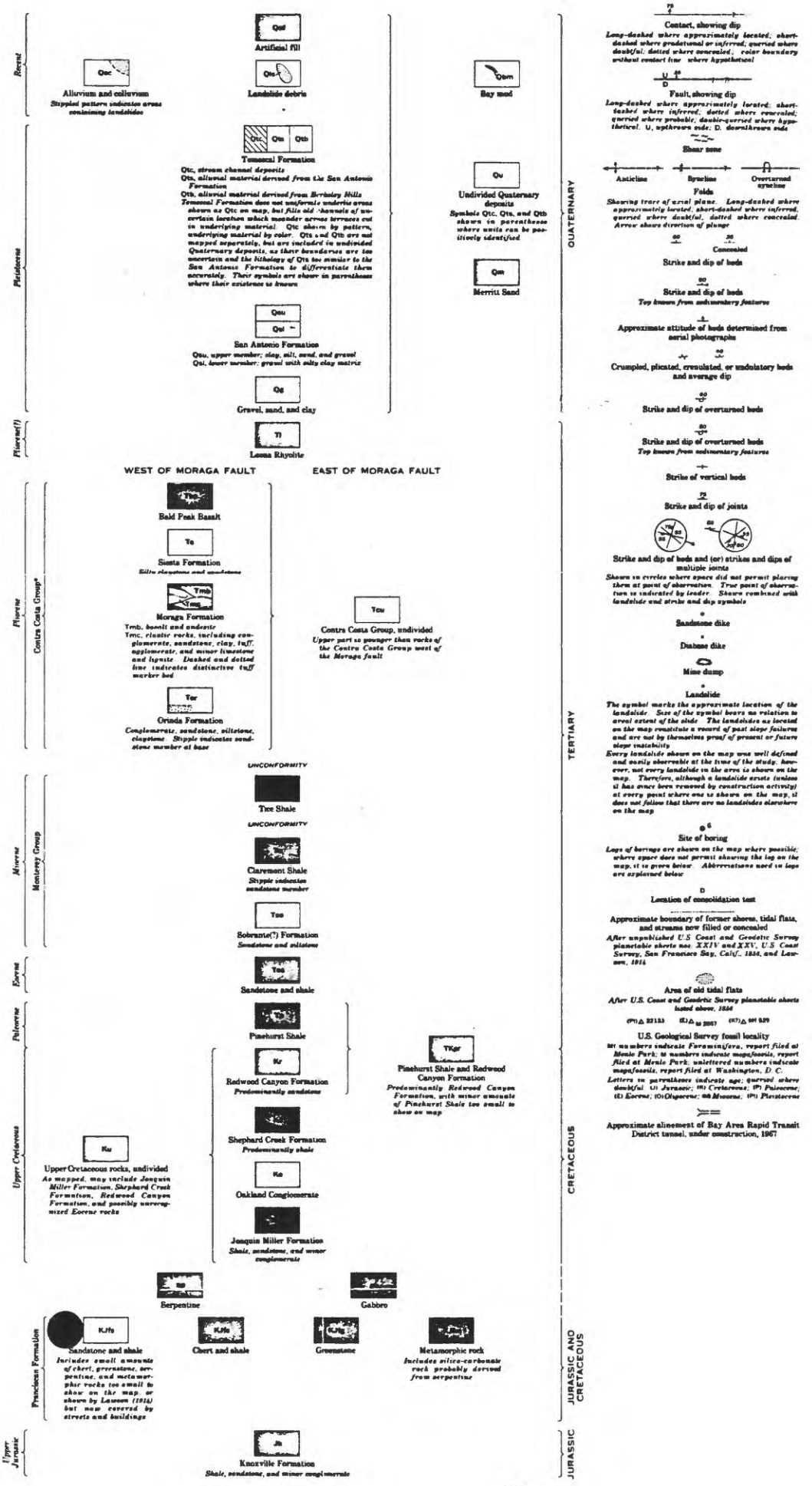
SCALE 1:24 000

1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

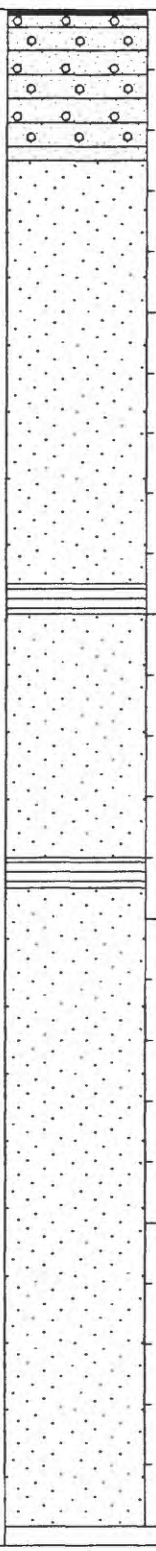
AREAL AND ENGINEERING GEOLOGY OF THE OAKLAND EAST QUADRANGLE, CALIFORNIA

By
Dorothy H. Radbruch
1969


Recent
Pleistocene
Pliocene(?)
Pliocene
Miocene
Eocene
Paleocene
Upper Cretaceous
Upper Jurassic
Franciscan Formation
QUATERNARY
TERTIARY
CRETACEOUS
JURASSIC AND CRETACEOUS
JURASSIC
Qaf
Artificial fill
Qac
Alluvium and colluvium
Stippled pattern indicates areas containing landslides
Qls
Landslide debris
Qbm
Bay mud
Qtc Qts Qtb
Temescal Formation
Qtc, stream channel deposits
Qts, alluvial material derived from the San Antonio Formation
Qtb, alluvial material derived from Berkeley Hills
Temescal Formation does not unconformable underlie areas shown as Qtc on map, but fills old channels of uncertain location which meander across terraces cut in underlying material. Qtc shown by pattern, underlying material by color. Qts and Qtb are not mapped separately, but are included in undivided Quaternary deposits, as their boundaries are too uncertain and the lithology of Qts too similar to the San Antonio Formation to differentiate them accurately. Their symbols are shown in parentheses where their existence is known
Qu
Undivided Quaternary deposits
Symbols Qtc, Qts, and Qtb shown in parentheses where units can be positively identified
Qm
Merritt Sand
Qsu
Qsl
San Antonio Formation
Qsu, upper member; clay, silt, sand, and gravel
Qsl, lower member; gravel with silty clay matrix
Qg
Gravel, sand, and clay
Tl
Lassa Rhyolite
WEST OF MORAGA FAULT
EAST OF MORAGA FAULT
Bald Peak Basalt
Ts
Siesta Formation
Silty claystone and sandstone
Tmb
Tmc
Moraga Formation
Tmb, basalt and andesite
Tmc, clastic rocks, including conglomerate, sandstone, clay, tuff, agglomerate, and minor limestone and lignite. Dashed and dotted line indicates distinctive tuff marker bed
Tor
Orinda Formation
Conglomerate, sandstone, siltstone, claystone. Stipple indicates sandstone member at base
Contra Costa Group*
Tcu
Contra Costa Group, undivided
Upper part to younger than rocks of the Contra Costa Group west of the Moraga fault
UNCONFORMITY
Tce
Tice Shale
UNCONFORMITY
Tcl
Claremont Shale
Stippie indicates sandstone member
Tso
Sobrante(?) Formation
Sandstone and siltstone
Monterey Group
Tes
Sandstone and shale
Tp
Pinehurst Shale
Kr
Redwood Canyon Formation
Predominantly sandstone
TKpr
Pinehurst Shale and Redwood Canyon Formation
Predominantly Redwood Canyon Formation, with minor amounts of Pinehurst Shale too small to show on map
Ks
Shepherd Creek Formation
Predominantly shale
Ku
Upper Cretaceous rocks, undivided
As mapped, may include Joaquin Miller Formation, Shepherd Creek Formation, Redwood Canyon Formation, and possibly unrecognized Eocene rocks
Ko
Oakland Conglomerate
Kjm
Joaquin Miller Formation
Shale, sandstone, and minor conglomerate
Serpentine
Gabbro
KJfs
Sandstone and shale
Includes small amounts of chert, greenstone, serpentine, and metamorphic rocks too small to show on the map, as shown by Lawson (1914) but now covered by streets and buildings
Chert and shale
Greenstone
Metamorphic rock
Includes silica-carbonate rock probably derived from serpentine
Jn
Knoxville Formation
Shale, sandstone, and minor conglomerate
Contact, showing dip
Long-dashed where approximately located; short-dashed where gradational or inferred; queried where doubtful; dotted where concealed; ruler boundary without contact line where hypothetical
U
D
Fault, showing dip
Long-dashed where approximately located; short-dashed where inferred; dotted where concealed; queried where probable; double-queried where hypothetical. U, upthrown side; D, downthrown side
Shear zone
Anticline
Syncline
Overturned syncline
Folds
Showing trace of axial plane. Long-dashed where approximately located, short-dashed where inferred, queried where doubtful, dotted where concealed. Arrow shows direction of plunge
Concealed
Strike and dip of beds
Strike and dip of beds
Top known from sedimentary features
Approximate attitude of beds determined from aerial photographs
Crumpled, plicated, crenulated, or undulatory beds and average dip
Strike and dip of overturned beds
Strike and dip of overturned beds
Top known from sedimentary features
Strike of vertical beds
Strike and dip of joints
Strike and dip of beds and (or) strikes and dips of multiple joints
Shown in circles where space did not permit placing them at point of observation. True point of observation is indicated by leader. Shown combined with landslide and strike and dip symbols
Sandstone dike
Dahome dike
Mine dump
Landslide
The symbol marks the approximate location of the landslide. Size of the symbol bears no relation to areal extent of the slide. The landslides as located on the map constitute a record of past slope failures and are not by themselves proof of present or future slope instability
Every landslide shown on the map was well defined and easily observable at the time of the study, however, not every landslide in the area is shown on the map. Therefore, although a landslide exists (unless it has since been removed by construction activity) at every point where one is shown on the map, it does not follow that there are no landslides elsewhere on the map
Site of boring
Logs of borings are shown on the map where possible; where space does not permit showing the log on the map, it is given below. Abbreviations used in logs are explained below
Location of consolidation test
Approximate boundary of former shores, tidal flats, and streams now filled or concealed
After unpublished U.S. Coast and Geodetic Survey planetable sheets nos. XXIV and XXV, U.S. Coast Survey, San Francisco Bay, Calif., 1854, and Lawson, 1914
Area of old tidal flats
After U.S. Coast and Geodetic Survey planetable sheets listed above, 1856
U.S. Geological Survey fossil locality
Italic numbers indicate Foraminifera, report filed at Menlo Park; roman numbers indicate megafossils, report filed at Menlo Park; underlined numbers indicate megafossils, report filed at Washington, D.C.
Letters in parentheses indicate age; queried where doubtful. (J) Jurassic; (K) Cretaceous; (P) Paleocene; (E) Eocene; (O) Oligocene; (M) Miocene; (Pl) Pleistocene
Approximate alinement of Bay Area Rapid Transit District tunnel, under construction, 1967

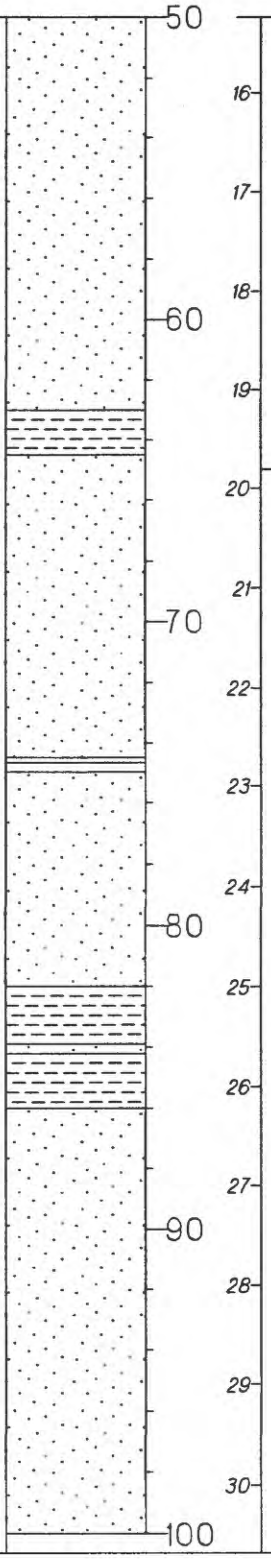
SITE: POINT BONITA

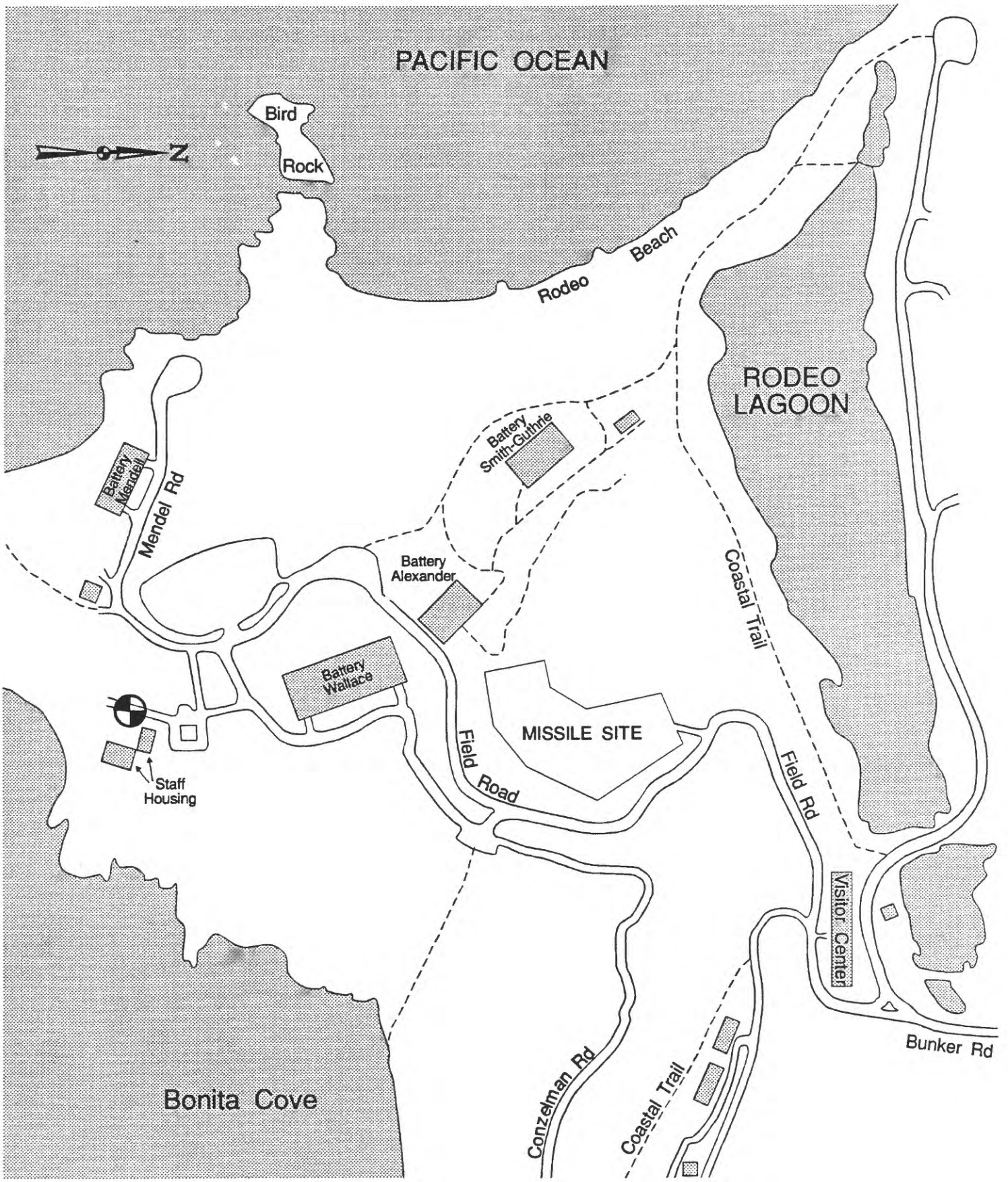
DATE: 8/6/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	GRAVELLY SILTY LOAM (fill), strong brown, soft
			1	
			2	SANDSTONE, brownish grey, medium to coarse grained, closely fractured, very weathered, firm
				harder, dark grey, moderately weathered
			10 3	
				hard
			4	
			5	
			20 6	SHALE, black, unweathered, very firm
				SANDSTONE, dark grey, medium to coarse grained, closely fractured, hard
			7	
			8	
				SHALE, black, closely fractured, very firm
			30 9	SANDSTONE, dark grey, medium to coarse grained, closely fractured, hard
			10	
			11	
			12	
			40	slightly harder, closely to very closely fractured
			13	
			14	
			15	
			50	

