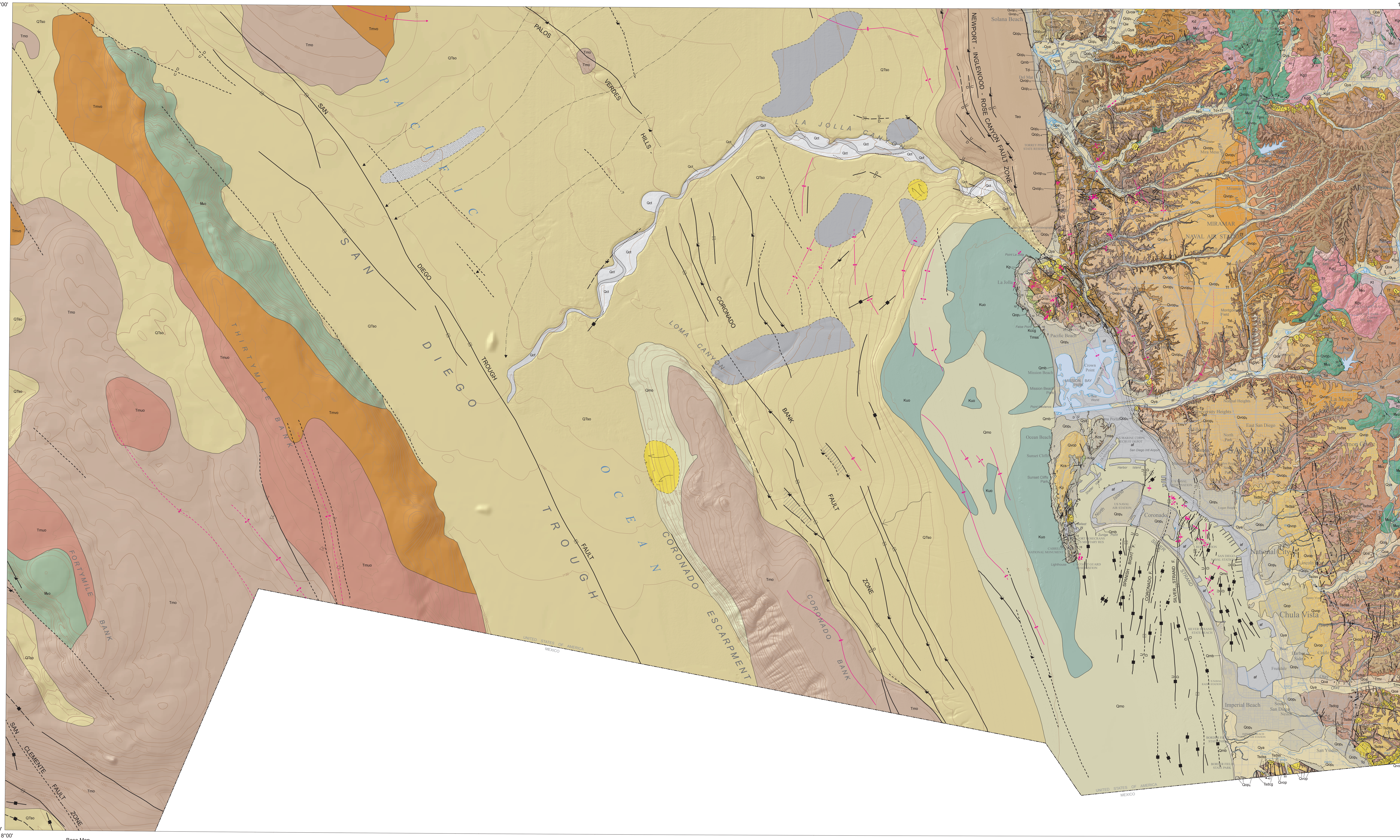

Base Map

Onshore base (hypsography, hydrography, and transportation) from U.S.G.S. digital line graph (DLG) data, San Diego 30' x 60' metric quadrangle. Shaded topographic base from U.S.G.S. digital elevation models (DEM's). Offshore bathymetric contours and shaded bathymetry from N.O.A.A. single and multibeam data. Projection is UTM, zone 11, North American Datum 1927.

