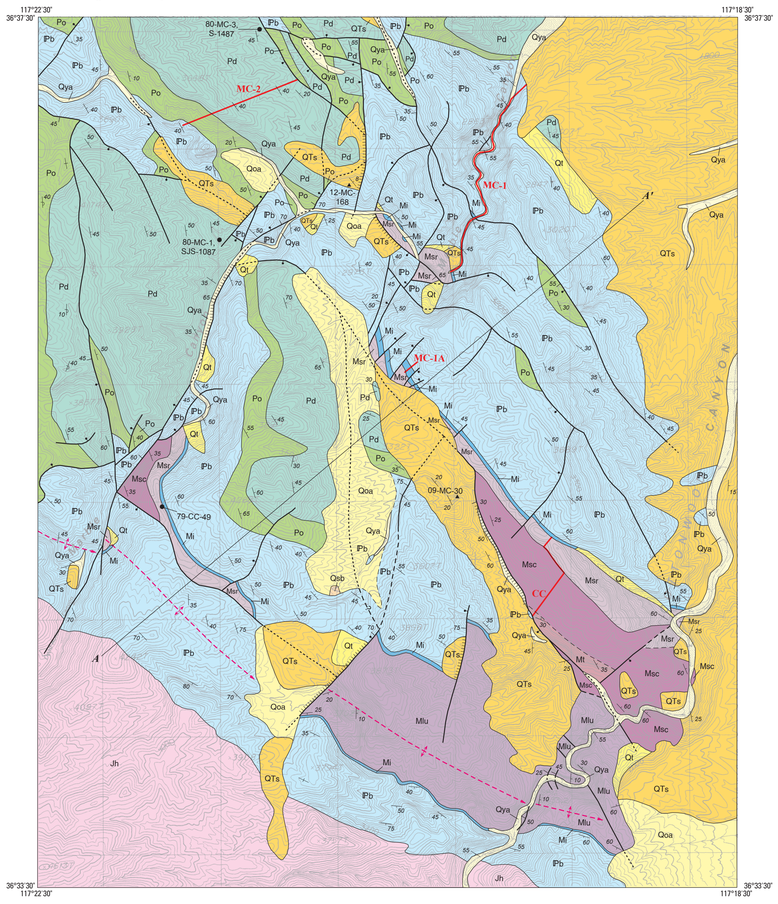
U.S. Department of the Interior
U.S. Geological Survey

Scientific Investigations Map 3298
Pamphlet accompanies map



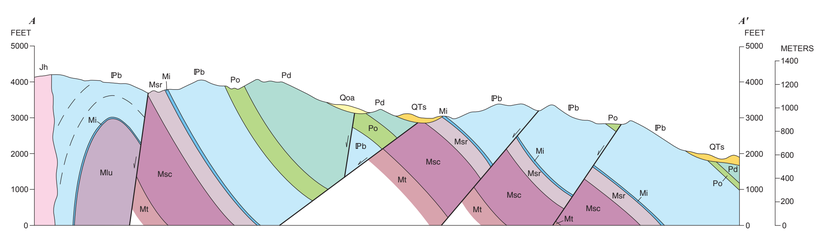
Base from U.S. Geological Survey, 7.5-minute Cottonwood Canyon quadrangle, 1987
Universal Transverse Mercator projection
1927 North American Datum
Clark 1866 Ellipsoid, Zone 11

TRUE NORTH
MAGNETIC NORTH
12½°
APPROXIMATE MEAN DECLINATION, 2014

SCALE 1:24 000
1 .5 0 1 KILOMETER
1 .5 0 1 MILE
1000 0 1000 2000 3000 4000 5000 FEET
CONTOUR INTERVAL 40 FEET

CALIF.
MAP LOCATION

Geology mapped by P. Stone, 1980, 2009-2012
GIS database and digital cartography by S.S. Priest
Edited by C. Landowski
Manuscript approved for publication April 24, 2014



DESCRIPTION OF MAP UNITS

Qya — **Younger alluvium (Quaternary)**—Unconsolidated to weakly consolidated sand and gravel deposits in modern washes

Qt — **Talus (Quaternary)**—Scree deposits on slopes below bedrock cliffs

Qoa — **Older alluvium (Quaternary)**—Moderately consolidated and dissected alluvial gravel deposits composed of locally derived Paleozoic sedimentary rock clasts

Qsb — **Slide block (Quaternary)**—Coherent slab of dark-gray limestone of the Osborne Canyon Formation (Po) resting on bedrock at the base of a sequence of older alluvium (Qoa)