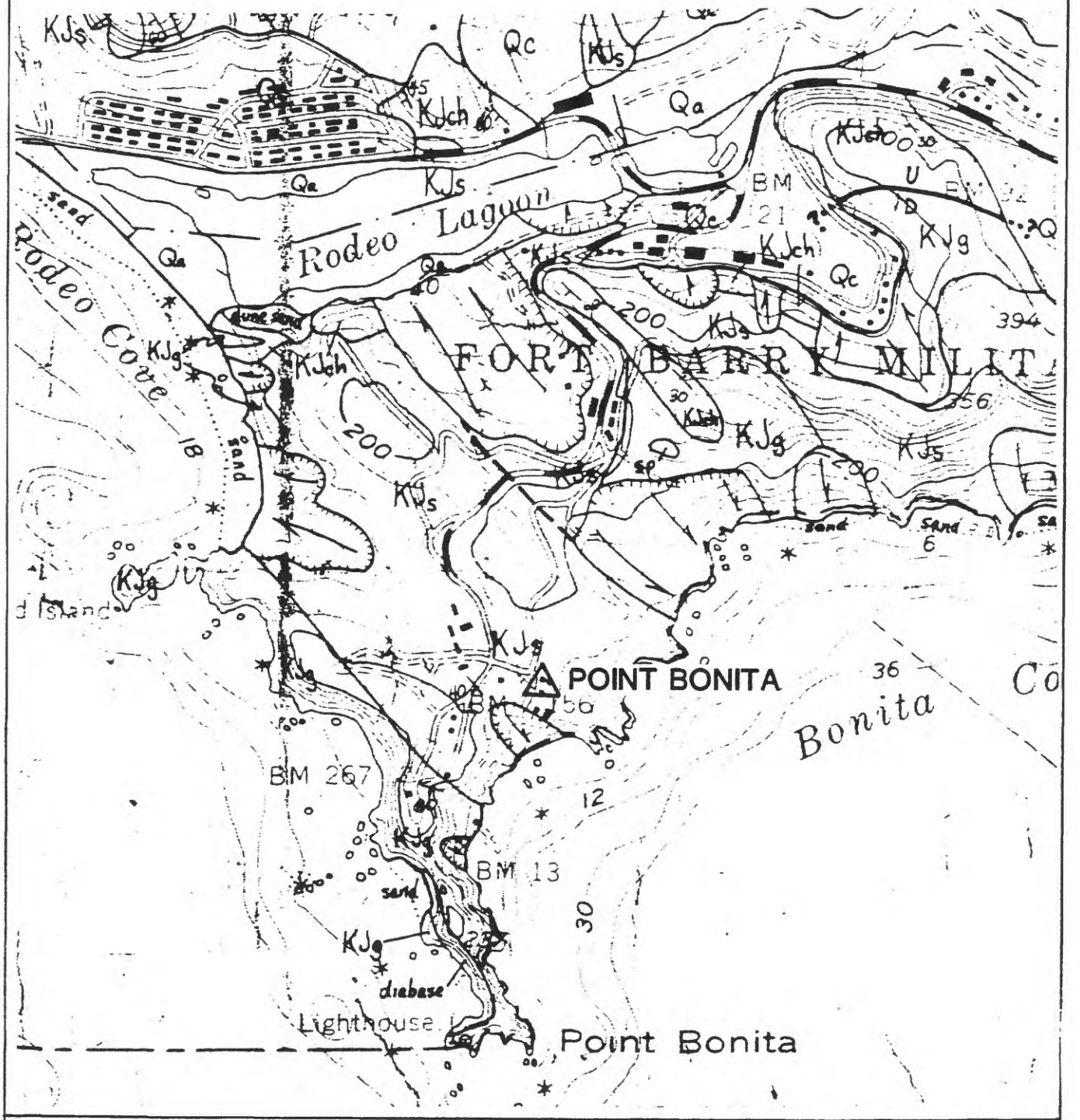
SITE: POINT BONITA

DATE: 8/6/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50 16 60 18 70 21 80 24 90 27 100 30	CLAY (gouge), steel grey, soft SANDSTONE, dark grey, medium to coarse grained, hard CLAY (gouge), grey, soft SANDSTONE, dark grey, medium to coarse grained, moderately fractured, hard



POINT BONITA



.5 0 1 KILOMETER

SCALE 1:12,000

GEOLOGY OF THE LOWER ROSS VALLEY, CORTE MADERA
HOMESTEAD VALLEY, TAMALPAIS VALLEY, TENNESSEE VALLEY,
AND ADJACENT AREAS
MARIN COUNTY, CALIFORNIA

Compiled by Salem J Rice and Theodore C. Smith

1978

QUATERNARY

Qaf

ARTIFICIAL FILL. Deposits of rock, soil, garbage and trash, or bay mud placed by man upon natural surfaces, mostly for engineering purposes. Highly variable from place to place as to composition, degree of compaction, etc. Not shown for most highway fills, for dikes on bay marshlands, or within many areas of dense urban development. Qaf/Qm indicates artificial fill placed on bay mud.

DEBRIS FLOW LANDSLIDES. Predominantly deposits of unconsolidated and unsorted soil and rock debris (colluvium) that have moved downslope en masse or in increments by flow or creep processes. Slip surfaces in the base materials of these landslides are roughly planar and approximately parallel to the slope surface. Includes some soil and rock debris avalanche deposits that have accumulated outward from the base of slopes by rapid flow. Estimated maximum thickness in feet is indicated where such estimates could be made with reasonable confidence from surface observations.

BLOCK SLUMP LANDSLIDES. Masses of relatively intact to highly disrupted bedrock that have moved downslope by rotational slip along deep concave slip planes, or rarely, by translational slip along planar surfaces. Commonly flanked by, and succeeded downslope by, debris flow deposits.

Qm

BAY MUD. Marshlands, former marshlands, and mudflats bordering San Francisco and San Pablo Bays. Mostly at or below mean sea level; these are thick deposits of unconsolidated, low-density, semi-fluid, highly compressible, highly impermeable silty clay. They are rich in disseminated peaty material, contain lenses of peat, and are likely to contain lenses of sand in many areas. Bay mud is plastic and swells when wet, but shrinks and becomes hard when dry. In places where dikes have excluded tide water for many decades, the surface consists of a partly dried, somewhat firm crust as much as a few feet thick, but such crusts are underlain by the soft, saturated mud described above.

Qa

ALLUVIUM. Unconsolidated deposits of clay, silt, sand, and gravel underlying the bottom lands of the main stream valleys, consisting of materials transported and deposited by the streams.

Qc

COLLUVIUM. Unconsolidated and unsorted soil material and weathered rock fragments accumulated on or at the base of slopes by natural gravitational or slope wash processes. Derived by weathering and decomposition of bedrock materials underlying the slopes. Covers most slopes, but mapped only where assumed to be more than about 5 feet thick. May include some unrecognized landslide deposits. Includes Colma Formation on Angel Island.

TERTIARY

Tv

VOLCANIC ROCKS, UNDIFFERENTIATED. Small exposures of andesite, dacite, and rhyolite, most of which are dikes, but some of which may be remnants of lava flows similar to those found near Novato on Burdell Mountain; all range in color from dark gray to purplish or pinkish.

CRETACEOUS

Ks

SANDSTONE AND SHALE, with very minor amounts of conglomerate. Occurrences of principal rock types and associations in this unit are indicated on the map by the following lithologic symbols:

ss Sandstone, mainly thickly bedded, medium- to coarse-grained arkose composed predominantly of fairly well sorted, angular to subrounded grains of quartz and feldspar, with minor fine-grained matrix. Also includes arkosic-wacke, which differs from the arkose only in that it contains grains of rock fragments as well as quartz and feldspar. Both types of sandstone are light gray where fresh, but buff to almost white in typical weathered exposures. Individual beds are as much as 50 feet thick, so exposures commonly appear massive, with evidence of bedding obscure.

sh Shale, generally well-bedded siltstone, dark gray where fresh, light gray, buff, or more or less stained brown by iron oxides along joints where weathered.

ssh Sandstone and shale. Thin beds of light gray, fine-grained, quartz-rich sandstone that grade upward into and alternate rhythmically with, thin beds of gray to black shale, the thickness of individual graded sandstone-shale couplets typically ranging from 2 to about 6 inches.

cg Conglomerate, composed of well-rounded pebbles in a sandy matrix.

It was not possible to follow and delineate contacts between these various lithologic varieties in the field. All of them typically yield light to medium brown, sandy or silty, moderately well-drained, non-swelling soils.

KJs

SANDSTONE AND SHALE. The sandstone (ss) is predominantly thickly bedded, medium- to coarse-grained graywacke composed of unsorted angular to subangular grains of quartz, feldspar, and dark rock fragments, with abundant fine-grained, clayey matrix. Typically gray or greenish gray where fresh, but brown where weathered. Some sandstones in this unit approach arkose in composition, with appropriately lighter colors. The shale (sh) is dark gray where fresh, brown where weathered. Relatively rare alternating thin beds of sandstone and shale (ssh), similar in composition and appearance to those within the unit Ks, are associated with this unit. In some places, these rocks are slightly to severely sheared or brecciated, and may grade gradually or abruptly into melange matrix. They all tend to yield brownish or buff, clay-rich, relatively poorly drained soils.

KJch

CHERT. Principally thinly bedded, hard, brittle, radiolarian chert; typical individual beds are one to a few inches thick and separated from each other by thin films or layers of shale. Mostly brown, but also greenish or light gray. Locally contains thick beds of brown chert or red or yellow jasper. Yields rocky, permeable soils.

JURASSIC

KJg

BASALTIC VOLCANIC ROCKS, all more or less altered. Predominantly greenstone, originally basalt erupted in a submarine environment, and exhibiting pillow structure in places where well exposed. Mostly dark gray green or dull green in fresh exposures, but dull greenish brown to reddish brown where weathered. Yields brown or reddish-brown, swelling, clay-rich soils.

mc mv KJsch

SEMI-SCHIST, PHYLLITE, AND SCHIST, with associated metachert and metavolcanic rocks. Predominantly slightly to well foliated or lineated metamorphosed sedimentary and volcanic rocks. The metasedimentary rocks, most of which were originally thinly bedded graywacke and shale are typically fine grained and are dark gray to bluish where freshly exposed in deep cuts, but pale gray to buff or brown in weathered exposures. In many places, these metasedimentary rocks appear superficially similar to unmetamorphosed graywacke. They are principally composed of quartz, with lesser amounts of mica, chlorite, glaucophane, jadeite, lawsonite, and pyrite that vary in proportion from place to place, and they commonly contain closely to widely spaced thin veins of white quartz. Metachert (mc), which occurs as sporadic small but prominent outcrops and elongated exposures, is white, pinkish, pale bluish, or reddish brown. In most places it exhibits the thin bedding characteristic of radiolarian chert, from which it was derived. The metavolcanic rocks (mv), are mostly dense, massive to schistose, fine-grained, metamorphosed basaltic rocks that are dull green, greenish gray, or bluish where fresh, but brown or greenish brown where weathered.

The metasedimentary rocks, except metachert, are deeply weathered in most places, and yield pale buff to brown, clay-rich soils that almost characteristically contain small angular fragments of white quartz derived from the thin veins in the bedrock. These soils contain swelling clay minerals, and are relatively unstable on slopes. The metavolcanic rocks weather to reddish brown, rocky, clay-rich soils.

fm

FRANCISCAN MELANGE. A tectonic mixture consisting of small to large masses of resistant rock types, principally of sandstone, greenstone, chert, and serpentine, but including various exotic metamorphic rock types, embedded in a matrix of pervasively sheared or pulverized rock material. The melange represents one or more immense, geologically ancient fault zones that resulted from the collision of two major plates of the earth's crust, the North American and the Pacific plates, during late Mesozoic and possibly early Cenozoic time. The various rock types along the interaction zone were differentially sheared or crushed, and mixed in such a way that the fragments or masses that resisted shearing, all of which are bounded by faulted surfaces, were brought into disoriented, commonly chaotic juxtaposition. It is these resistant masses or fragments that are seen in outcrop, the weak, finely sheared matrix in which they are embedded being easily weathered and eroded so that exposures of it are seldom apparent in natural terrain. Melange most commonly yields irregularly hummocky topography, the topographic irregularities often resulting both from differential erosion of the resistant masses embedded in the weak matrix and from abundant landsliding. Where they were seen at the surface, the resistant rock masses are indicated separately on the map, but many more of them are certain to be present than so indicated. These separate masses are outlined to scale, where possible, but boundaries of many are indeterminate from field observations alone. Masses too small to be delineated at this scale are indicated by the symbol X. Melange matrix tends to weather to brownish gray or black, clay-rich, swelling soils that are generally easily distinguished from those derived from other geologic units underlying upland portions of the mapped area. Unsheared rock masses enclosed within the matrix yield local zones of soils characteristic of these various source rocks, mostly soils similar in texture and appearance to those mentioned for similar rock types under Ks, KJg, and KJsch. Exposures of rock masses within the sheared melange matrix are identified separately by lithologic symbols as follows:

ss Sandstone and shale. Mainly graywacke-type sandstone, with or without relatively minor amounts of shale; these are generally similar to the unit labelled KJs in very large masses. Includes dark-gray, tough metagraywacke and some masses of arkosic sandstone similar to that found in Ks.

ssh Sandstone and shale. Alternating thin beds of sandstone and shale, similar to that so labelled within Ks.

cg Conglomerate. Small isolated outcrops of hard, dark-colored rocks composed of well-rounded pebbles in a sandy matrix. The pebbles are chiefly of gray chert.

ch Chert and allied siliceous rocks. Mainly isolated prominent outcrops of reddish-brown, greenish, or light-gray, thinly bedded radiolarian chert, but includes prominent exposures of massive, red, yellow, or mottled jasper.

gs Greenstone. More or less altered or metamorphosed basaltic igneous rocks similar to KJg, except occurring in small, isolated masses.

gl Metamorphic rocks. Chiefly dense, coarsely crystalline, dark-bluish, glaucophane-bearing schists or gneisses and dark-green eclogite. These characteristically occur as small prominent outcrops, mostly less than a few tens of feet in maximum dimension. Includes masses of fine-grained semi-schist, phyllite, metachert, and metavolcanic rocks similar to KJsch, that are found within areas principally underlain by melange matrix.

am Amphibolite. Dense, dark-colored rocks composed principally of black hornblende and white feldspar.

sp Serpentine. Pale-green to dark-green, fine-grained, metamorphic rocks composed almost entirely of the magnesium silicate minerals lizardite and chrysotile, commonly with abundant, finely disseminated magnetite. Most or all derived by metamorphism of various kinds of peridotite, igneous rocks that originated in the mantle, below the earth's crust. In this area, the serpentine is closely sheared, so that most outcrops reveal abundant curved, polished surfaces. Occurs as tiny to very large lenses or irregular-shaped sheet-like masses that are mostly or entirely limited to melange or other fault zones. Because of its unique chemical characteristics, serpentine weathers very slowly, and it tends to crop out prominently, with thin, poor-quality soils sparsely distributed between more abundant rock exposures.

SITE: PORTSIDE PARK (APEEL 2) DATE: 4/24/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	VERY GRAVELLY, CLAY LOAM (fill), dk brown (7SYR 3/4)
			1	
			2	CLAY, very dark greenish grey (5GY 3/1), very soft (HOLOCENE ESTUARINE DEPOSITS)
			10 3	
			4	CLAY, dark greenish grey (5GY 4/1), very soft
			5	
			20 6	
			7	
			8	
			9	ORGANIC-RICH CLAY, dk greenish-grey (5GY 4/1), soft
			30	SAND, dark greenish grey, very fine to fine grained
			10	
			11	
			12	SANDY CLAY, light olive brown (2.5Y 5/4), stiff (LATE PLEISTOCENE ALLUVIUM AND ESTUARINE DEPOSITS)
			40 13	
			14	
			15	stiffer
			50	

SITE: PORTSIDE PARK (APEEL 2) DATE: 4/24/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50 16	CLAY, olive (5Y 4/3) to olive grey (5Y 4/2), stiff
			17	
			18 60	
			19	olive grey
			20	
			21 70	
			22	
			23	olive grey mottled olive
			24 80	
			25	
			26	
			27 90	greenish grey (5G 5/1), stiff
			28	
			29	
			30 100	

SITE: PORTSIDE PARK (APEEL 2) DATE: 4/24/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			100 31	
			32	CLAY TO CLAY LOAM, brown (10YR 5/3)
			33	
			110 34	FINE GRAVELLY SAND
				FINE SANDY CLAY LOAM, dark yellowish brown (10YR 4/4), stiff
			35	
			36	
			120 37	grading to CLAY, greenish grey (5GY 4/1)
			38	FINE GRAVELLY SAND, mixed greenish grey, dark brown, and olive brown
			39	
			130 40	CLAY LOAM, dark greyish brown (2.5Y 4/2)
			41	
			42	
			140 43	CLAY LOAM, dark greyish brown (2.5Y 4/2) to olive brown (2.5Y 4/4), poorly sorted (some fine gravel), very stiff
			44	
			45	
				CLAY LOAM, olive brown (2.5Y 4/4), poorly sorted
			150	

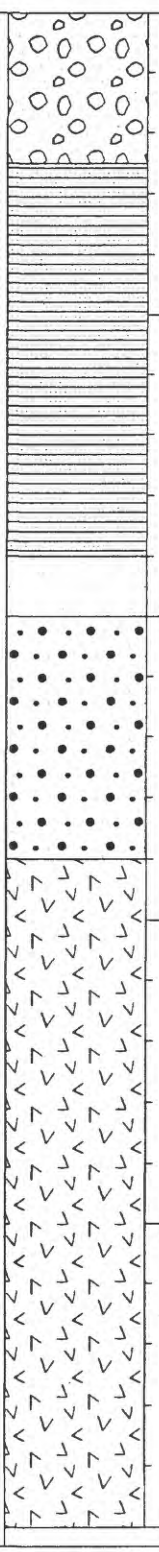
SITE: PORTSIDE PARK (APEEL 2) DATE: 4/24/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			150 46	
			47	
			48	
			160 49	CLAY, dark yellowish brown (10YR 4/4)
			50	
			51	CLAY, dark yellowish brown (10YR 4/6)
			170 52	
			53	CLAY LOAM, strong brown (7.5YR 4/6)
			54	
			180 55	
			56	
			57	GRAVEL, dark brown, poorly sorted
			190 58	
			59	
			60	
			200	

SITE: PORTSIDE PARK (APEEL 2) DATE: 4/24/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			200 61	CLAY LOAM, dark brown (7.5YR 4/4)
			62	
			63	
			210 64	
			65	
			66	
			220 67	CLAY, very stiff
			68	
			69	
			230 70	SANDY GRAVEL, brown
			71	
			72	
			73	CLAY, very stiff
			240	
			74	
			75	
			76	
			250	

