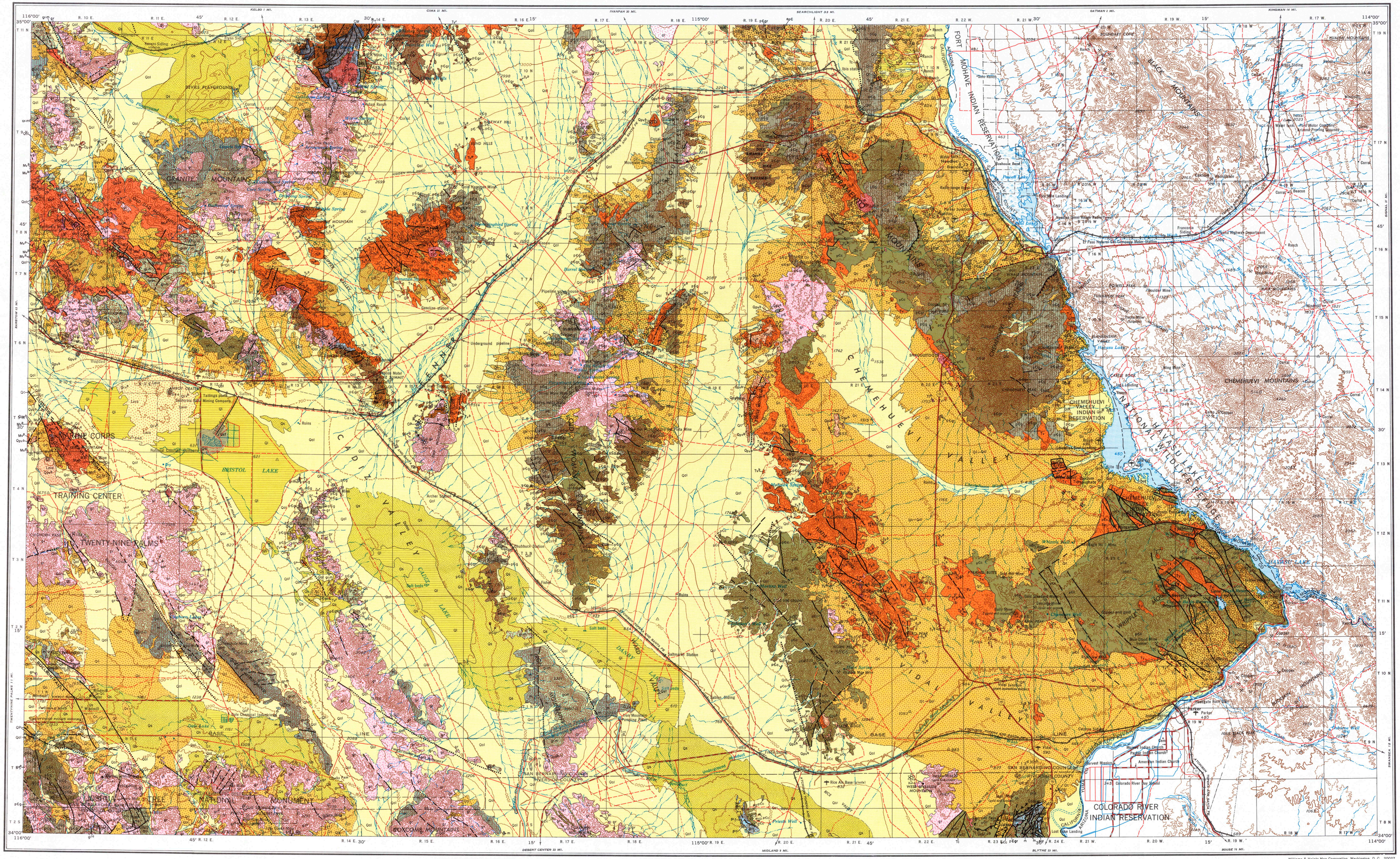
DIVISION OF MINES AND GEOLOGY
IAN CAMPBELL, CHIEF
GORDON B. OAKESHOTT, DEPUTY CHIEF