QTs — **Sedimentary deposits and minor tuff (Quaternary? and Tertiary)**—Consists mainly of locally derived conglomerate and sandstone forming perched remnants and dissected badlands. Contains clasts of Paleozoic rocks and Hunter Mountain Quartz Monzonite. Oldest recognized part of unit consists of coarse-grained arkosic sandstone that dips as much as 50°; younger parts of unit dip progressively less steeply. Includes Pliocene tuff of Mesquite Spring (~3.28 Ma) of Snow and Lux (1999) at locality 12-MC-168 and a tuff of probable Miocene age at locality 09-MC-30

Jh — **Hunter Mountain Quartz Monzonite (Jurassic)**—Brown-weathering monzonite and quartz monzonite

Owens Valley Group (Cisuralian)

Pd — **Darwin Canyon Formation**—Brown, thick-bedded,very fine grained sandstone; sparse graded beds of bioclastic and conglomeratic limestone; and near the top of the exposed section, a massive bed of grayish-orange, very fine grained, silty limestone containing unsorted limestone clasts and bioclasts that include fusulinids and coral fragments. Maximum exposed thickness about 400 m; top of formation not exposed

Po — **Osborne Canyon Formation**—Silty mudstone, mostly pinkish gray to purplish gray, that typically contains sparse to abundant, spherical, dark-gray limestone concretions; thin-bedded, black chert; thin-bedded, medium-gray, fine-grained, calcareous sandstone, mainly in lower part of unit; and, in upper part of unit, conglomerate composed of poorly sorted, mostly spherical limestone clasts (probably reworked concretions) 1 to 15 cm in diameter in a light-gray, silty limestone matrix. About 150 m thick

IPb — **Bird Spring Formation (Pennsylvanian)**—Primarily composed of light- to dark-gray, light purplish-gray, and tan, thin- to medium-bedded, silty, cherty, very fine grained limestone. Upper part includes thick-bedded to massive limestone. Fossils, including small fusulinids, are rare. Thickness is about 600 m in eastern part of map area but as little as 425 m in western part

Mi — **Indian Springs Formation (Upper Mississippian)**—Fine-grained quartz sandstone; coarse-grained, calcarenitic limestone; and greenish-gray siliceous mudstone. Thickness generally about 15 to 20 m

Mlu — **Limestone and marble, undivided (Mississippian)**—Structurally complex and metamorphosed strata equivalent to Santa Rosa Hills Limestone, Stone Canyon Limestone, and Tin Mountain Limestone

Msr — **Santa Rosa Hills Limestone (Middle Mississippian)**—Predominantly light-gray echinodermal limestone. Uppermost part is darker gray. Commonly massive in general appearance, but good exposures locally display well developed bedding. About 100 to 120 m thick

Msc — **Stone Canyon Limestone (Middle Mississippian)**—Medium- to dark-gray, thin- to medium-bedded limestone that contains abundant beds, lenses, and nodules of brown to black chert. Thickness about 420 m

Mt — **Tin Mountain Limestone (Middle and Lower Mississippian)**—Medium- to dark-gray, thin- to medium-bedded limestone containing sparse beds, lenses, and nodules of brown chert. Base not exposed. Maximum exposed thickness about 100 m

CORRELATION OF MAP UNITS

Units	Epoch	Period
Qya, Qoa, Qsb, Qt	Quaternary	CENOZOIC
QTs	Tertiary	CENOZOIC
Jh		JURASSIC
Pd	Cisuralian	PERMIAN
Po	Cisuralian	PERMIAN
IPb		PENNSYLVANIAN
Mi	Upper Mississippian	MISSISSIPPIAN
Msr	Middle Mississippian	MISSISSIPPIAN
Msc	Middle Mississippian	MISSISSIPPIAN
Mt	Lower Mississippian	MISSISSIPPIAN
Mlu	Upper, Middle, Lower Mississippian	MISSISSIPPIAN

EXPLANATION OF MAP SYMBOLS

Contact—Dashed where approximately located

Fault—Showing dip where known. Bar and ball on downthrown side. Dashed where inferred, queried where uncertain, dotted where concealed

Fault-line scarp—Showing dip where known. Hachures point downscarp

Anticline—Trace of axial surface, showing plunge of axis. Approximately located

Strike and dip of beds

Inclined

Vertical

Overturned

Fossil locality

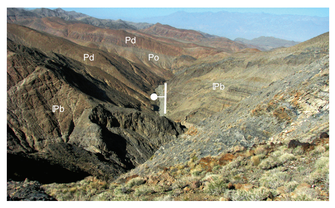
Tuff locality

Line of measured section

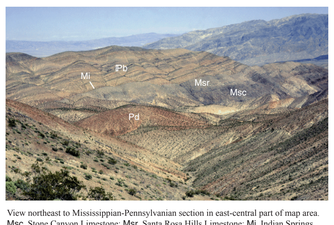
Line of structural cross section

PHOTOGRAPHS OF MAP AREA

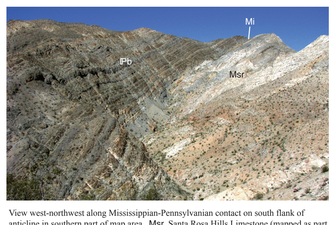
View northeast showing typical exposures of Pennsylvanian Bird Spring Formation (IPb). Note outcrop of Mississippian Santa Rosa Hills Limestone (Msr) faulted against Bird Spring Formation in central part of view. Death Valley and Grapevine Mountains in distance.