SITE: PORTSIDE PARK (APEEL 2) DATE: 4/24/91

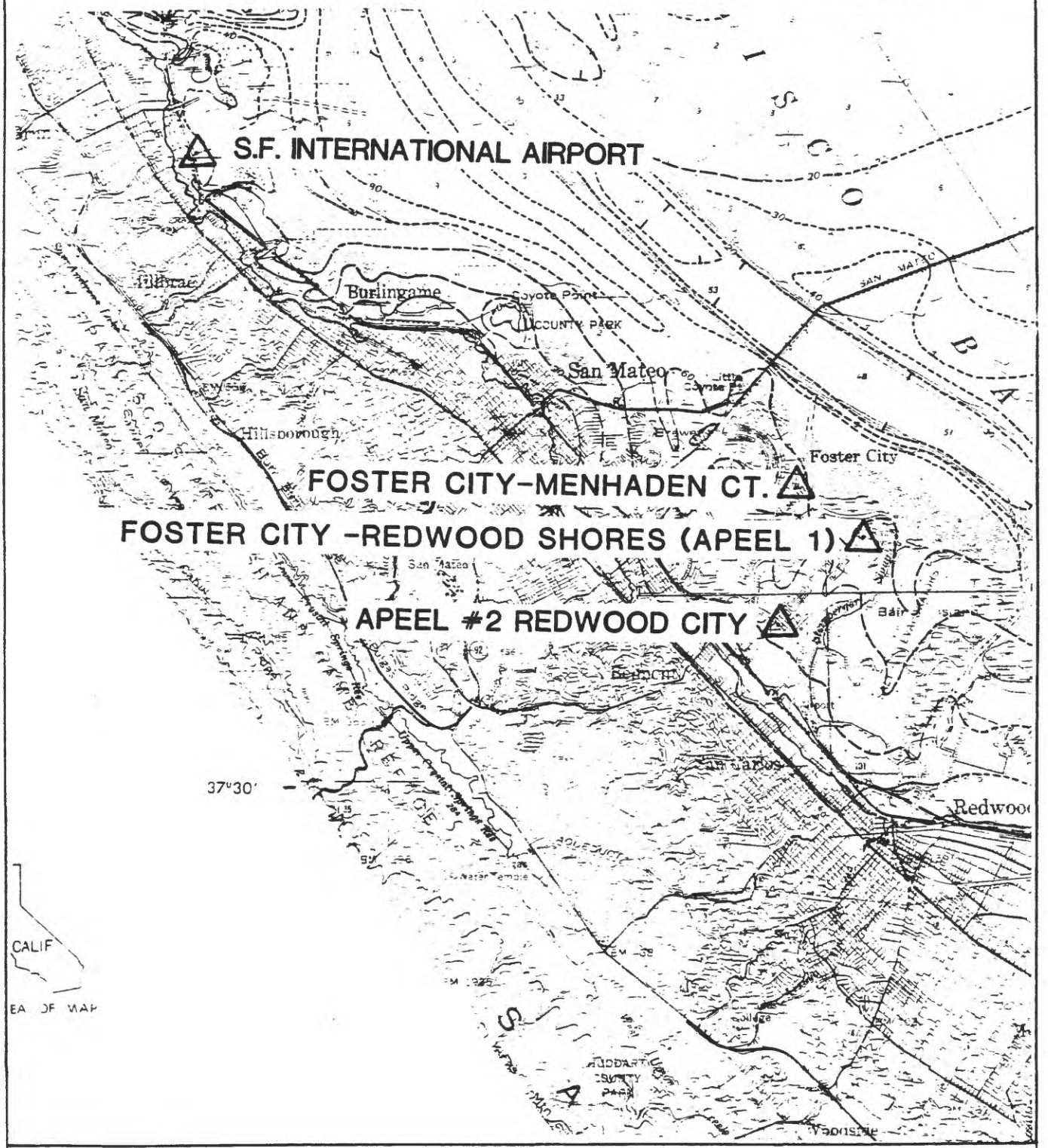
BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			250 77	SANDY GRAVEL, very dense
			78	SANDY CLAY LOAM, very dense, some gravel lenses
			260 79	
			80	
			81	
			82	SAND
			270	GRAVELLY SAND, yellowish brown (10YR 5/6)
			83	
			84	
			85	GREYWACKE, greenish grey (5G 5/1), very closely fractured
			280 86	
			87	
			88	
			290	dk greenish grey (5G 5/1), very hard
			89	
			90	
			91	
			300	

SITE: PORTSIDE PARK (APEEL 2) DATE: 4/24/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			300 92	
			93	
			94	
			310 95	
			96	
			97	
			320 98	
			99	
			100	
			330 101	
			102	
			103	
			340 104	
			105	
			106	
			350	

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-976



MAP SHOWING THICKNESS OF YOUNG BAY MUD, SOUTHERN SAN FRANCISCO BAY, CALIFORNIA

BY

SANDRA D. McDONALD, DONALD R. NICHOLS, NANCY A. WRIGHT, AND BRIAN ATWATER

1978

EXPLANATION

Generalized thickness contours, in feet, of young bay mud. Contour interval is 10 ft (3 m) or 20 ft (6 m). Hachures point towards areas where mud is thinner than the value of the surrounding contour.

———— Uncertainty in thickness generally less than or equal to one-half the local contour interval

— — — Uncertainty in thickness generally less than or equal to the local contour interval

– – – – – Uncertainty in thickness may be greater than the local contour interval

Soft gray clay, probably young mud, located landward of historic tidal marshes

Locations of boreholes

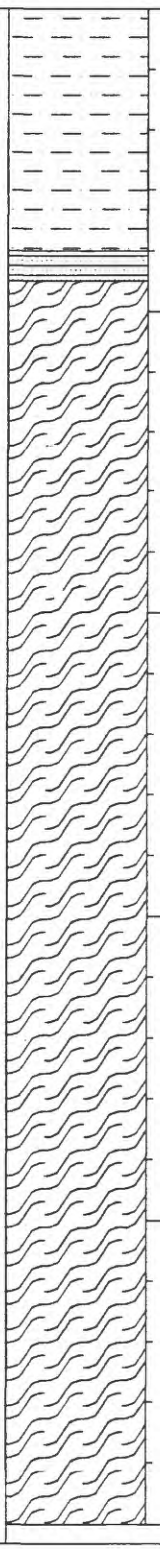
• Borehole from which young bay mud was not reported

• Borehole from which top and bottom of young bay mud was reported

◦ Borehole from which top, but not bottom, of young bay mud was reported

SITE: PRESIDIO

DATE: 4/11/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	SILTY CLAY LOAM, very dark brown, (7.5YR 3/2)
			1	brown (7.5YR 4/4)
			2	SANDY LOAM, light olive brown, (2.5Y 5/4)
			3	SERPENTINITE, light olive brown (2.5Y 5/4), very closely fractured, hard
			4	
			5	olive grey to black (5Y 4/2), closely to moderately fractured
			6	very closely to closely fractured
			7	
			8	
			9	greenish grey (5GY 5/1), sheared, texture is very coarse sandy clay
			10	sheared to very closely fractured
			11	
			12	very closely to closely fractured sheared to very closely fractured
			13	
			14	
			15	

10

20

30

40

50

SITE: PRESIDIO

DATE: 4/11/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50 16	bluish grey (5B 6/1 to 5B 5/1), sheared (texture is sandy clay)
			17	
			60 18	
			19	
			20	
			70 21	
			22	
			23	
			24	SHALE, black, hard, closely to very closely fractured
			80	SERPENTINITE, sheared
			25	
			26	
			27	
			90 28	
			29	
			30	
			100	

SITE: PRESIDIO

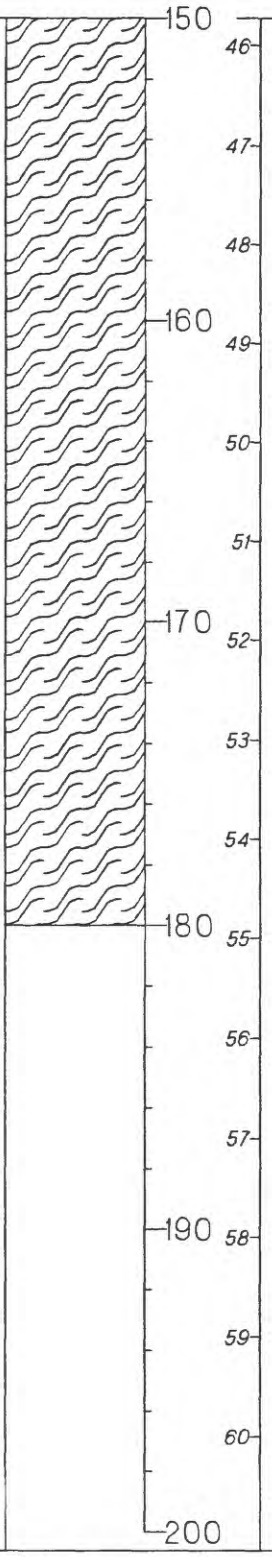
DATE: 4/11/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			100 31	SHALE, black, hard
			32	
			33	
			110 34	SERPENTINITE, sheared (texture is sandy clay)
			35	
			36	
			120 37	
			38	rocky
				very firm, sheared (texture is sandy clay)
			39	
			130 40	
			41	
			42	rocky
			140 43	very firm, sheared
			44	
			45	rocky
				very firm, sheared
			150	

SITE: PRESIDIO

DATE: 4/11/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION



SCALE 1:24 000

1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

GEOLOGIC MAP OF THE SAN FRANCISCO NORTH QUADRANGLE, SAN FRANCISCO AND MARIN COUNTIES, CALIFORNIA

Geology mapped in 1948–61 by Julius Schlocker, M. G. Bonilla, D. H. Radbruch, D. A. Rave, and N. Konkoff

EXPLANATION

SURFICIAL DEPOSITS

Holocene

Qaf — Artificial fill

Predominantly dune sand but includes silt, clay, rock waste from excavations, manmade debris, and organic waste. Probable fill material indicated in parentheses. Maximum thickness approximately 80 feet

Qb — Modern beach deposits

Predominantly well sorted medium to coarse gray sand; coarse gravel and large cobbles in some places. Maximum thickness approximately 10 feet

Holocene(?) and Pleistocene(?)

Qls (Qly, Qlo) — Landslide deposits

Generally unstratified mixtures of bedrock, sand, silt, and clay in varying proportions.
Qly, younger landslide deposits
Qlo, older landslide deposits

Qal — Alluvium

Predominantly clayey silty sand and clayey silt, some pebbles; locally clean medium sand, generally gray to brown. Maximum thickness approximately 25 feet; observed thickness 15 feet

Qsr — Slope debris and ravine fill

Angular rock fragments in sand, silt, and clay matrix, generally light yellow to reddish brown. Maximum thickness approximately 80 feet

Qd — Dune sand

Clean well-sorted fine to medium sand; yellowish brown to light gray. Maximum thickness approximately 150 feet

Pleistocene

Qob — Older beach deposits

Predominantly well sorted medium to coarse gray sand. Maximum thickness approximately 20 feet

Qc — Colma Formation

Unconsolidated fine to medium sand with small to moderate amounts of silt and clay; in places includes clay beds, 6 inches to 3 ft thick; cobble-size rubble rare; commonly light brown to gray. Observed thickness 75 feet; probably maximum thickness approximately 200 feet

Holocene and Pleistocene

Qm — Bay mud and clay

Plastic gray silty clay; some lenses of sand, peat, and shell fragments; fluid to soft upper layers; moderately stiff clay at depth. Concealed except for exposures north of Corinthian Island and north of Sausalito Point. Maximum thickness approximately 140 feet

Qu — Surficial deposits, undivided

QUATERNARY

BEDROCK

Upper Cretaceous

Ks — Sheared rocks, undifferentiated

Coherent blocks and pieces of hard rock as much as several hundred feet in diameter, in a matrix of intensely sheared shale and serpentine. Clasts predominantly sandstone, chalt, and serpentine, but also include all other rock types known in Franciscan Formation. Matrix gray to greenish gray, moderately firm to soft and clayey; generally expansive and plastic when wet

Intrusive into Franciscan Formation

Serpentine

Mostly soft sheared rock containing hard knobs of unsheared serpentine, rodingite, and rocks of the Franciscan Formation. Derived from peridotites (mostly harzburgite, some dunite).
sph, hard serpentine, slightly sheared. Shown separately on Potrero Hill only. Variously colored, but generally greenish gray, blue, or brown. Includes sheared rocks (Ks) where that unit is mostly serpentine

Gabbro

Fine- to coarse-grained gabbro; includes diabase where texture is subophitic. Occurs as inclusions or segregations in serpentine

Franciscan Formation

KJss (KJsh, KJs) — Clastic sedimentary rocks

KJss, sandstone; thick-bedded and massive graywacke sandstone interbedded with thin layers of shale and fine-grained sandstone; some thick conglomerate lenses
KJsh, shale and thin-bedded sandstone; predominantly interbedded and laminated shale and fine-grained graywacke sandstone; beds generally 2 to 5 inches thick.
KJs, sandstone and shale, undifferentiated; consists of units KJss or KJsh or poorly exposed that predominant lithology could not be determined.
Sandstone and shale at Point Lobos and vicinity west of City College fault zone is probably Great Valley sequence of Bailey, Irwin, and Jones (1964, p. 188)

KJr — Radiolarian chert and shale

Reddish-brown; alternate beds of hard brittle chert, 1 to 5 inches thick, and firm brittle shale, ½ to ½ inch thick. Locally includes bodies of massive chert

KJg — Greenstone

Greenish-gray aphanitic to medium-grained altered volcanic rocks; predominantly basalt. Includes flows, agglomerate, and tuff; pillow lavas common; less commonly massive; interbedded with radiolarian chert and sandstone

KJm — Metamorphic rocks

Fine- to coarse-grained slate, schist, and granofels of the blueschist facies

Jurassic(?) and Lower and Upper Cretaceous

JURASSIC(?) AND CRETACEOUS

CRETACEOUS

Contact
Long dashed where approximately located, short dashed where indefinite, dotted where concealed

Fault, showing dip and relative movement
Long dashed where approximately located; short dashed where inferred; dotted where concealed. Query indicates greater uncertainty as to existence of fault than does dashed line. U, upthrown side; D, downthrown side

Shear zone
Showing average dip — *Approximately horizontal*

Anticline — Syncline
Folds
Showing axis and direction of plunge. Dashed where approximately located; dotted where concealed

Strike and dip of beds

Strike and dip of foliation

X
Fossil locality

Top of landslide scarp

Approximate boundary of transverse sand bars in San Francisco Bay (Modified from Gibson, 1951, p. 6)

Quarry

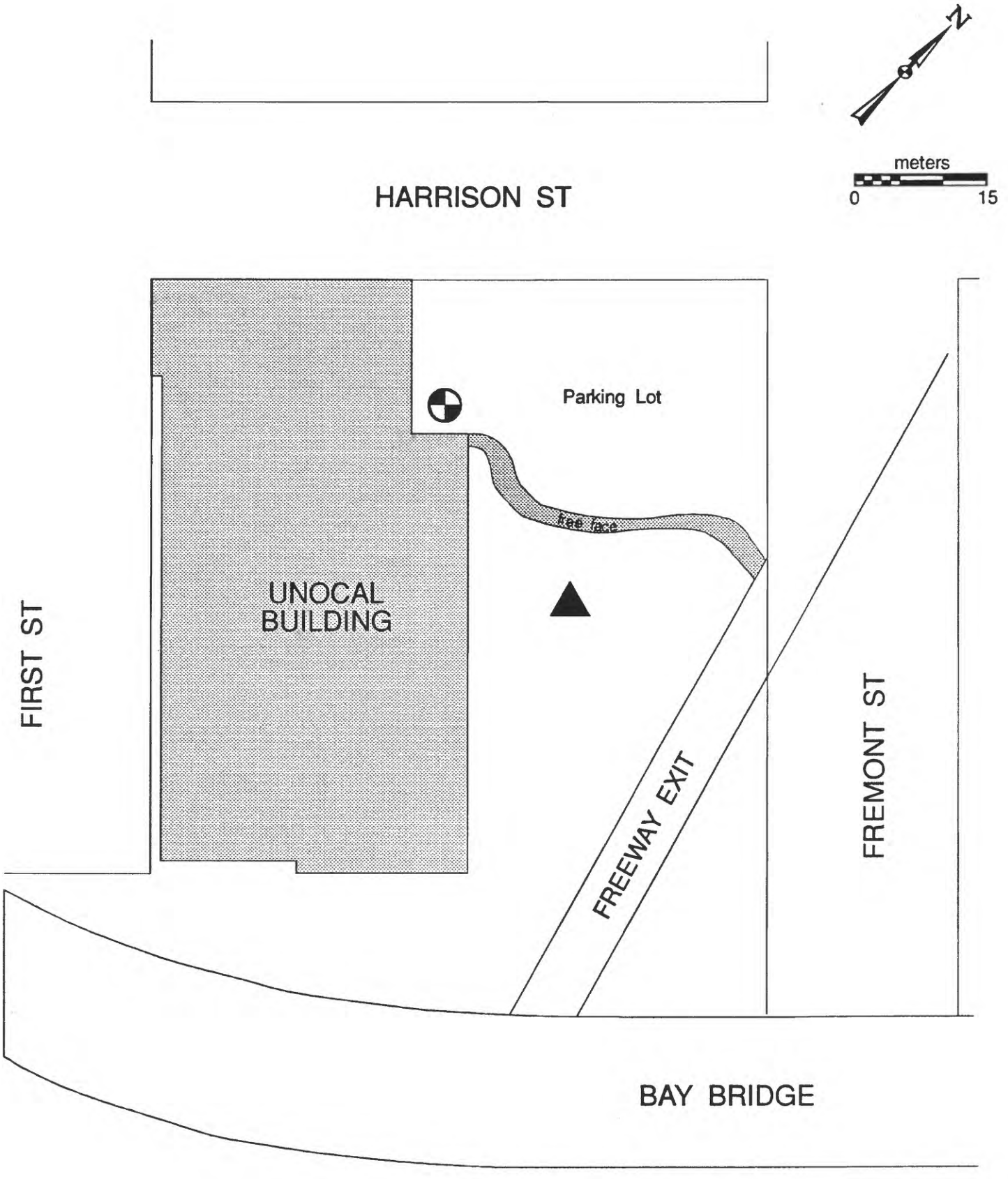
Abbreviated columnar section
Stratigraphic sequence and approximate thickness in feet of geologic map unit based on logs of boreholes and excavation. Sand-clay may include one or both of the following: sand, silt, and clay in various proportions, alternating thin beds of sand and silty clay