SCALE 1:100,000

2 0 2 4 6 Miles

2 0 2 4 6 Kilometers

Contour Interval: 50 meters (approximately 164 feet)
Bathymetric Contour Interval: 50 meters (approximately 164 feet)

Geology compiled 2002-2004

This map was funded in part by the U.S. Geological Survey National Cooperative Geologic Mapping Program, STATEMAP Award no. 98HQAG2049.

Prepared in cooperation with the U.S. Geological Survey, Southern California Areal Mapping Project.

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GEOLOGIC MAP OF THE SAN DIEGO 30' x 60' QUADRANGLE, CALIFORNIA

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2008

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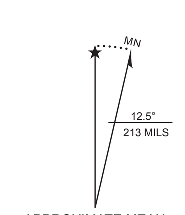


APPROXIMATE MEAN DECLINATION, 2008

ABBREVIATED EXPLANATION

Approximate stratigraphic relationships only;
see pamphlet and CMU (Plate 2) for more detailed information

CENOZOIC — QUATERNARY

MODERN SURFICIAL DEPOSITS

Holocene

- af — Artificial fill (late Holocene)
- Qw — Wash deposits (late Holocene)
- Qls — Landslide deposits, undivided (Holocene and Pleistocene)
- Qmb — Marine beach deposits (late Holocene)
- Qpe — Paralic estuarine deposits (late Holocene)
- Qmo — Undivided marine deposits in offshore region (late Holocene)
- Qcf — Canyon fill deposits in offshore region (late Holocene)

YOUNG SURFICIAL DEPOSITS

- Qya — Young alluvial flood-plain deposits (Holocene and late Pleistocene)
- Qyc — Young colluvial deposits (Holocene and late Pleistocene)
- Qct — Undivided canyon terrace deposits in offshore region (Holocene and Pleistocene)

OLD SURFICIAL DEPOSITS

- Qoa — Old alluvial flood-plain deposits, undivided (late to middle Pleistocene)
- Qop — Old paralic deposits, undivided (late to middle Pleistocene)
  - Qop_7 — Unit 7
  - Qop_6 — Unit 6
  - Qop_{2-4} — Units 2-4, undivided

VERY OLD SURFICIAL UNITS

Pleistocene

- Qvoa — Very old alluvial flood-plain deposits, undivided (middle to early Pleistocene)
- Qvop — Very old paralic deposits, undivided (middle to early Pleistocene)

$Qvop_7$	Unit 7				
$Qvop_6$	Unit 6	$Qvop_{13}$	Unit 13		
$Qvop_5$	Unit 5	$Qvop_{12}$	Unit 12		
$Qvop_4$	Unit 4	$Qvop_{11}$	Unit 11	$Qvop_{11a}$	Unit 11a
$Qvop_3$	Unit 3	$Qvop_{10}$	Unit 10	$Qvop_{10a}$	Unit 10a
$Qvop_2$	Unit 2	$Qvop_9$	Unit 9	$Qvop_{9a}$	Unit 9a
$Qvop_1$	Unit 1	$Qvop_8$	Unit 8	$Qvop_{8a}$	Unit 8a

SEDIMENTARY AND VOLCANIC BEDROCK UNITS

TERTIARY

- QTso — Undivided sediments and sedimentary rocks in offshore region (Holocene, Pleistocene, Pliocene and Miocene)

Pliocene

- Tsd (Tsdcg, Tsdss) — San Diego Formation (early Pleistocene and late Pliocene)
  - Tsd - undivided
  - Tsdcg - transitional marine and nonmarine pebble and cobble conglomerate
  - Tsdss - marine sandstone

Miocene

- Tba — Basaltic-andesite dike (Miocene)
- Tmo — Undivided sedimentary rocks in offshore region (Miocene)
- Tmvo — Undivided volcanic rocks in offshore region (Miocene)
- Tmuo — Undivided volcanic and sedimentary rocks in offshore region (Miocene)

Oligocene

- To — Otay Formation (late Oligocene)