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF CONSERVATION

GEOLOGIC MAP OF CALIFORNIA
NEEDLES SHEET

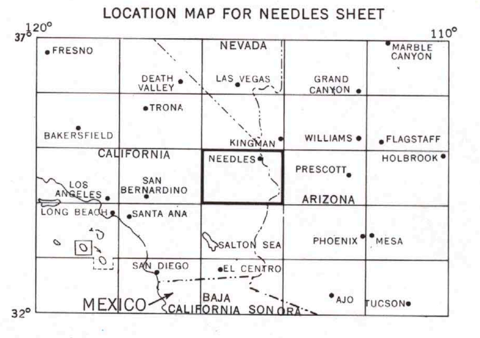


TOPOGRAPHIC BASE MAP
Prepared by the Army Map Service (KCBM), Corps of Engineers, U. S. Army, Washington, D. C. Compiled in 1957 by U. S. Coast & Geodetic Survey by photogrammetric methods and from: United States Quadrangles, 1:24,000, 1:50,000, 1:62,000, USGS and AMS, 1947–1954; Metropolitan Water District, 1:120,000, California, Sheet 69, 1929. Planimetric detail revised by photo-planimetric methods. Horizontal and vertical control by USC&GS, USGS, and CE. Photography field annotated 1956.

Land net prepared by U. S. Geological Survey

Minor corrections and additions to culture by California Division of Mines and Geology, 1963

LOCATION MAP FOR NEEDLES SHEET



Contact
Dashed where approximately located, gradational or inferred

Fault
Dashed where approximately located; dotted where concealed

Thrust fault
Barbs on upper plate; dashed where approximately located, dotted where concealed

(Vertebrate fossil locality)

(Radiometric age determination)

Scale 1:250,000

5 0 5 10 15 20 Statute Miles

5 0 5 10 15 20 25 30 Kilometers

CONTOUR INTERVAL 200 FEET

TRANSVERSE MERCATOR PROJECTION

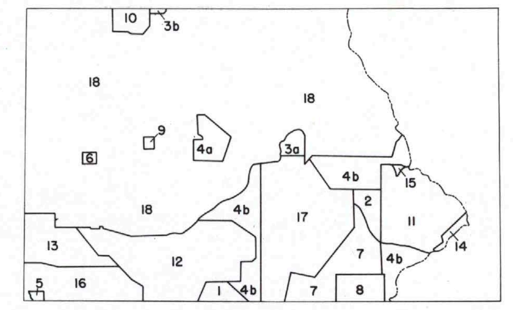
GEOLOGIC MAP OF CALIFORNIA

OLAF P. JENKINS EDITION

NEEDLES SHEET

COMPILATION BY CHARLES C. BISHOP, 1963

FOURTH PRINTING, 1992



Williams & Heintz Map Corporation, Washington, D. C. 20027

INDEX TO GEOLOGIC MAPPING
(COMPLETE INDEX ON EXPLANATORY DATA SHEET)

1. Anonymous, unpublished.
2. Anonymous, unpublished.
3a. Bishop, C. C., unpublished.
3b. Bishop, C. C., unpublished.
4a. Bishop, C. C. and Jennings, C. W., unpublished.
4b. Bishop, C. C. and Jennings, C. W., unpublished.
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10. Hazzard, J. C., 1954.
11. Kemnitzer, L. E., unpublished.
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16. Rogers, T. H. and Jennings, C. W., unpublished.
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EXPLANATION

SEDIMENTARY AND METASEDIMENTARY ROCKS — IGNEOUS AND META-IGNEOUS ROCKS

CENOZOIC

QUATERNARY

Recent
- Qs — Dune sand
- Qal — Alluvium
- Qsc — Stream channel deposits (GREAT VALLEY)
- Qf — Fan deposits (GREAT VALLEY)
- Qb — Basin deposits (GREAT VALLEY)
- Qst — Salt deposits
- Ql — Quaternary lake deposits
- Qg — Glacial deposits
- Qt — Quaternary nonmarine terrace deposits
- Qrv — Recent volcanic: Qrv^r—rhyolite; Qrv^a—andesite; Qrv^b—basalt; Qrv^p—pyroclastic rocks

Pleistocene
- Qm — Pleistocene marine and marine terrace deposits
- Qc — Pleistocene nonmarine
- QP — Plio-Pleistocene nonmarine
- Qpv — Pleistocene volcanic: Qpv^r—rhyolite; Qpv^a—andesite; Qpv^b—basalt; Qpv^p—pyroclastic rocks
- Quaternary and/or Pliocene cinder cones

TERTIARY

Pliocene
- Pc — Undivided Pliocene nonmarine
- Puc — Upper Pliocene nonmarine
- Pu — Upper Pliocene marine
- Pmlc — Middle and/or lower Pliocene nonmarine
- Pml — Middle and/or lower Pliocene marine
- Pv — Pliocene volcanic: Pv^r—rhyolite; Pv^a—andesite; Pv^b—basalt; Pv^p—pyroclastic rocks