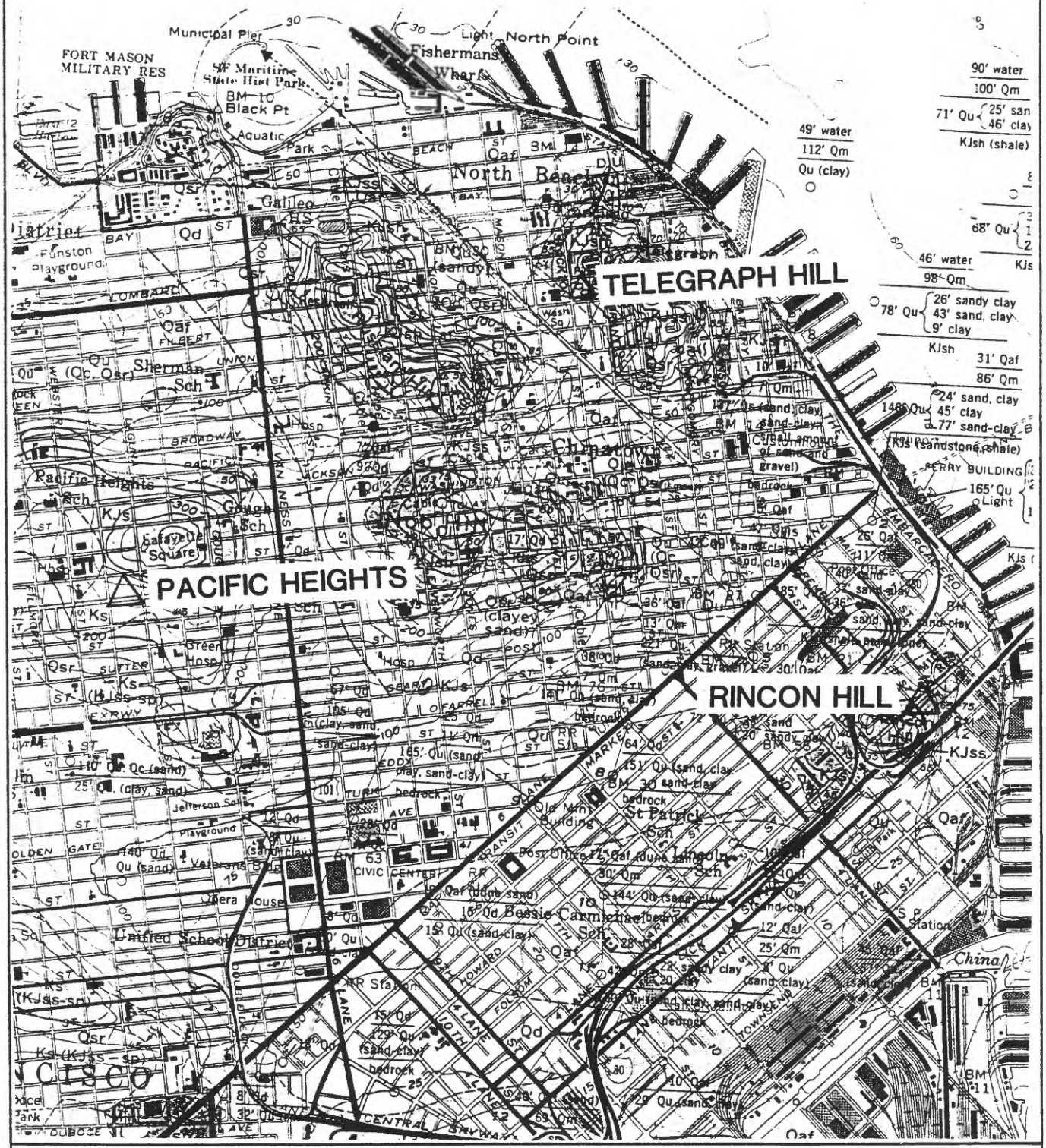
SITE: RINCON HILL – SAN FRANCISCO DATE: 7/29/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	SHALE, strong brown, closely to very closely fractured, extremely weathered, very soft
			10	SANDSTONE, brown fine-grained and red medium-grained, very weathered, soft
				SHALE, strong brown, fairly weathered, firm
				SANDSTONE, brown to grey, fine-grained, moderately weathered, very firm
				SHALE, dark brown to grey, closely to very closely fractured, slightly weathered, very firm
			20	
				very firm, dark brownish-grey, moderately fractured, unweathered
			30	slightly harder
				closely to very closely fractured
			40	
			50	

SITE: RINCON HILL – SAN FRANCISCO DATE: 7/29/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50	soft
			16	firm
				GREYWACKE, grey, closely to very closely fractured, hard
			17	
				SHALE, dark grey to black, closely to very closely fractured, firm
			18	
			60	GREYWACKE, dark grey, closely to very closely fractured, very hard
			19	
				soft, moderately fractured
			20	hard, some black shale interbeds.
				harder
			21	
			70	very hard, finer grained, closely fractured
			22	
				coarser grained
			23	
				slightly softer
				finer grained
			24	
			80	slightly softer
			25	very hard, closely to very closely fractured
			26	
			27	
			90	moderately fractured
			28	
			29	
			30	
			100	


N
meters
0
15
HARRISON ST
Parking Lot
tee face
UNOCAL
BUILDING
FIRST ST
FREEWAY EXIT
FREMONT ST
BAY BRIDGE
RINCON HILL



SCALE 1:24 000

1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

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EXPLANATION

SURFICIAL DEPOSITS

QUATERNARY

Holocene

Qaf

Artificial fill

Predominantly dune sand but includes silt, clay, rock waste from excavations, manmade debris, and organic waste. Probable fill material indicated in parentheses. Maximum thickness approximately 60 feet

Qb

Modern beach deposits

Predominantly well sorted medium to coarse gray sand; coarse gravel and large cobbles in some places. Maximum thickness approximately 40 feet

Holocene and Pleistocene(?)

Ql | Qly | Qlo

Landslide deposits

Generally unstratified mixtures of bedrock, sand, silt, and clay in varying proportions.
Qly, younger landslide deposits
Qlo, older landslide deposits

Qal

Alluvium

Predominantly clayey silty sand and clayey silt, some pebbles; locally clean medium sand, generally gray in brown. Maximum thickness approximately 25 feet; observed thickness 15 feet

Qsr

Slope debris and ravine fill

Angular rock fragments in sand, silt, and clay matrix; generally light yellow to reddish brown. Maximum thickness approximately 80 feet

Qd

Dune sand

Clean well-sorted fine to medium sand; yellowish brown to light gray. Maximum thickness approximately 150 feet

Pleistocene

Qob

Older beach deposits

Predominantly well sorted medium to coarse gray sand. Maximum thickness approximately 30 feet

Qc

Colma Formation

Unconsolidated fine to medium sand with small to moderate amounts of silt and clay, in places includes clay beds, 6 inches to 5 ft thick; cobble-size rubble rare; commonly light brown to gray. Observed thickness 75 feet; probably maximum thickness approximately 300 feet

Qm

Bay mud and clay

Plastic gray silty clay; some lenses of sand, peat, and shell fragments; fluid to soft upper layers, moderately stiff clay at depth. Concealed except for exposures north of Corinthian Island and north of Sausalito Point. Maximum thickness approximately 140 feet

Qu

Surficial deposits, undivided

BEDROCK

CRETACEOUS

Upper Cretaceous

Ks

Sheared rocks, undifferentiated

Coherent blocks and pieces of hard rock as much as several hundred feet in diameter, in a matrix of intensely sheared shale and serpentine. Clasts predominantly sandstone, shale, and serpentine, but also include all other rock types known in Franciscan Formation. Matrix gray to greenish gray, moderately firm to soft and clayey, generally expansive and plastic when wet

JURASSIC(?) AND CRETACEOUS

Intrusive into Franciscan Formation

sp

Serpentine

Mostly soft sheared rock containing hard knobs of unsheared serpentine, rodingite, and rocks of the Franciscan Formation. Derived from peridotites (mostly harzburgite, some dunite)
sph, hard serpentine, slightly sheared. Shown separately on Potrero Hill only. Variously colored, but generally greenish gray, blue, or brown. Includes sheared rocks (Ks) where that unit is mostly serpentine

gb

Gabbro

Fine- to coarse-grained gabbro; includes diabase where texture is subophitic. Occurs as inclusions or segregations in serpentine

Jurassic(?) and Lower and Upper Cretaceous

KJss | KJsh | KJs

Clastic sedimentary rocks

KJss, sandstone; thick-bedded and massive graywacke sandstone interbedded with thin layers of shale and fine-grained sandstone; some thick conglomerate lenses
KJsh, shale and thin-bedded sandstone; predominantly interbedded and laminated shale and fine-grained graywacke sandstone; beds generally 2 to 5 inches thick.
KJs, sandstone and shale, undifferentiated, consists of units KJss or KJsh so poorly exposed that predominant lithology could not be determined
Sandstone and shale at Point Lobos and vicinity west of City College fault zone is probably Great Valley sequence of Bailey, Irwin, and Jones (1964, p. 123).

Franciscan Formation

KJc

Radiolarian chert and shale

Reddish-brown, alternate beds of hard brittle chert, 1 to 5 inches thick, and firm brittle shale, ½ to ¼ inch thick. Locally includes bodies of massive chert

KJg

Greenstone

Greenish-gray aphanitic to medium-grained altered volcanic rocks; predominantly basalt. Includes flows, agglomerate, and tuff; pillow lavas common, less commonly massive, interbedded with radiolarian chert and sandstone

KJm

Metamorphic rocks

Fine- to coarse-grained slate, schist, and granofels of the blueschist facies

---

Contact

Long dashed where approximately located, short dashed where indefinite; dotted where concealed

Fault, showing dip and relative movement

Long dashed where approximately located, short dashed where inferred; dotted where concealed. Query indicates greater uncertainty as to existence of fault than does dashed line. U, upthrown side; D, downthrown side

Showing average dip — Approximately horizontal

Shear zone

Anticline — Syncline

Folds

Showing axis and direction of plunge. Dashed where approximately located, dotted where concealed

Strike and dip of beds

Strike and dip of foliation

X

Fossil locality

Top of landslide scarp

Approximate boundary of transverse sand bars in San Francisco Bay (Modified from Gibson, 1951, p. 6)

Quarry

Abbreviated columnar section

Stratigraphic sequence and approximate thickness in feet of geologic map unit based on logs of boreholes and excavation. Sand-clay may include one or both of the following: sand, silt, and clay in various proportions, alternating thin beds of sand and silty clay

SITE: SAGO SOUTH

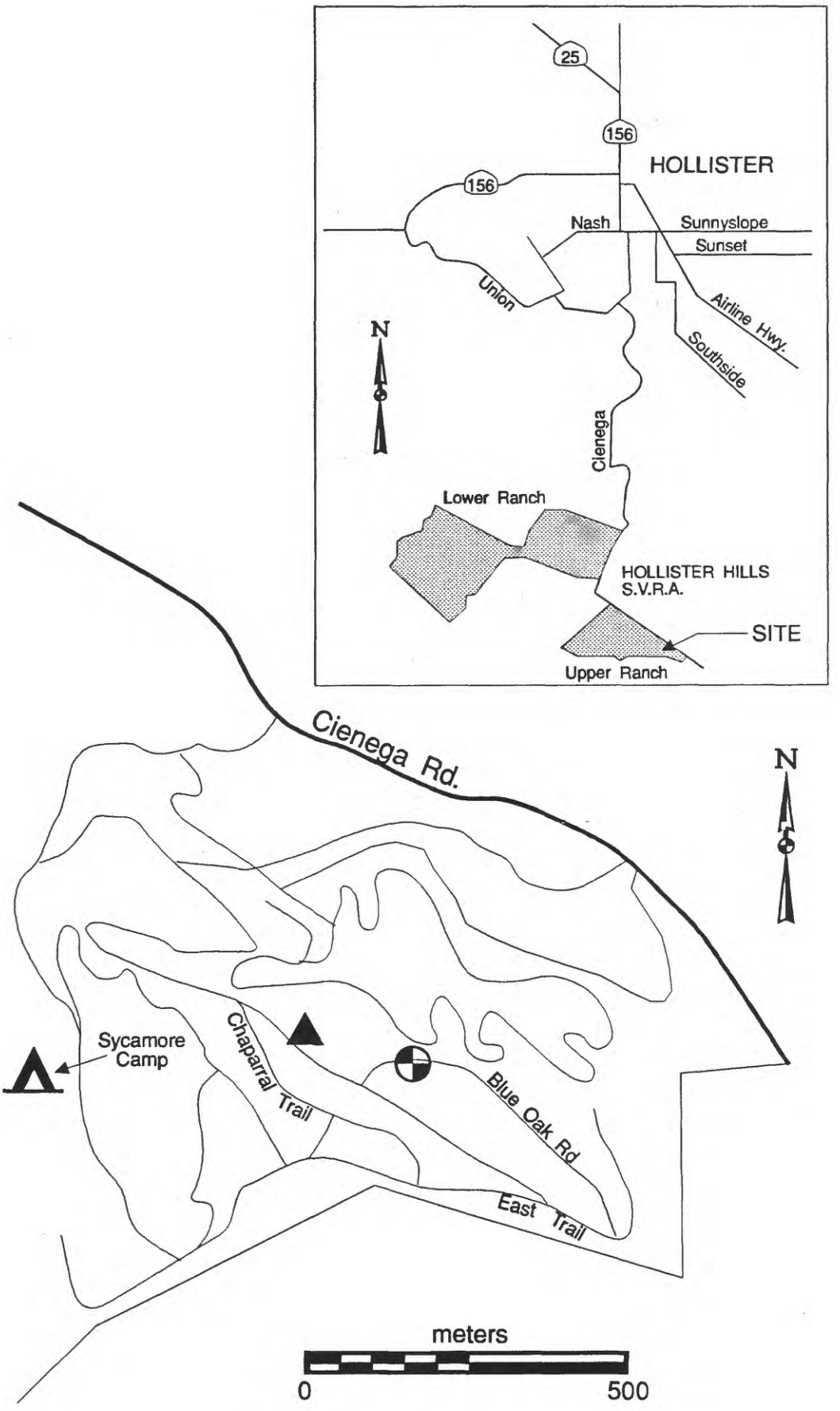
DATE: 7/21/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	SILTY SAND (fill), brown
			1	GRAVEL, dark brown, very deeply weathered granodiorite fragments
				GRAVELLY LOAM, dark brown, very poorly sorted
			2	GRANODIORITE, greyish-brown, very closely fractured, deeply weathered
			10 3	hard
				deeply weathered (texture is loamy sand)
			4	
				progressively harder and more mafic
			5	
				MAFIC SCHIST, very dark grey, slightly weathered, very closely to closely fractured
			20 6	harder, closely fractured
				softer, very closely fractured
			7	harder, moderately fractured
			8	softer, very closely fractured
			9	SILTY CLAY (gouge), yellowish grey, soft
			30	GNEISS, light greenish grey, very closely fractured, hard
			10	
			11	SILTY CLAY (gouge), yellowish grey, soft
			12	GNEISS, dark brownish grey, very closely to closely fractured, hard
			40 13	harder, more quartz
			14	
			15	
			50	

SITE: SAGO SOUTH

DATE: 7/21/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50 16	slightly harder, less quartz
			17	very hard, moderately fractured
			18 60	
			19	softer, intermittent yellowish brown clay seams (gouge)
			20	
			21 70	
			22	
			23	
			24 80	
			25	
			26	
			27 90	
			28	SCHIST, black, very closely to closely fractured, very hard
			29	
			30 100	


25
156
HOLLISTER
156
Nash
Sunnyslope
Sunset
Union
Airline Hwy.
Southside
N
Cienega
Lower Ranch
HOLLISTER HILLS
S.V.R.A.
SITE
Upper Ranch
Cienega Rd.
N
Sycamore
Camp
Chaparral Trail
Blue Oak Rd
East Trail
meters
0
500