Eocene

- Tp — Pomerado Conglomerate (middle Eocene)
  - Tpm - Miramar Sandstone Member
- Tmv — Mission Valley Formation (middle Eocene)
- Tst — Stadium Conglomerate (middle Eocene)
- Tf — Friars Formation (middle Eocene)
- Tsc — Scripps Formation (middle Eocene)
  - Tscu - upper unit
- Ta — Ardath Shale (middle Eocene)
- Tt — Torrey Sandstone (middle Eocene)
- Td — Delmar Formation (middle Eocene)
- Td+Tf — Delmar Formation and Friars Formation, undivided (middle Eocene)
- Tmss / Tmsc — Mount Soledad Formation (middle Eocene)
  - Tmss - sandstone
  - Tmsc - cobble conglomerate
- Teo — Undivided Eocene rocks in offshore region (Eocene)

MESOZOIC — CRETACEOUS

Upper Cretaceous

- Kcs / Kccg — Cabrillo Formation (Upper Cretaceous)
  - Kcs - sandstone
  - Kccg - cobble conglomerate
- Kp — Point Loma Formation (Upper Cretaceous)
- Kl — Lusardi Formation (Upper Cretaceous)
- Kuo — Undivided rocks of the Rosario Group in the offshore area (Upper Cretaceous)

UNNAMED CRETACEOUS ROCKS OF THE PENINSULAR RANGES BATHOLITH

mid-Cretaceous

- Kgu — Granodiorite and tonalite, undivided (mid-Cretaceous)
- Kgd — Granodiorite, undivided (mid-Cretaceous)
- Kt — Tonalite, undivided (mid-Cretaceous)
- Kd — Diorite, undivided (mid-Cretaceous)
- Kgh — Hypabyssal rocks, undivided (mid-Cretaceous)

JURASSIC AND CRETACEOUS METAMORPHOSED AND UNMETAMORPHOSED VOLCANIC AND SEDIMENTARY ROCKS

JURASSIC

- Mzu — Metamorphosed and unmetamorphosed volcanic and sedimentary rocks, undivided (Mesozoic)
- Mzo — Undivided metamorphic rocks in offshore region (Mesozoic)

ONSHORE MAP SYMBOLS

Contact - Contact between geologic units; dotted where concealed.

70 U D — Fault - Solid where accurately located; dashed where approximately located; dotted where concealed. U = upthrown block, D = downthrown block. Arrow and number indicate direction and angle of dip of fault plane.

Anticline - Solid where accurately located; dashed where approximately located; dotted where concealed. Arrow indicates direction of axial plunge.

Syncline - Solid where accurately located; dotted where concealed. Arrow indicates direction of axial plunge.

Qls? — Landslide - Arrows indicate principal direction of movement. Queried where existence is questionable.

Strike and dip of beds

70 — Inclined

Strike and dip of igneous joints

60 — Inclined

Vertical

Strike and dip of metamorphic foliation

55 — Inclined

OFFSHORE MAP SYMBOLS

Contacts

Contact - All contacts are extrapolated from a combination of seismic reflection data, seafloor samples and bathymetry, and are approximate in location.

Faults

U D ? — Fault - Solid where well defined; dashed where approximately located; short dash where inferred; dotted where concealed; queried where uncertain. Where fault offsets sea floor, age symbol is shown on bar on downthrown side. Where age was determined, age symbol is shown astride fault and relative offset, if known, is shown by "D" and "U" on downthrown and upthrown sides. Ages of faults are indicated as follows:
- ⊠ cuts strata of Holocene age
- ■ cuts strata of late Quaternary age
- ◩ cuts strata of Quaternary age
- △ cuts Miocene or older strata

Fault zone - Area of extensively sheared rock within a zone defined by multiple faults.

Folds

Anticline - Solid where well defined; short dash where inferred.

Syncline - Solid where well defined; short dash where inferred.

Channels

Active - Dash-dot line marks axis, arrow indicates direction of sediment transport.

Levees

Levees - Dashed where inferred.

Landslides

Creep - Dashed where inferred.

Creep (noted on single survey line) - Arrow indicates apparent direction of sediment movement.

Slump - Dashed where inferred, queried where uncertain. Arrows indicate direction of movement.

ABBREVIATED INDEX TO GEOLOGIC SOURCE DATA

(Primary compilaton sources shown in bold type)

See pamphlet for complete citation

Del Mar Quadrangle
Kennedy, 1975; Kern, 1996a,b; Tan and Giffen, 1995.