Miocene
- Mc — Undivided Miocene nonmarine
- Muc — Upper Miocene nonmarine
- Mu — Upper Miocene marine
- Mmc — Middle Miocene nonmarine
- Mm — Middle Miocene marine
- Ml — Lower Miocene marine
- Mv — Miocene volcanic: Mv^r—rhyolite; Mv^a—andesite; Mv^b—basalt; Mv^p—pyroclastic rocks

Oligocene
- Φc — Oligocene nonmarine
- Φ — Oligocene marine
- Φv — Oligocene volcanic: Φv^r—rhyolite; Φv^a—andesite; Φv^b—basalt; Φv^p—pyroclastic rocks

Eocene
- Ec — Eocene nonmarine
- E — Eocene marine
- Ev — Eocene volcanic: Ev^r—rhyolite; Ev^a—andesite; Ev^b—basalt; Ev^p—pyroclastic rocks

Paleocene
- Epc — Paleocene nonmarine
- Ep — Paleocene marine

Undivided
- QTc — Cenozoic nonmarine
- Tc — Tertiary nonmarine
- Tl — Tertiary lake deposits
- Tm — Tertiary marine
- QTv — Cenozoic volcanic: QTv^r—rhyolite; QTv^a—andesite; QTv^b—basalt; QTv^p—pyroclastic rocks
- Tg^r — Tertiary granitic rocks
- Ti — Tertiary intrusive (hypabyssal) rocks: Ti^r—rhyolite; Ti^a—andesite; Ti^b—basalt
- Tv — Tertiary volcanic: Tv^r—rhyolite; Tv^a—andesite; Tv^b—basalt; Tv^p—pyroclastic rocks

MESOZOIC

CRETACEOUS
- K — Undivided Cretaceous marine
- Ku — Upper Cretaceous marine
- Kl — Lower Cretaceous marine

JURASSIC
- Jk — Knoxville Formation
- Ju — Upper Jurassic marine
- Jml — Middle and/or Lower Jurassic marine

TRIASSIC
- T̄R — Triassic marine

- KJf — Franciscan Formation
- KJfv — Franciscan volcanic and metavolcanic rocks
- gr — Mesozoic granitic rocks: gr^a—granite and adamellite; gr^g—granodiorite; gr^t—tonalite and diorite
- bi — Mesozoic basic intrusive rocks
- ub — Mesozoic ultrabasic intrusive rocks
- J̄Rv — Jura-Trias metavolcanic rocks

UNDIVIDED
- m, ls — Pre-Cretaceous metamorphic rocks (ls = limestone or dolomite)
- ms — Pre-Cretaceous metasedimentary rocks
- IP, ls — Paleozoic marine (ls = limestone or dolomite)
- mv — Pre-Cretaceous metavolcanic rocks
- gr-m — Pre-Cenozoic granitic and metamorphic rocks
- IPv — Paleozoic metavolcanic rocks

PALEOZOIC

PERMIAN
- P — Permian marine
- Pmv — Permian metavolcanic rocks

CARBONIFEROUS
- C — Undivided Carboniferous marine
- CP — Pennsylvanian marine
- CM — Mississippian marine
- Cv — Carboniferous metavolcanic rocks

DEVONIAN
- D — Devonian marine
- Dv — Devonian metavolcanic rocks
- Dv? — Devonian and pre-Devonian? metavolcanic rocks

SILURIAN
- S — Silurian marine
- pSs — Pre-Silurian metasedimentary rocks
- pS — Pre-Silurian metamorphic rocks
- pSv — Pre-Silurian metavolcanic rocks

ORDOVICIAN
- O — Ordovician marine

CAMBRIAN
- Є — Cambrian marine
- Є? — Cambrian – Precambrian marine

PRECAMBRIAN
- pЄ — Undivided Precambrian metamorphic rocks, pЄg = gneiss, pЄs = schist
- lpЄ — Later Precambrian sedimentary and metamorphic rocks
- epЄ — Earlier Precambrian metamorphic rocks
- pЄc — Precambrian igneous and metamorphic rock complex
- pЄgr — Undivided Precambrian granitic rocks
- pЄan — Precambrian anorthosite

HEAVY BORDER ON BOXES INDICATES UNITS THAT APPEAR ON THIS SHEET