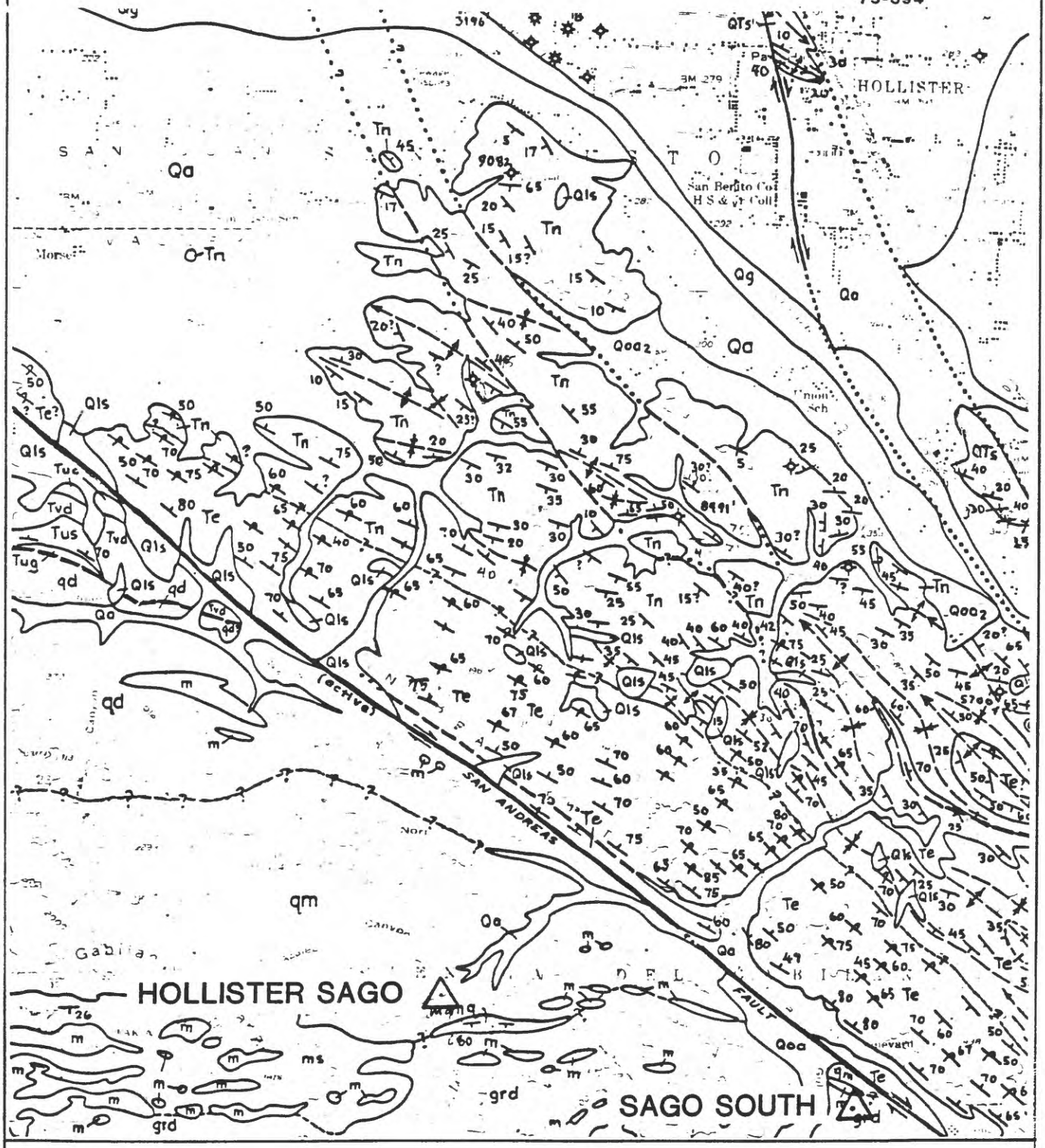
SAGO SOUTH

DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

OPEN FILE MAP

75-394



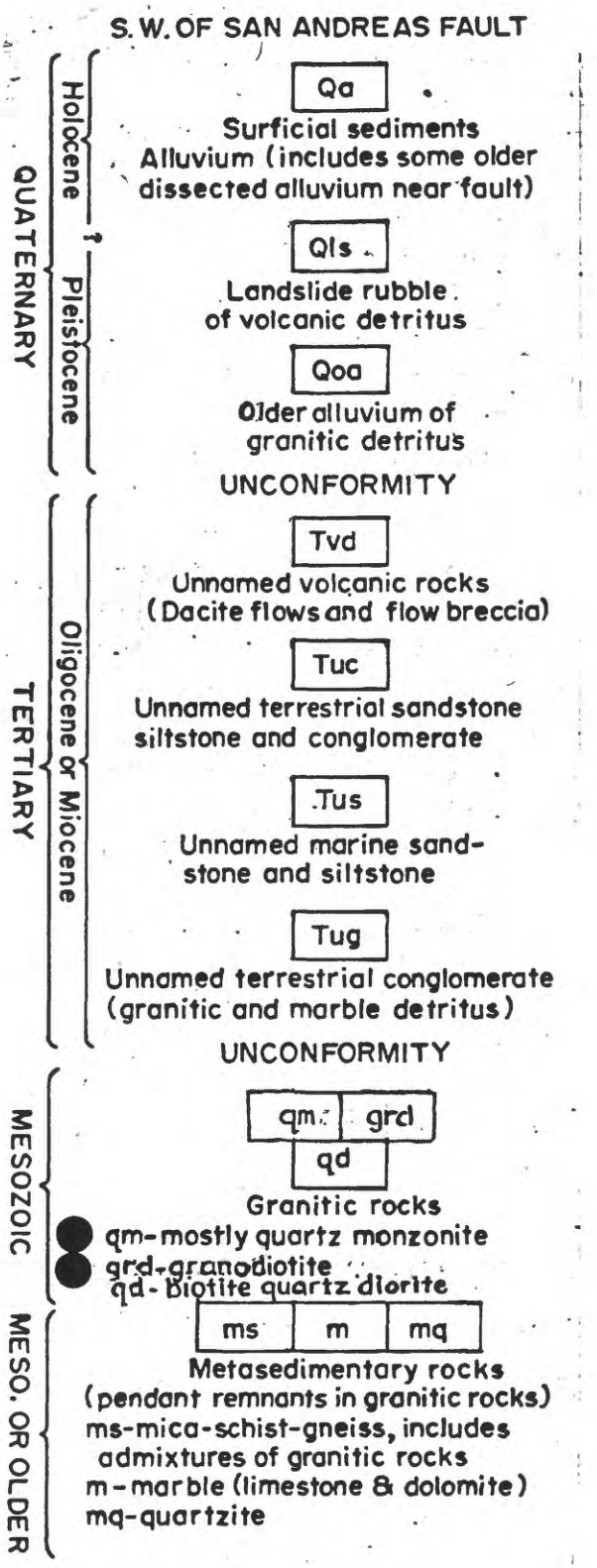
SCALE 1:62 500

1 ½ 0 1 2 3 4 5 MILES

1 .5 0 1 2 3 4 5 6 7 KILOMETERS

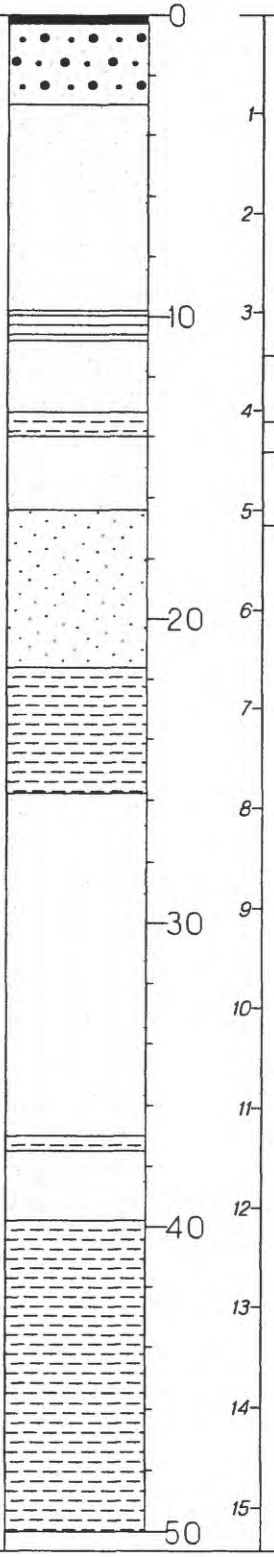
GEOLOGIC MAP OF THE HOLLISTER QUADRANGLE, CALIFORNIA

Geology by T.W. Dibblee Jr. & T.H. Rogers


S.W. OF SAN ANDREAS FAULT
QUATERNARY
Holocene
?
Pleistocene
Qa
Surficial sediments
Alluvium (includes some older dissected alluvium near fault)
Qls
Landslide rubble of volcanic detritus
Qoa
Older alluvium of granitic detritus
UNCONFORMITY
TERTIARY
Oligocene or Miocene
Tvd
Unnamed volcanic rocks
(Dacite flows and flow breccia)
Tuc
Unnamed terrestrial sandstone siltstone and conglomerate
Tus
Unnamed marine sandstone and siltstone
Tug
Unnamed terrestrial conglomerate
(granitic and marble detritus)
UNCONFORMITY
MESOZOIC
qm
grd
qd
Granitic rocks
qm-mostly quartz monzonite
grd-granodiotite
qd-Biotite quartz diorite
MESO. OR OLDER
ms
m
mq
Metasedimentary rocks
(pendant remnants in granitic rocks)
ms-mica-schist-gneiss, includes admixtures of granitic rocks
m-marble (limestone & dolomite)
mq-quartzite

SITE: SIERRA POINT

DATE: 8/24/92



BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	FILL – fine sand to coarse gravel
			1	SANDSTONE, yellow to brown, very weathered, very closely fractured, fine grained, soft
			2	
			3	SHALE, black, fairly weathered, very closely fractured,
				SANDSTONE, yellow–brown, fairly weathered, very closely fractured, fine grained, hard
			4	CLAYSTONE, yellow, soft
				SANDSTONE, yellow, slightly weathered, closely to very closely fractured, medium grained, hard
			5	SANDSTONE, deep brown, unweathered, very closely fractured, medium grained, very hard
			6	
			7	CLAYSTONE, yellow, soft
			8	SANDSTONE, yellowish brown to deep brown, very closely fractured, medium grained, hard
			9	
			10	harder, closely fractured
			11	
				SANDSTONE, brown, very closely fractured, fine grained, hard
			12	CLAYSTONE, grey and yellow, soft
			13	
			14	
			15	

SITE: SIERRA POINT

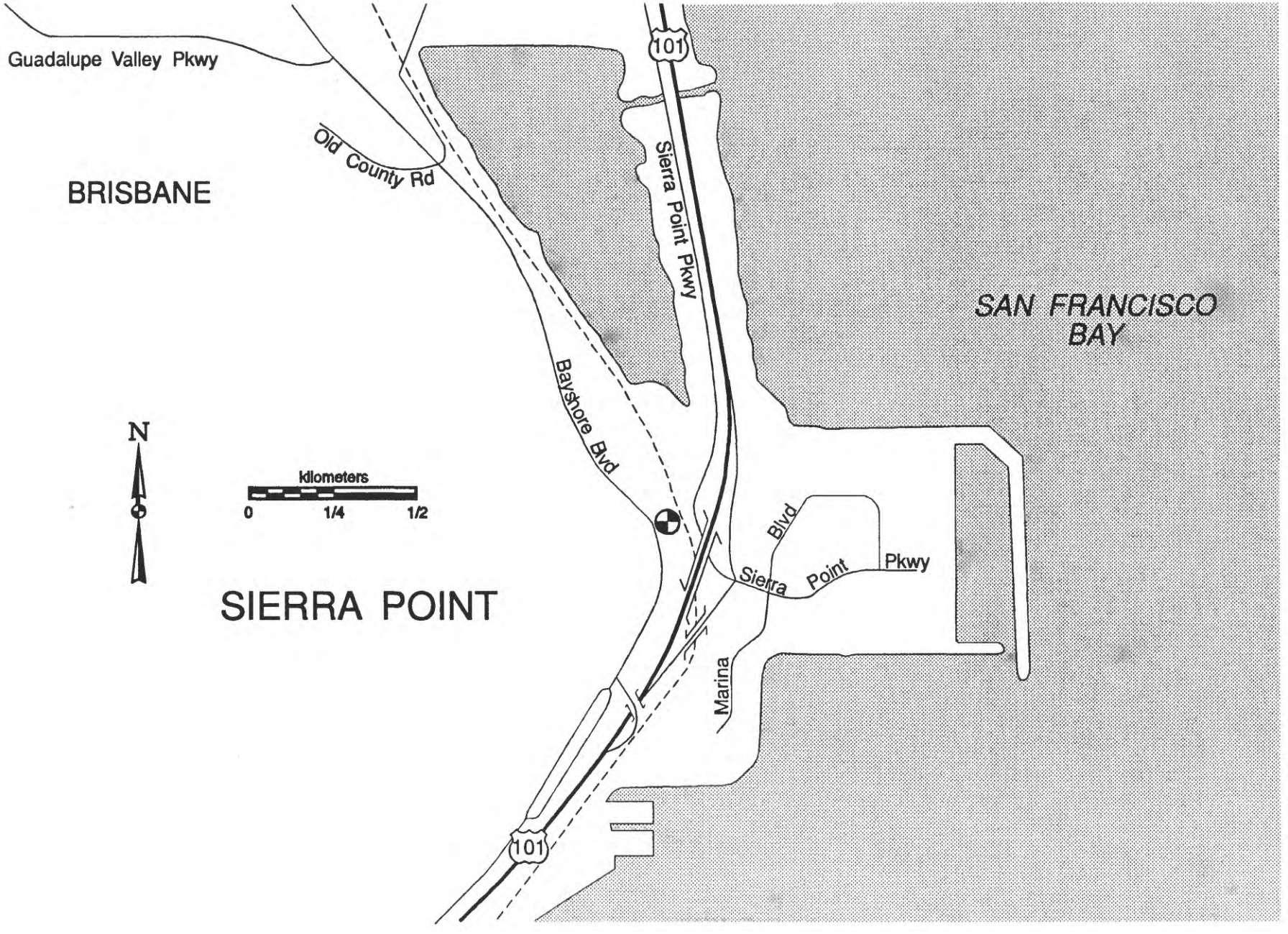
DATE: 8/24/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50 16	
			17	
			18 60	
			19	
			20	
			21 70	
			22	SANDSTONE, grey, moderately fractured, medium grained, hard
				CLAYSTONE, yellow, medium hard
			23	
				gradational contact to
			24 80	SANDSTONE, light grey, moderately fractured, medium grained, hard
			25	CLAYSTONE, yellow, soft
			26	
			27	
			90	SANDSTONE, brown, moderately fractured, medium grained, very hard
			28	CLAYSTONE, yellow, hard
			29	
			30	ALTERNATING SANDSTONE AND CLAYSTONE
			100	

SITE: SIERRA POINT

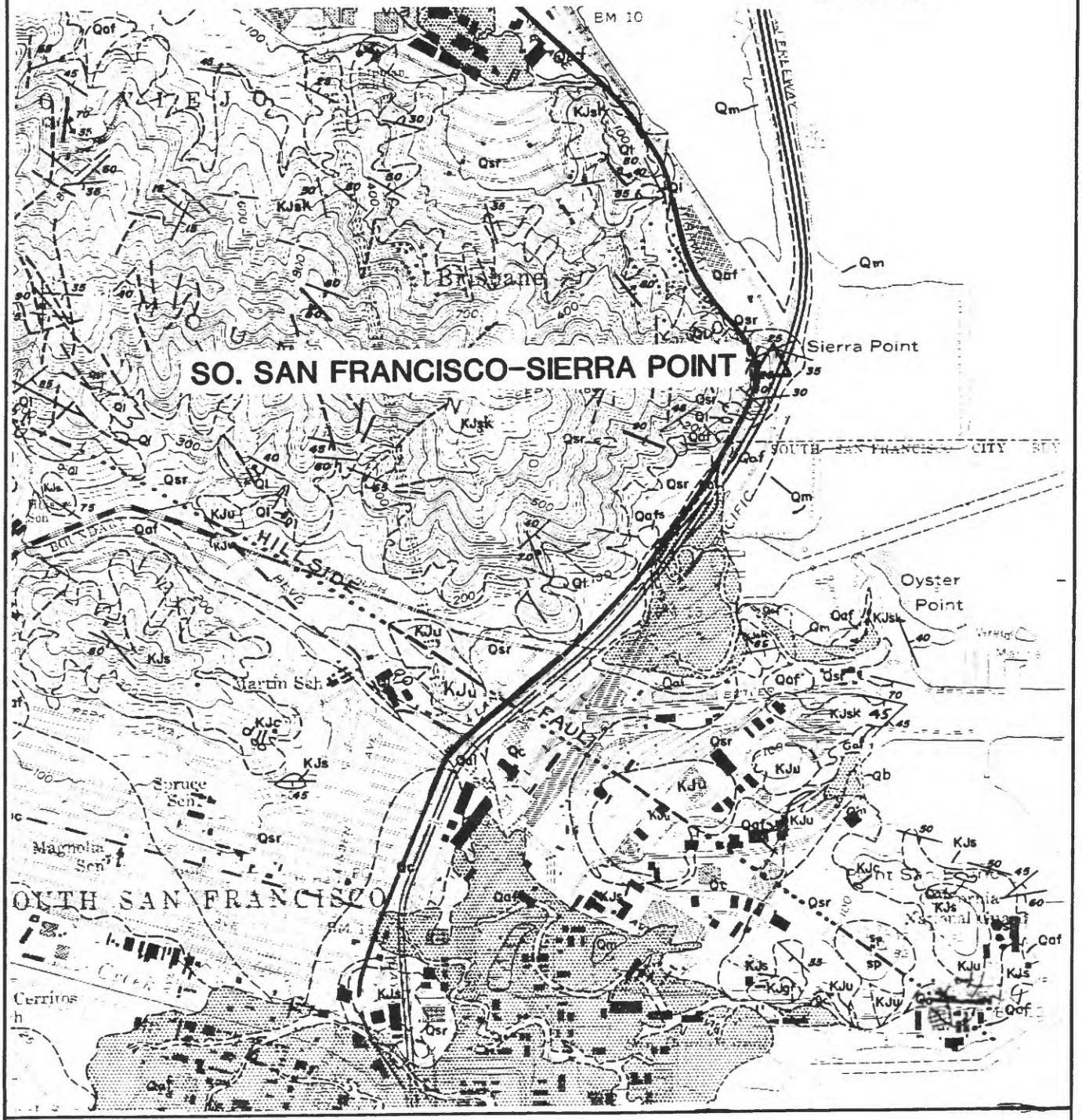
DATE: 8/24/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			100 31	
			32	SANDSTONE, brown, moderately fractured, medium grained, very hard
			33	
			110 34	
			35	
			36	
			120 37	
			38	
			39	
			130 40	
			41	
			42	
			140 43	
			44	
			45	
			150	


Guadalupe Valley Pkwy
Old County Rd
BRISBANE
101
Sierra Point Pkwy
SAN FRANCISCO BAY
Bayshore Blvd
N
kilometers
0
1/4
1/2
SIERRA POINT
Sierra Point Blvd
Pkwy
Marina
101

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-311



SCALE 1:24000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

PRELIMINARY GEOLOGIC MAP OF THE SAN FRANCISCO SOUTH QUADRANGLE AND PART OF THE HUNTERS POINT QUADRANGLE, CALIFORNIA

by

M. G. Bonilla

1971

Recent — **Pleistocene** — **Pliocene and Pleistocene**

QUATERNARY

Qaf, Qafs — **Artificial fill**
Clay, silt, sand, rock fragments, organic matter, and man-made debris.
Qafs, Indian shellmound

Ql — **Landslide deposits**
Composition and structure depend on geologic formation involved and type of landslide. Query indicates probable landslide deposit

Qal — **Alluvium**
Mostly sand and silt but locally contains clay, gravel, or boulders; generally gray to brown

Qb — **Beach deposits**
Predominantly well sorted medium-grained loose gray sand; locally consists of sandy gravel and cobbles

Qm — **Bay mud**
Soft gray clay and silt; locally contains shell fragments, plant remains, and thin beds of sand

Qd — **Dune sand**
Well sorted fine-grained gray sand, loose in most places

Qt — **Marine terrace deposits**
Predominantly friable well sorted fine-grained yellowish-orange to gray sand; includes some alluvial gravel and colluvial clay

Qsr — **Slope debris and ravine fill**
Stony silty to sandy clay; locally silty to clayey sand or gravel; yellowish orange to medium gray, unstratified or poorly stratified

Qc — **Colma Formation**
In northeast and central parts of area, friable well sorted fine to medium sand containing a few beds of sandy silt, clay, and gravel; in southeast part of area, mostly sandy clay and silty sand; yellowish orange to gray

Qu — **Sedimentary deposits, undifferentiated**

TERTIARY AND QUATERNARY

QTm — **Merced Formation**
Friable to firm sand, silt, and clay; minor amounts of gravel, lignite, and volcanic ash; medium gray to yellowish orange

JURASSIC AND CRETACEOUS

Franciscan Formation

KJs, KJsk — **Sandstone and shale**
Interbedded sandstone and shale, hard where fresh and intact, soft where sheared. Commonly medium dark gray where fresh, olive gray to yellowish brown where moderately weathered, and yellowish orange to yellowish gray where highly weathered.
KJsk, sandstone generally containing more than two percent potassium-feldspar

KJc — **Chert**
Hard chert interbedded with firm shale; chert layers generally two... shale layers less than one inch thick; generally grayish red

KJg — **Greenstone**
Altered volcanic rocks, fine-grained, mostly basalt; hard where fresh, ... weathered and firm to soft in most exposures; commonly grayish olive to moderate olive gray where moderately weathered, dark yellowish orange to light brown where highly weathered

sp — **Serpentine**
Hard to soft, generally greenish gray; contains small bodies of gabbro and diabase. Intrusive into Franciscan Formation

KJm — **Metamorphic rocks**
Hard to firm, fine- to coarse-grained schistose, gneissose, ... of glaucophane metamorphic rocks; dark gray, dark greenish gray, or dark bluish gray

KJu — **Sheared rocks**
Small to large fragments of hard rock in matrix of sheared rock. Matrix generally coherent and firm, but soft in places, especially where ..., dark gray where fresh, yellowish brown where weathered. Derived mostly from shale and sandstone of Franciscan Formation and serpentine