Imperial Beach Quadrangle
Kennedy and others, 1975; **Kennedy and Tan, 1977**; Kern, 1996a,b; Tan, 1995.

La Jolla Quadrangle
Kennedy, 1975; Kennedy and others, 1975; Kern, 1996a,b; Tan, 1995.

La Mesa Quadrangle
Kennedy and Peterson, 1975; Kennedy and others 1975; Kern, 1996a,b; Tan, 1995.

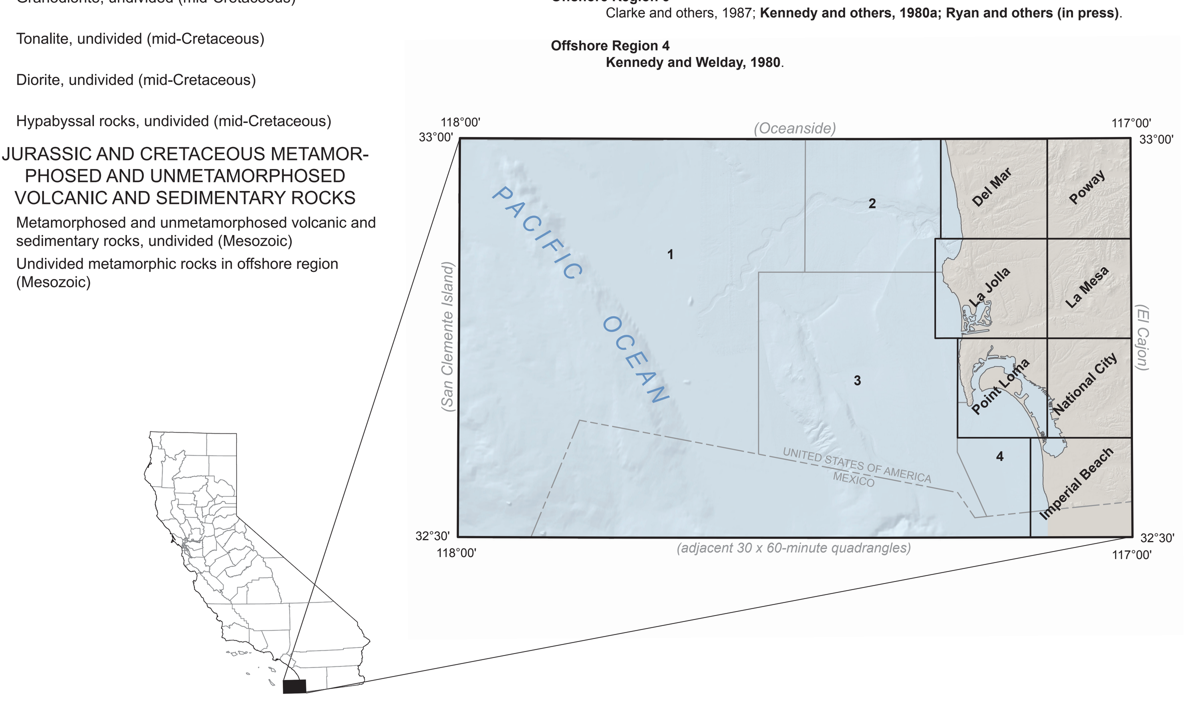
National City Quadrangle
Kennedy and others, 1975; **Kennedy and Tan, 1977**; Kern, 1996a,b; Tan, 1995.

Point Loma Quadrangle
Kennedy, 1975; **Kennedy and Clarke, 1999a,b**; Kennedy and others, 1975; Kern, 1996a,b; Tan, 1995.

Poway Quadrangle
Kennedy and Peterson, 1975; Kern, 1996a,b; Tan and Giffen, 1995.

Offshore Region 1
Clarke and others, 1987; Ryan and others, (in press).

Offshore Region 2
Clarke and others, 1987; **Kennedy and others, 1980b; Ryan and others (in press)**.

Offshore Region 3
Clarke and others, 1987; **Kennedy and others, 1980a; Ryan and others (in press)**.

Offshore Region 4
Kennedy and Welday, 1980.