---

Contact
Dashed where approximately located

Indefinite contact
Includes inferred contacts and gradational contacts; dotted where concealed

Approximate boundary of former shoreline and tidal flat, and location of stream channel now filled or concealed
After U.S. Coast Survey map number 3815, 1869, and unpublished U.S. Coast Survey maps T.352, 1852, and T 468, 1854. Because old maps could not be matched exactly with the modern maps, lines may be off as much as one eighth of an inch

Approximate area of old tidal flats
After U.S. Coast Survey maps listed above

70, 35

Fault
Showing dip, and bearing and plunge of grooves, striations, or slickensides. Dashed where approximately located; short dashed where inferred; dotted where concealed. Most faults on San Bruno Mountain inferred from study of air photos

90

Vertical fault

60

Thrust fault, showing dip
T indicates upper plate

Fault showing relative horizontal movement
Dashed where approximately located; dotted where concealed. Trace of 1906 surface-rupture of San Andreas fault is shown; limits of San Andreas fault zone are not shown, but zone of most intense brecciation, shearing, and gouge formation is indicated by shear zone symbol

Hypothetical fault

Shear zone
Showing generalized dip of shear planes

50

Strike and dip of beds
Includes original structures in tuffaceous greenstone

90

Strike of vertical beds

Horizontal beds

Approximate strike and direction of dip of beds

25

Strike and dip of foreset beds

Approximate strike and direction of dip of foreset beds

60

Strike and dip of foliation

80

Strike and dip of joints

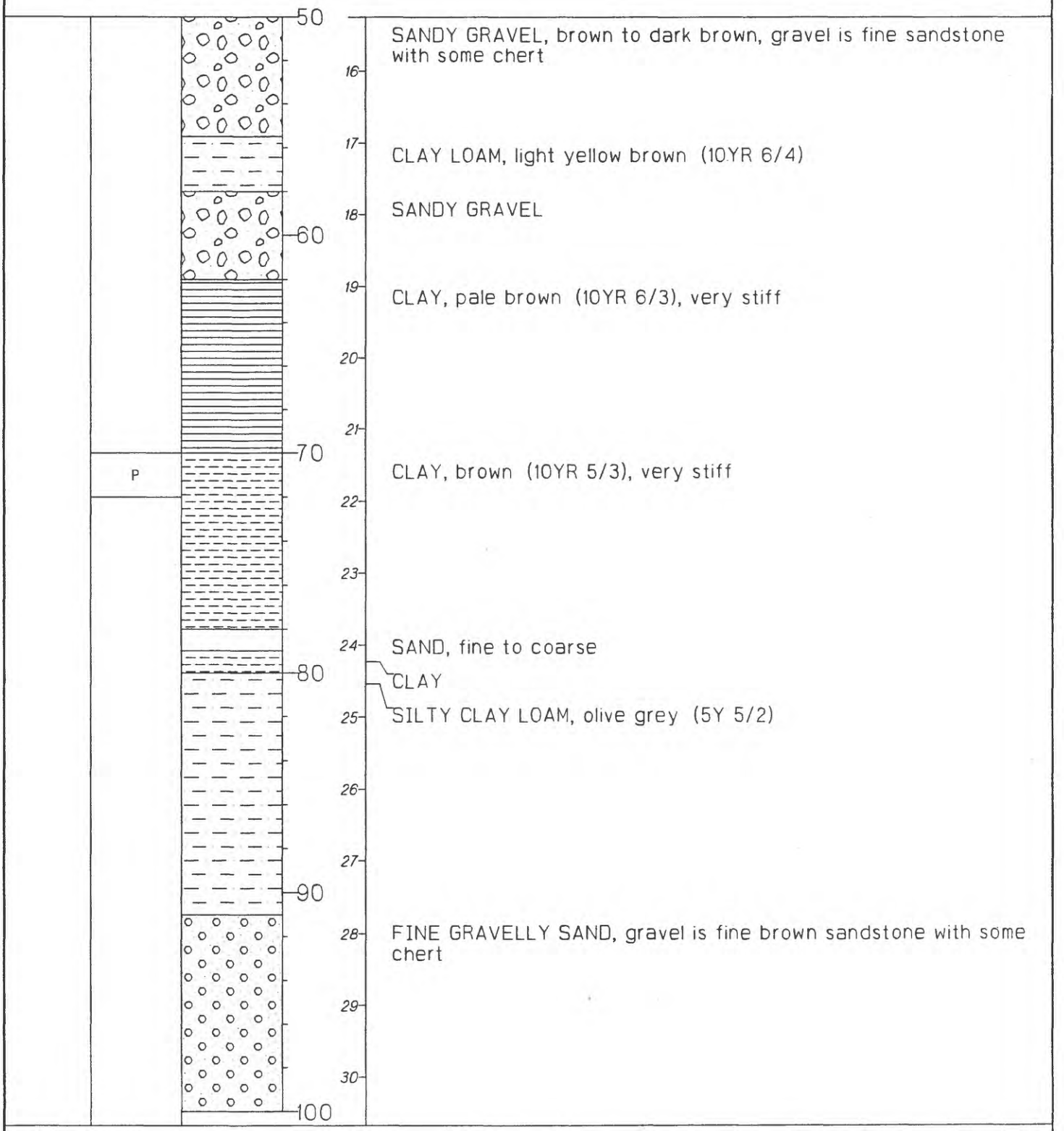
Quarry

Top of landslide scarp

SITE: SNOW PARK (19TH & ALICE, OAKLAND) DATE: 4/22/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	VERY COARSE SANDY LOAM (fill)
				VERY FINE SANDY LOAM (fill), very dark greyish brown (10YR 3/2)
			1	GRAVELLY SAND (MERRITT SAND)
				SANDY CLAY LOAM, brown (10YR 4/3), very stiff, sand is very fine to fine
			2	
			10	
			3	brown (10YR 5/3) sand is up to medium grained
			4	
				FINE SANDY LOAM, light olive brown, (2.5Y 5/4)
			5	
				FINE SANDY CLAY LOAM
			20 6	
			7	FINE GRAVELLY SAND, brown
				FINE SANDY CLAY LOAM, light olive brown (2.5Y 5/4)
			8	
				CLAY LOAM, greyish brown (2.5Y 5/2)
			30 9	
			10	
			11	SILTY CLAY, yellowish brown (10YR 5/4), very stiff
			12	
			40	
			13	CLAY LOAM TO SILTY CLAY LOAM
			14	
			15	SANDY LOAM TO SAND
			50	

SITE: SNOW PARK (19TH & ALICE, OAKLAND) DATE: 4/22/91



SITE: SNOW PARK (19TH & ALICE, OAKLAND) DATE: 4/22/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			100 31	
			32	CLAY, olive grey, stiff (PLEISTOCENE ESTUARINE DEPOSITS)
			33	very dark greenish grey (5GY 3/1 to 5G 3/1)
	P		110 34	dark greenish grey (5G 4/1)
			35	
				dark greenish grey (5GY 4/1)
			36	
	P		120 37	
			38	
				softer
			39	
			130 40	SILTY CLAY, dark greenish grey (5GY 4/1), medium stiff
			41	
			42	
	P		140 43	
				SILT LOAM
			44	SAND
				SILT LOAM
			45	SILTY CLAY LOAM, dark greenish grey (5G 4/1)
			150	

SITE: SNOW PARK (19TH & ALICE, OAKLAND) DATE: 4/22/91

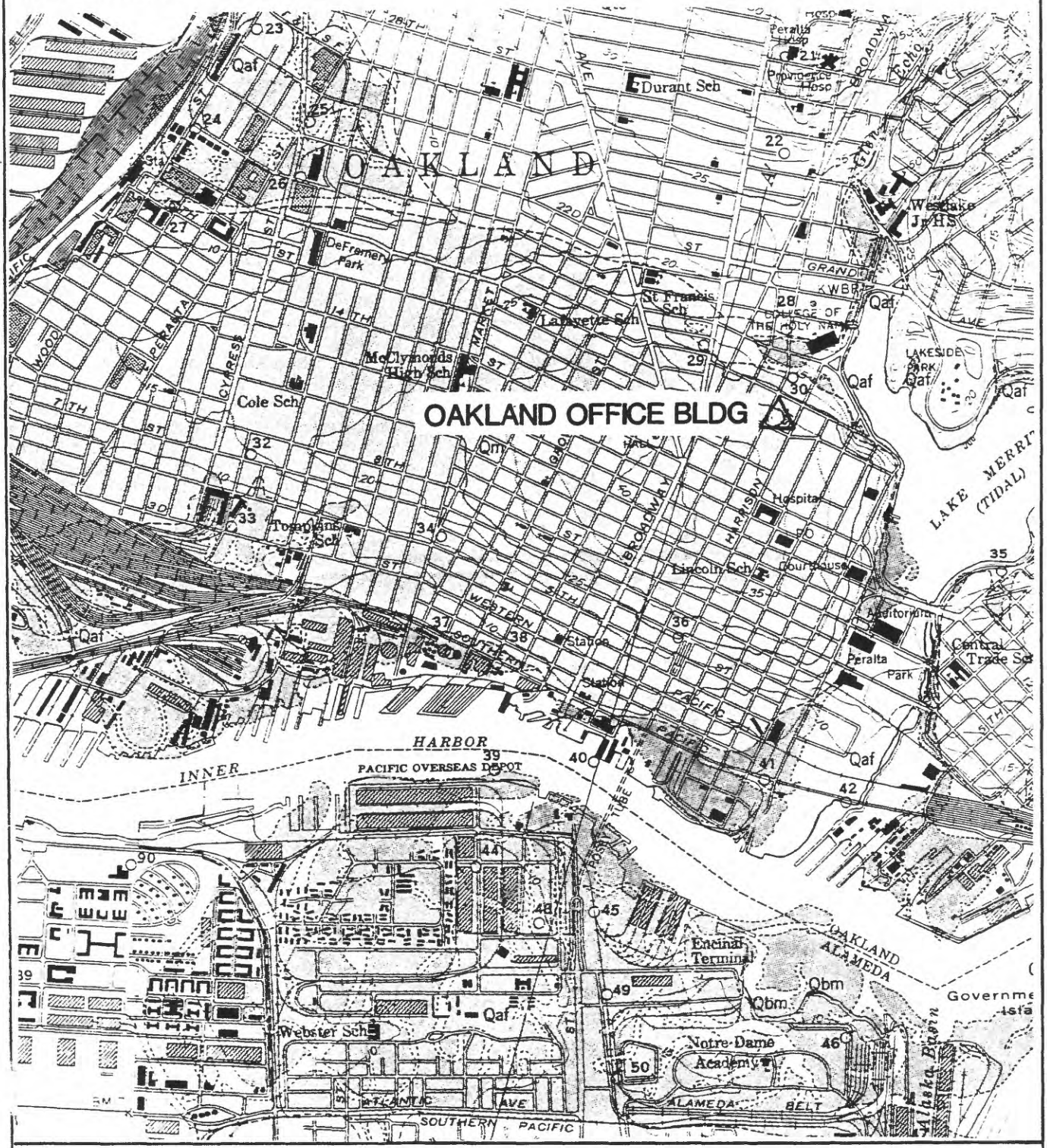
BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			150 46	
			47	
			48	CLAY, dark greenish grey (5GY 4/1), very stiff, some small carbonate (?) nodules
	P		160 49	
			50	
			51	
				SANDY CLAY LOAM, brown (10YR 4/3) to yellowish brown (10YR 5/4)
			170 52	VERY COARSE SAND
				CLAY TO CLAY LOAM, dark greenish grey (5GY 4/1), very stiff
			53	
			54	
	P		180 55	CLAY
			56	
			57	
			190 58	
			59	
			60	
			200	

SITE: SNOW PARK (19TH & ALICE, OAKLAND) DATE: 4/22/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
	P		200 61	olive grey (5Y 5/2)
			62	
			63	
			210 64	
			65	
			66	
			220 67	
			68	
			69	
			230 70	
			71	
			72	
			240 73	
			74	
			75	
			250 76	

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-239



SCALE 1:24000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

AREAL AND ENGINEERING GEOLOGY OF THE OAKLAND WEST QUADRANGLE, CALIFORNIA

By
Dorothy H. Radbruch

1957

EXPLANATION

Recent

Qls

Landslide debris
Clayey, silty sand that has moved down steep slope on Yerba Buena Island.

Qaf

Artificial fill
Sand, clay, or miscellaneous refuse.

Qrc

Reworked colluvium
Silty, clayey sand derived from underlying sandstone of the Franciscan group; moved downslope by water and gravity; in places reworked by wind.

Qbm

Bay mud
Sandy, clayey silt with shells and other organic material. Underlies most artificial fill.

QUATERNARY

Pleistocene

Qm

Merritt sand
Beach or near-shore deposit of slightly clayey, silty sand.

Qtc

Temescal formation
Alluvial-fan deposit comprising interfingering lenses of clayey gravel, sandy silty clay, and sand-clay-silt mixtures.

Qa

Alameda formation
Upper exposed few feet composed of sandy, silty clay with few pebbles; lower part consists of continental and marine sand, clay, gravel. Maximum known thickness, 1,050 feet.

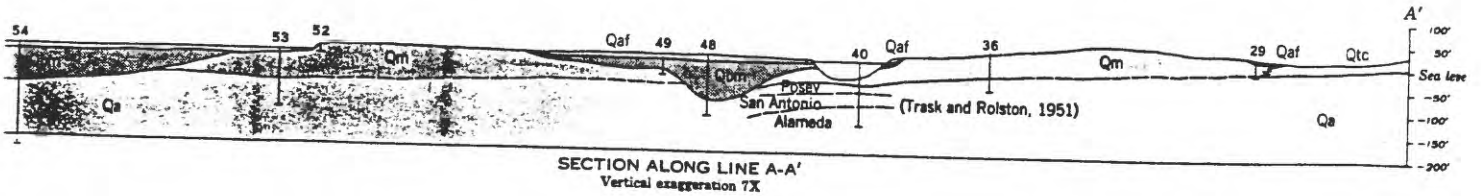
JURASSIC CRETACEOUS

Jk

Knoxville formation (Jurassic)
Shale with some beds of graywacke.

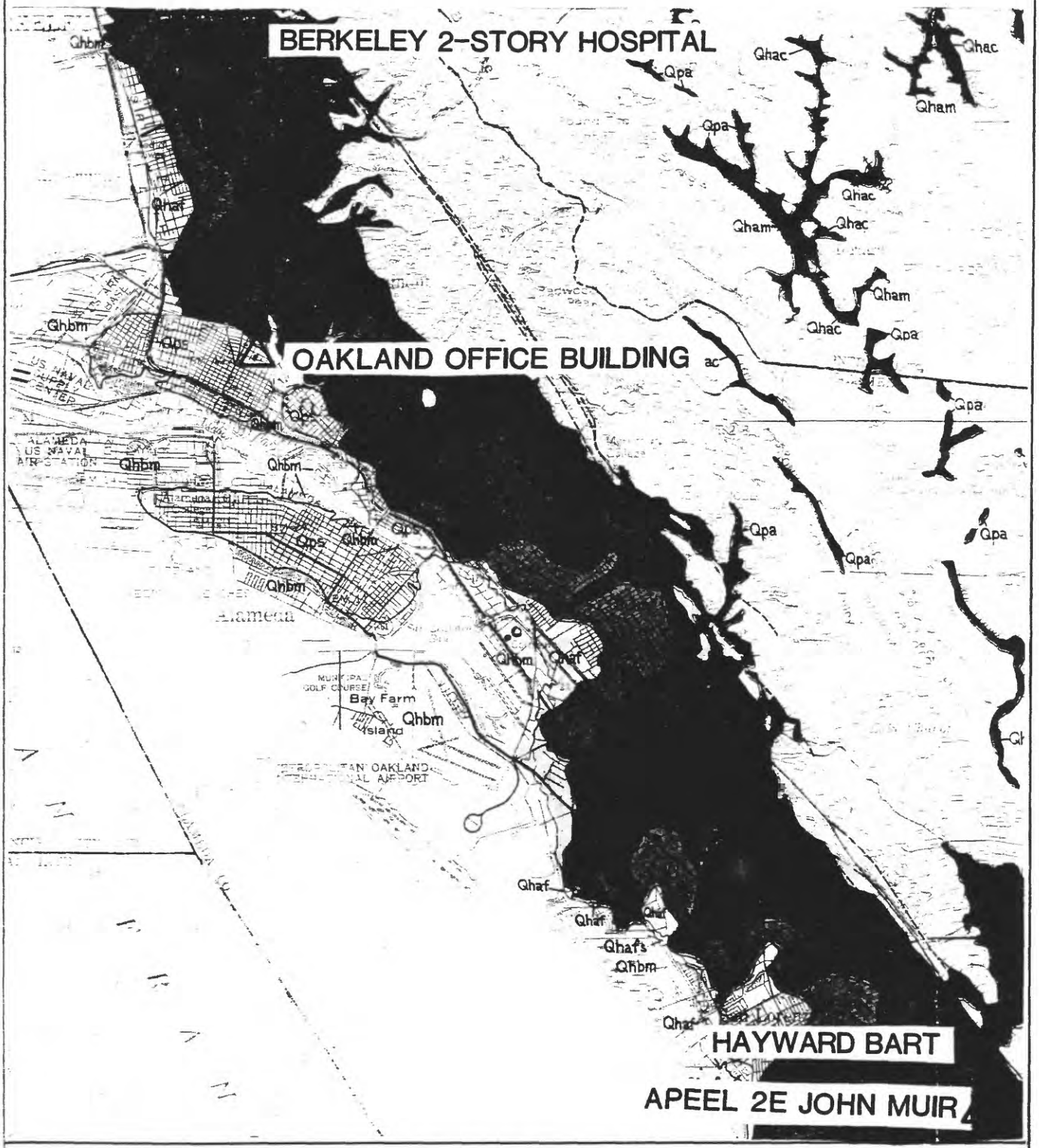
KJf

Franciscan group (Jurassic and Cretaceous)
Graywacke with small amounts of shale.



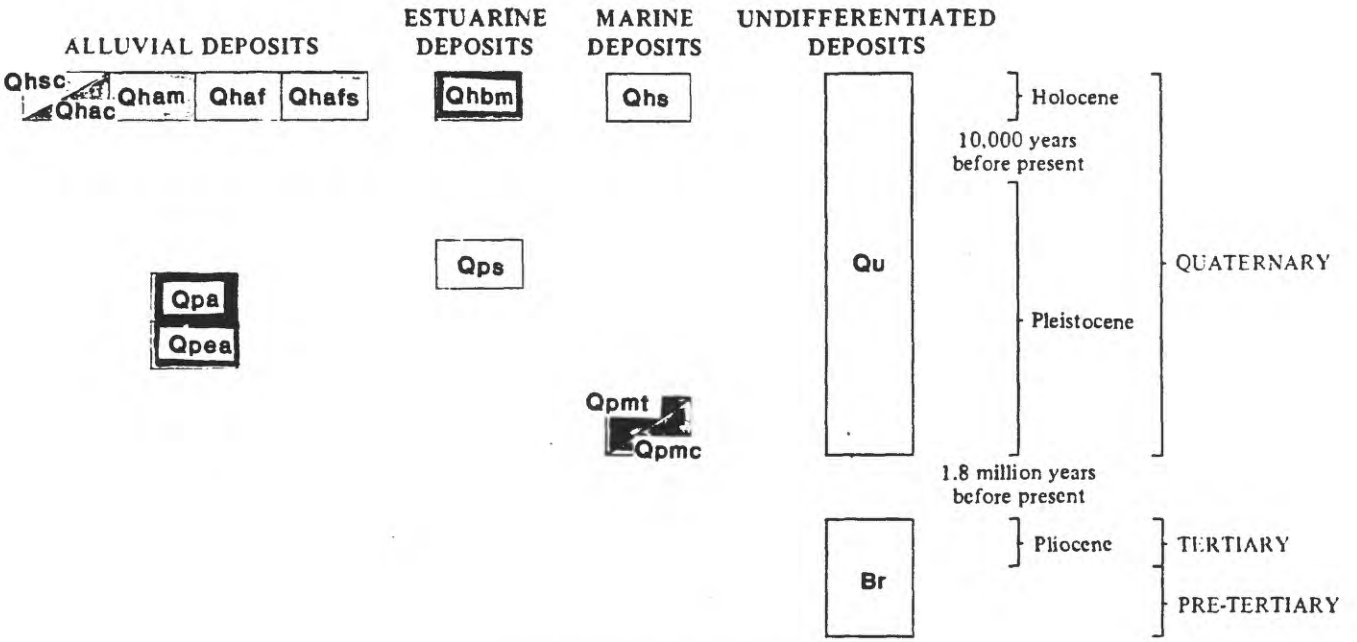
SECTION ALONG LINE A-A'
Vertical exaggeration 7X

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



GEOLOGIC MAP OF THE FLATLAND DEPOSITS OF THE SOUTHERN PART OF THE SAN FRANCISCO BAY REGION

CORRELATION OF MAP UNITS



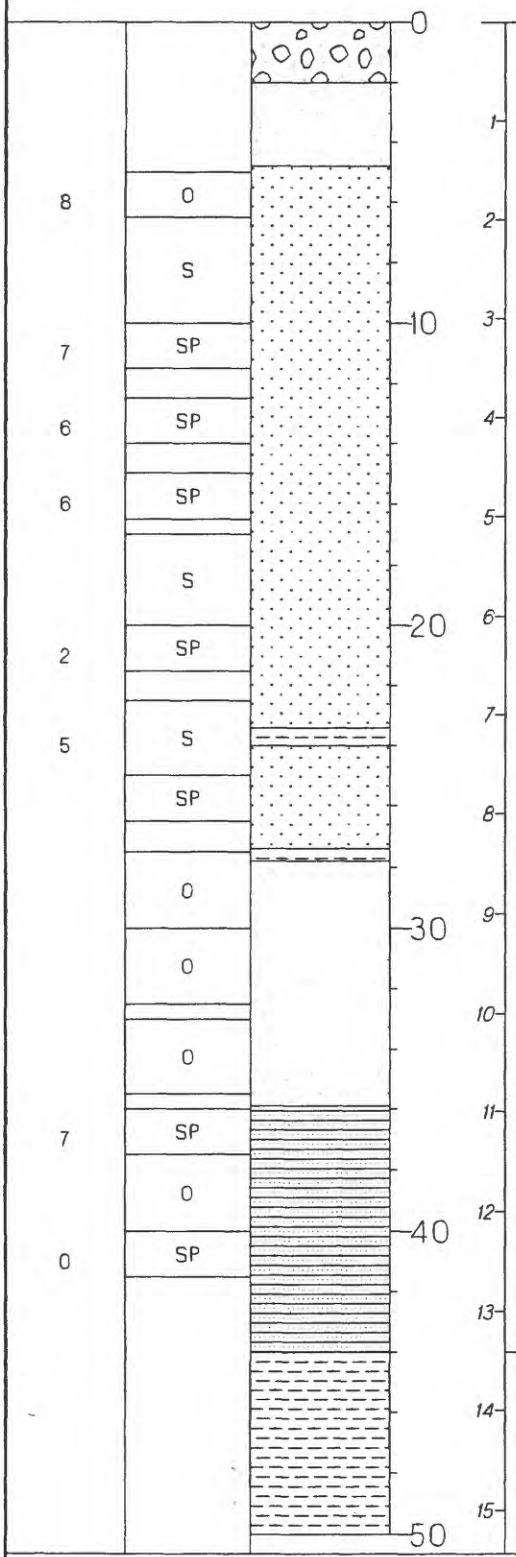
DESCRIPTION OF MAP UNITS

Qhsc	STREAM CHANNELS – Open alluvial channels with movable beds, mapped where scale permits
Qhac	COARSE-GRAINED ALLUVIUM – Unconsolidated, moderately sorted permeable sand and silt with coarse sand and gravel; more abundant toward fan heads
Qham	MEDIUM-GRAINED ALLUVIUM – Unconsolidated moderately sorted moderately sorted permeable fine sand, silt, and clayey silt with a few thin beds of coarse sand
Qhaf	FINE-GRAINED ALLUVIUM – Unconsolidated plastic moderately to poorly sorted carbonaceous silt and clay
Qhafs	FINE-GRAINED SALT - AFFECTED ALLUVIUM – Unconsolidated plastic moderately to poorly sorted carbonaceous silt and clay. Irregularly bedded with carbonate nodules
Qhbm	BAY MUD – Unconsolidated water-saturated dark plastic carbonaceous clay and silty clay
Qhs	BEACH AND DUNE SAND DEPOSITS – Loose well-sorted fine- to medium-grained sand
Qpa	LATE PLEISTOCENE ALLUVIUM – Weakly consolidated slightly weathered poorly sorted irregularly interbedded clay, silt, sand, and gravel
Qps	PLEISTOCENE BEACH AND DUNE SAND DEPOSITS (MERRIT SAND) – Loose well-sorted fine to medium sand
Qpea	EARLY PLEISTOCENE ALLUVIUM – Moderately consolidated deeply weathered poorly sorted irregularly interbedded clay, silt, sand, and gravel
Qpmt	MARINE TERRACE DEPOSITS – Weakly consolidated slightly weathered sand and gravel
Qpmc	COLMA FORMATION – Pale, loose or friable well-sorted fine- to medium-grained sandstone with subordinate gravel, sandstone, siltstone, and claystone
Qu	UNDIVIDED QUATERNARY DEPOSITS – Not recognizable as discrete map units because original form obliterated by urbanization
Br	UNDIVIDED BEDROCK – Older than Pleistocene

AP2,HBART
BER
OOB

SITE: TREASURE ISLAND

DATE: 11/19/90



GRAVELLY SAND (fill)

SAND (fill), lt. olive brown, well-sorted, very fine to fine, loose

SAND (fill), olive gray, well-sorted, very fine to fine, loose

very loose

CLAY (fill)

SAND (fill), v. dk. greenish gray, well sorted, fine to medium grained

FINE SANDY LOAM (fill), v. dk. greenish gray, loose

very loose

CLAY, very dark greenish gray, soft (HOLOCENE ESTUARINE DEPOSITS)

SITE: TREASURE ISLAND

DATE: 11/19/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
0			50 16	
			17	
			18	
0			60 19	
			20	
			21	
0			70 22	with shells
			23	
			24	
0			80 25	
			26	
			27	
0			90 28	
			29	SHELLS, 10-50% dk. greenish gray SAND
			30 100	

SITE: TREASURE ISLAND

DATE: 11/19/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
	SP		100 31	
				SANDY LOAM, v. dk. greenish gray, some shells and gravel (OLDER SOIL)
			32	
			33	
	S		110 34	
			35	
			36	
			120 37	CLAY
			38	LOAMY FINE SAND, v. dk. greenish gray to olive gray
			39	
	S		130 40	
			41	
				CLAY, dk. greenish gray, stiff to v. stiff (LATE PLEISTOCENE ESTUARINE DEPOSITS)
			42	
			140 43	
			44	
			45	
			150	

SITE: TREASURE ISLAND

DATE: 11/19/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
	S		150 46	
			47	SAND
			48	
			160 49	
			50	
			51	
	S		170 52	SAND
			53	
			54	
			180 55	
			56	
			57	
			190 58	
			59	
			60	
			200	

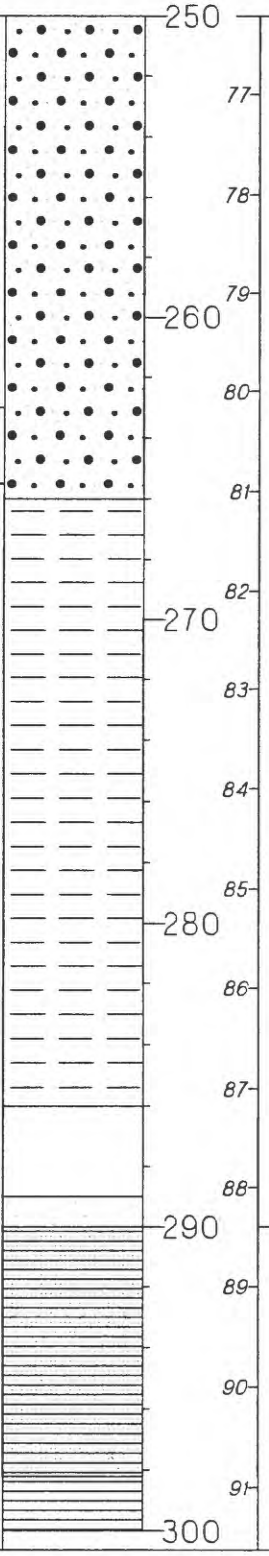
SITE: TREASURE ISLAND

DATE: 11/19/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
	S		200 61	SILTY CLAY, v. dk. greenish gray, stiff to v. stiff
			62	
				SAND
			63	
			210 64	
			65	
			66	
			220 67	
			68	
			69	
			230 70	
	S		71	
			72	
			240 73	
			74	
			75	
			76	FINE GRAVELLY SAND, dk. greenish gray
			250	

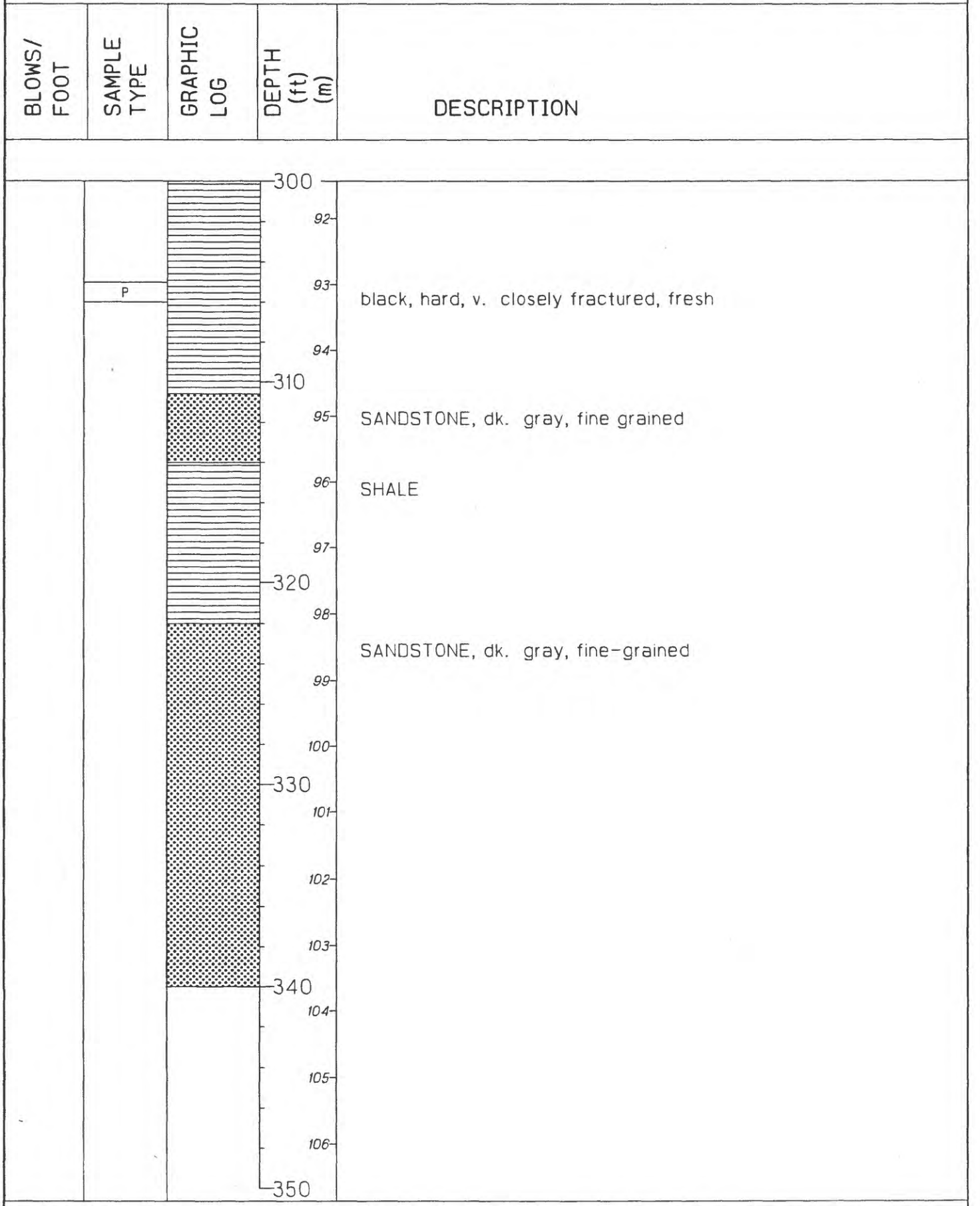
SITE: TREASURE ISLAND

DATE: 11/19/90

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
	P		250 77 78 79 260 80 81	SILTY CLAY, v. dk. greenish gray
			82 270 83 84 85 280 86 87	WOOD
			88 290 89 90 91	SHALE, pale olive, deeply weathered (texture is sandy clay) SHALE, lt. greenish gray to dk. brownish gray, firm
			300	

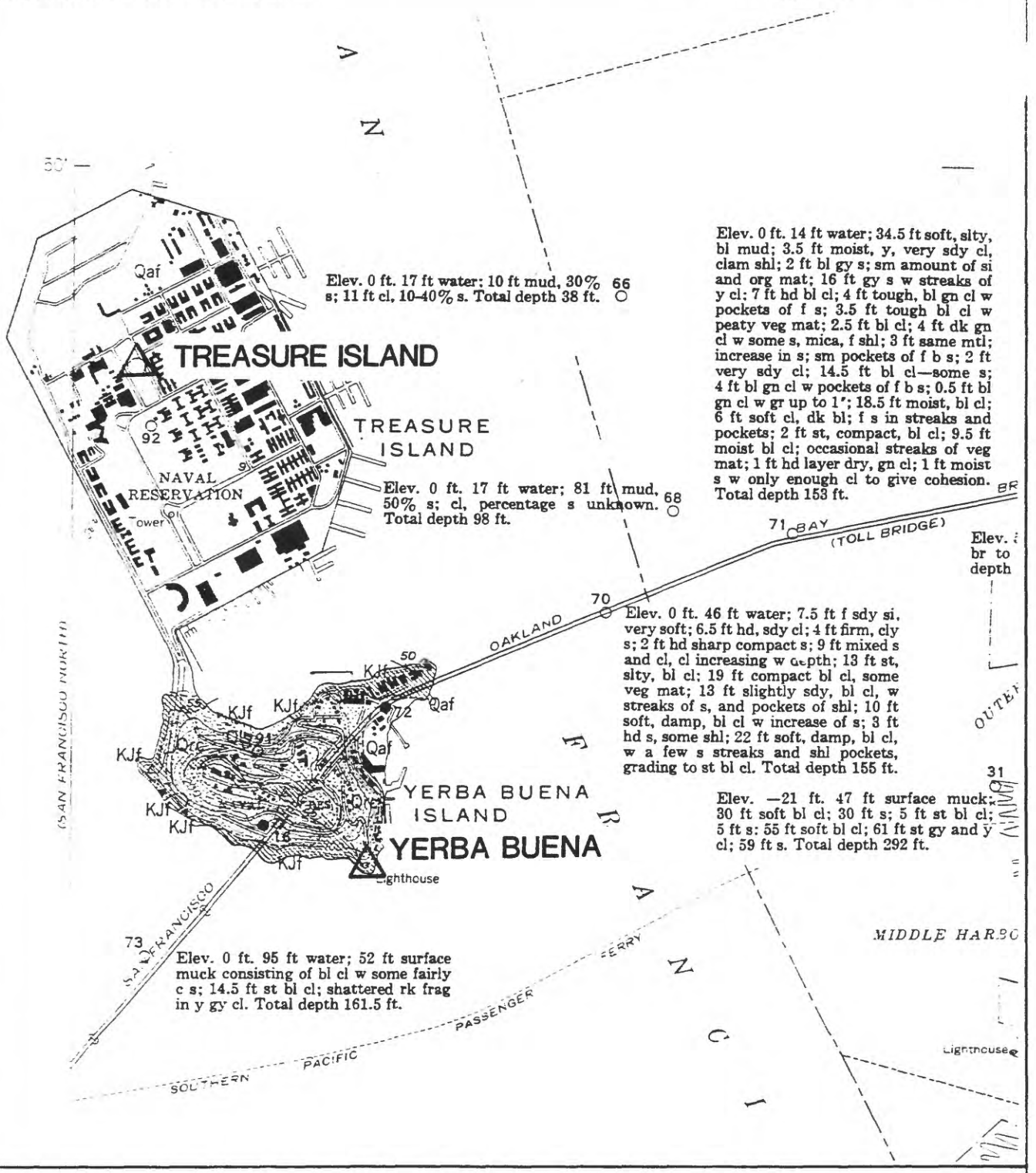
SITE: TREASURE ISLAND

DATE: 11/19/90



DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-239



SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0 1 KILOMETER

AREAL AND ENGINEERING GEOLOGY OF THE OAKLAND WEST QUADRANGLE, CALIFORNIA

By
Dorothy H. Radbruch

1957

EXPLANATION

Recent

Qls

Landslide debris

Clayey, silty sand that has moved down steep slope on Yerba Buena Island.

Qaf

Artificial fill

Sand, clay, or miscellaneous refuse.

Qrc

Reworked colluvium

Silty, clayey sand derived from underlying sandstone of the Franciscan group; moved downslope by water and gravity; in places reworked by wind.

Qbm

Bay mud

Sandy, clayey silt with shells and other organic material. Underlies most artificial fill.

Pleistocene

Qm

Merritt sand

Beach or near-shore deposit of slightly clayey, silty sand.

Qtc

Temescal formation

Alluvial-fan deposit comprising interfingering lenses of clayey gravel, sandy silty clay, and sand-clay-silt mixtures.

Qa

Alameda formation

Upper exposed few feet composed of sandy, silty clay with few pebbles; lower part consists of continental and marine sand, clay, gravel. Maximum known thickness, 1,050 feet.

Jk

Knoxville formation (Jurassic)

Shale with some beds of graywacke.

KJf

Franciscan group (Jurassic and Cretaceous)

Graywacke with small amounts of shale.

QUATERNARY

JURASSIC CRETACEOUS

Contact

Indefinite contact

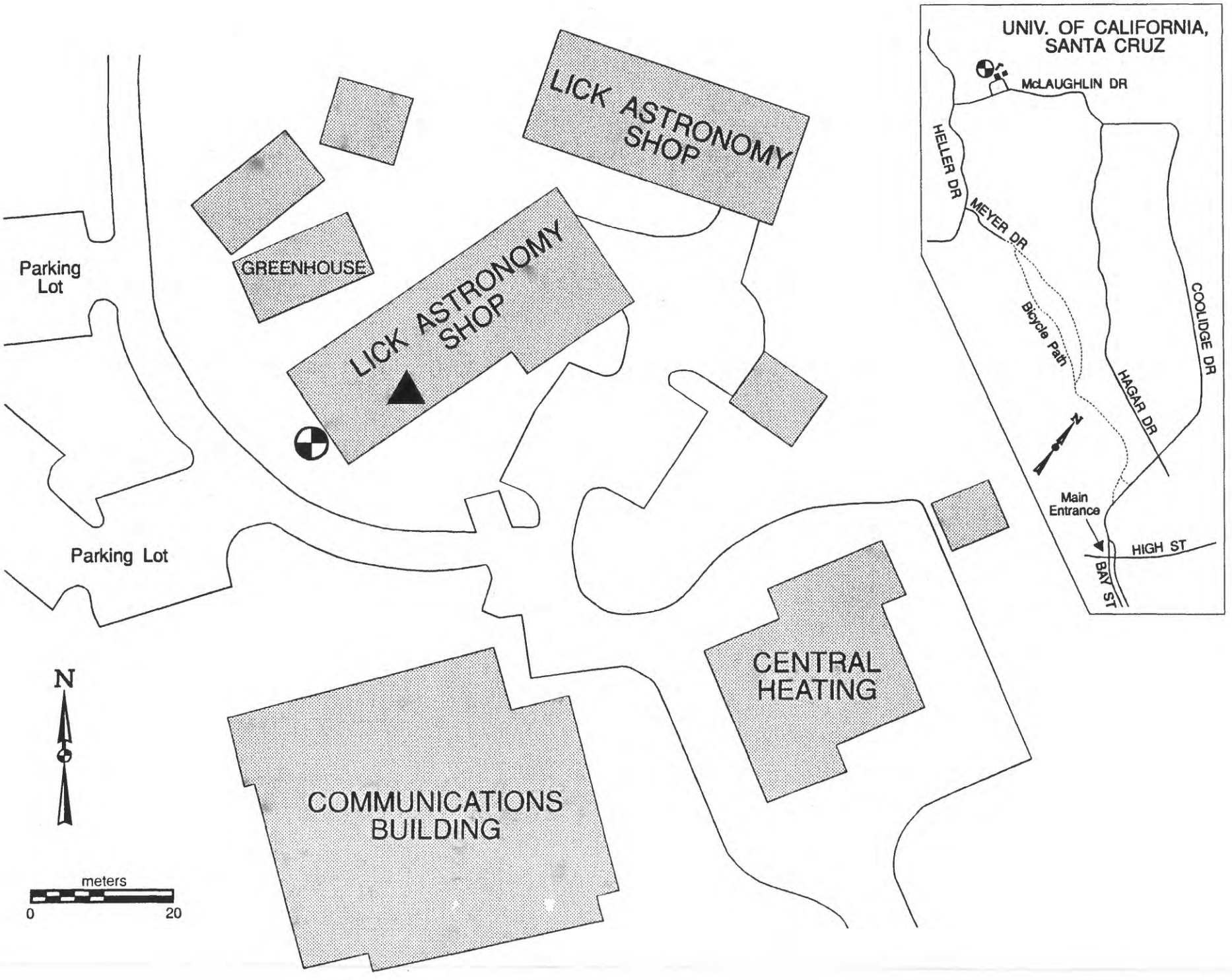
Includes gradational contacts, inferred contacts, and indefinite boundaries of surficial deposits.

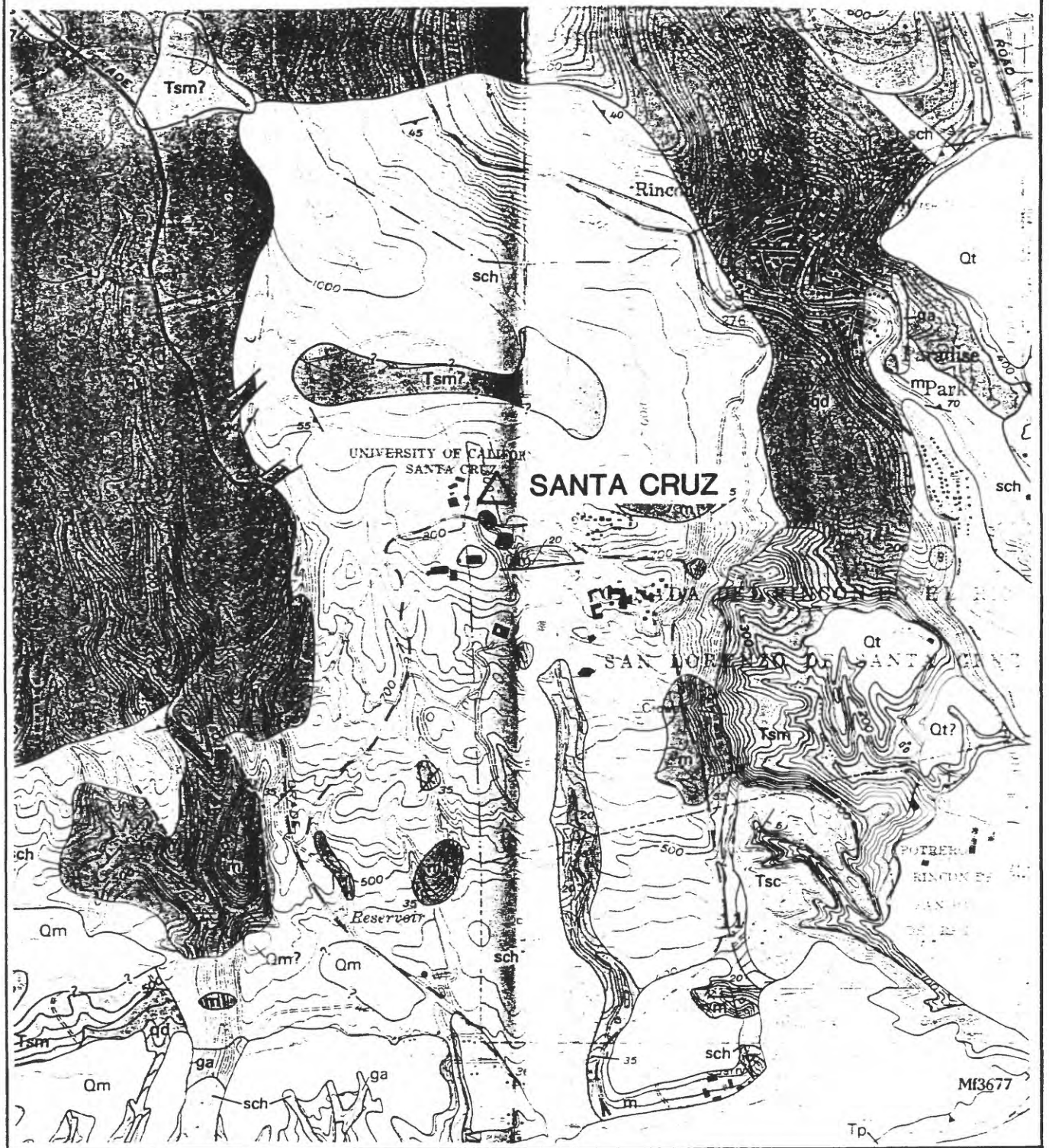
Approximate boundaries of former shores, ponds, tidal flats, and streams now filled or concealed

After unpublished U. S. Coast and Geodetic Survey planetable sheets nos. XXIV and XXV, U. S. Coast Survey, San Francisco Bay, Calif., 1856.

SITE: UCSC/LICK ASTRONOMY SHOP DATE: 8/20/92

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	COARSE SAND, brown, slightly silty
				some fine gravel
			1	CLAY, brownish red
			2	softer
				reddish yellow
			10 3	
			4	
			5	slightly softer, some coarse sand
			20 6	
			7	slightly harder, brown
				SCHIST, black, hard, very closely fractured, fairly weathered
			8	VOID (no rock or sediment)
				SCHIST
			30 9	VOID
				SCHIST
			10	VOID
				SCHIST
			11	VOID
				SCHIST
			40 12	VOID
				SCHIST
			13	VOID
				SCHIST
			14	
			15	
			50	


LICK ASTRONOMY SHOP
GREENHOUSE
LICK ASTRONOMY SHOP
Parking Lot
Parking Lot
CENTRAL HEATING
COMMUNICATIONS BUILDING
N
meters
0
20
UNIV. OF CALIFORNIA, SANTA CRUZ
McLAUGHLIN DR
HELLER DR
MEYER DR
Bicycle Path
HAGAR DR
COOLIDGE DR
Main Entrance
HIGH ST
BAY ST



SCALE 1:24 000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

GEOLOGIC MAP AND SECTIONS OF THE FELTON-SANTA CRUZ AREA, SANTA CRUZ COUNTY, CALIFORNIA

By JOSEPH C. CLARK

DESCRIPTION OF MAP UNITS

SURFICIAL SEDIMENTS

Qal — ALLUVIUM—Unconsolidated gravel, sand, and silt

Qls — LANDSLIDE MATERIAL—Half arrows show direction of downslope movement

Qt — RIVER TERRACE DEPOSITS—Unconsolidated sandy pebble and cobble gravel and dark-yellowish-orange fine to medium sand

Qm — MARINE TERRACE DEPOSIT—Unconsolidated moderate-yellowish-brown fine sand and granular gravel

UPPER MIOCENE TO PLIOCENE SEDIMENTARY SEQUENCE

Tp — PURISIMA FORMATION (upper Miocene and Pliocene)—Very thick bedded yellowish-gray tuffaceous and diatomaceous siltstone with thick interbeds of bluish-gray semifriable fine-grained andesitic sandstone. Includes Santa Cruz Mudstone east of Scotts Valley and north of Santa Cruz

Tsc — SANTA CRUZ MUDSTONE (upper Miocene)—Medium- to thick-bedded and faintly laminated blocky-weathering pale-yellowish-brown siliceous organic mudstone. Includes Santa Margarita Sandstone along Glenwood syncline

Tsm — SANTA MARGARITA SANDSTONE (upper Miocene)—Very thick bedded to massive thickly crossbedded yellowish-gray to white friable granular medium- to fine-grained arkosic sandstone; locally calcareous

MIDDLE MIOCENE SEDIMENTARY SEQUENCE

Tm — MONTEREY FORMATION—Medium- to thick-bedded and laminated olive-gray to light-gray subsiliceous organic mudstone and sandy siltstone. Includes few thick dolomite interbeds

LOMPICO SANDSTONE—Thick-bedded to massive yellowish-gray medium- to fine-grained calcareous arkosic sandstone; locally friable

EOCENE TO LOWER MIOCENE SEDIMENTARY SEQUENCE

LAMBERT SHALE (lower Miocene)—Thin- to medium-bedded and faintly laminated olive-gray to dusky-yellowish-brown organic mudstone with phosphatic laminae and lenses in lower part

Tv — VAQUEROS SANDSTONE (Oligocene and lower Miocene)—Thick-bedded to massive yellowish-gray arkosic sandstone

Basalt—Spheroidal-weathering pillow basalt flows in upper part

ZAYANTE SANDSTONE (Oligocene)—Thick- to very thick bedded yellowish-orange arkosic sandstone with thin interbeds of greenish and reddish siltstone and lenses and thick interbeds of pebble and cobble conglomerate

SAN LORENZO FORMATION

Tsr — Rices Mudstone Member (Eocene and Oligocene)—Massive medium-light-gray fine- to very fine grained arkosic sandstone; thick bed of glauconitic sandstone at base

Tst — Twobar Shale Member (Eocene)—Very thin bedded and laminated olive-gray shale

BUTANO SANDSTONE (Eocene)

Tbc — Upper sandstone member—Thin- to very thick bedded medium-gray fine- to medium-grained arkosic sandstone with thin interbeds of medium-gray siltstone

Middle siltstone member—Thin- to medium-bedded nodular olive-gray pyritic siltstone

Lower sandstone member—Very thick bedded to massive yellowish-gray granular medium- to coarse-grained arkosic sandstone.

Conglomerate—Thick to very thick interbeds of sandy pebble conglomerate in lower part of lower sandstone member

PALEOCENE SEDIMENTARY SEQUENCE

Tl — LOCATELLI FORMATION—Nodular olive-gray to pale-yellowish-brown micaceous siltstone

Sandstone—Massive medium-gray fine- to medium-grained arkosic sandstone locally at base

CRYSTALLINE PLUTONIC AND METAMORPHIC ROCKS

QUARTZ DIORITE—Grades to granodiorite south and east of Ben Lomond Mountain

ga — GRANITE AND ADAMELLITE

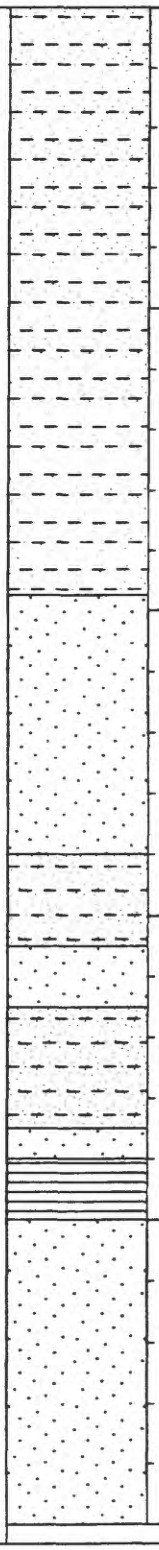
gd — GNEISSIC GRANODIORITE

HORNBLENDE-CUMMINGTONITE GABBRO

sch — METASEDIMENTARY ROCKS—Mainly pelitic schist and quartzite

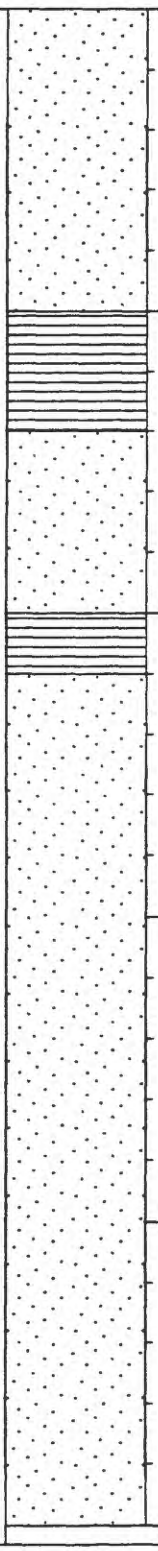
MARBLE—Locally contains interbedded schist and calc-silicate rocks

SITE: WOODSIDE FIRE STATION DATE: 4/4/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			0	FINE SANDY CLAY, dark yellowish brown (10YR 4/4 to 7.5 R 4/4)
			1	
			2	
			3	
			4	yellowish brown (10YR 5/6)
			5	
			6	SANDSTONE, light yellowish brown (10YR 6/4), fine-grained, soft
			7	firmer
			8	olive (5Y 5/3)
				gray (5Y 5/1), very firm
				thin interbeds of very dark grey mudstone
			9	
				SANDSTONE, grey (5Y 5/1 to N 5/), fine-grained
			10	interbeds of firm dark grey mudstone
			11	very firm to hard
				SANDSTONE, grey, fine-grained, hard
			12	MUDSTONE, dark grey, firm
				SANDSTONE, light grey, fine-grained, very firm
			13	
			14	
			15	

10
20
30
40
50

SITE: WOODSIDE FIRE STATION DATE: 4/4/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			50 16	
			17	
			18	
			60 19	MUDSTONE, dark grey, firm
				SANDSTONE, light grey, fine-grained, very firm
			20	
			21	
			70 22	MUDSTONE, dark grey, firm
				SANDSTONE, light grey, fine-grained, very firm
			23	
			24	
			80 25	
			26	
			27	
			90 28	
			29	
			30	
			100	

SITE: WOODSIDE FIRE STATION

DATE: 4/4/91

BLOWS/ FOOT	SAMPLE TYPE	GRAPHIC LOG	DEPTH (ft) (m)	DESCRIPTION
			100 31	hard
			32	
			33	
			110 34	
			35	
			36	
			120 37	
			38	MUDSTONE, very dark grey, firm
			39	
			130 40	
				SANDSTONE, light grey, fine-grained, hard
			41	SHALE, very firm
			42	
			140 43	
			44	
			45	
			150	

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF–328

SCALE 1:62 500

1 ½ 0 1 2 3 4 5 MILES

1 .5 0 1 2 3 4 5 6 7 KILOMETERS

PRELIMINARY GEOLOGIC MAP OF SAN MATEO COUNTY, CALIFORNIA

Compiled by

Earl E. Brabb and Earl H. Pampeyan

1972