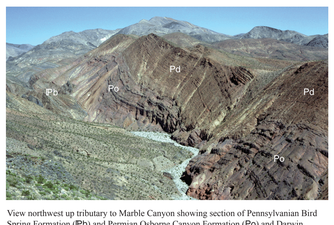
View north-northwest down Marble Canyon showing outcrops of Pennsylvanian Bird Spring Formation (IPb) and Permian Osborne Canyon Formation (Po) and Darwin Canyon Formation (Pd). Note west-dipping normal fault along the canyon floor.



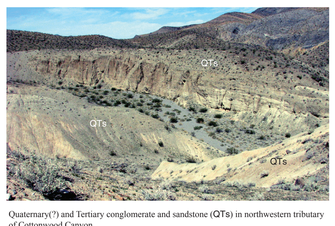
View northeast to Mississippian-Pennsylvanian section in east-central part of map area. Msc, Stone Canyon Limestone; Msr, Santa Rosa Hills Limestone; Mi, Indian Springs Formation; IPb, Bird Spring Formation. Permian Darwin Canyon Formation (Pd) in foreground.



View west-northwest along Mississippian-Pennsylvanian contact on south flank of anticline in southern part of map area. Msr, Santa Rosa Hills Limestone (mapped as part of undivided limestone and marble unit Mlu); Mi, Indian Springs Formation; IPb, Bird Spring Formation.

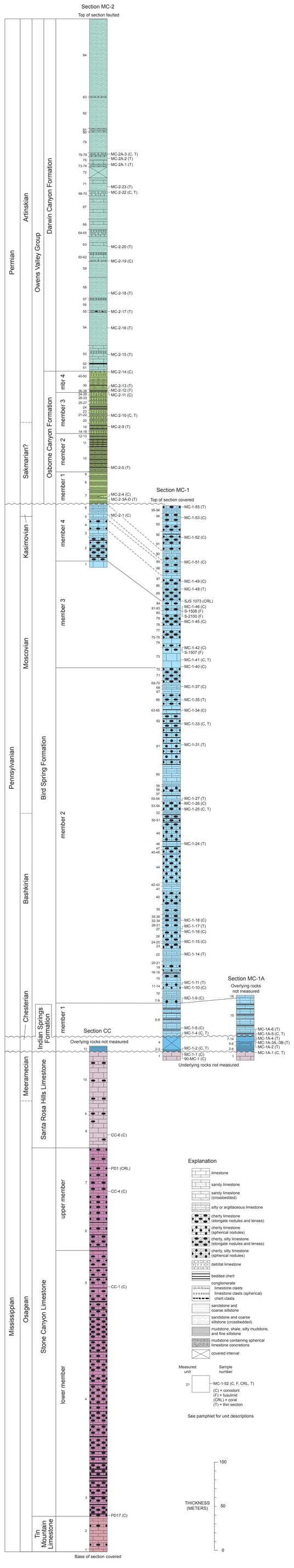


View northwest up tributary to Marble Canyon showing section of Pennsylvanian Bird Spring Formation (IPb) and Permian Osborne Canyon Formation (Po) and Darwin Canyon Formation (Pd).



Quaternary(?) and Tertiary conglomerate and sandstone (QTs) in northwestern tributary of Cottonwood Canyon.

MEASURED SECTIONS



Geologic Map and Upper Paleozoic Stratigraphy of the Marble Canyon Area, Cottonwood Canyon Quadrangle, Death Valley National Park, Inyo County, California

By
Paul Stone,[1] Calvin H. Stevens,[2] Paul Belasky,[3] Isabel P. Montanez,[4] Lauren G. Martin,[5]
Bruce R. Wardlaw,[1] Charles A. Sandberg,[1] Elmira Wan,[1] Holly A. Olson,[1] and Susan S. Priest[1]
2014

[1]U.S. Geological Survey
[2]San Jose State University
[3]Ohlone College
[4]University of California, Davis
[5]Apache Corporation

Any use of trade, firm, or product names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.

This map was printed on an electronic plotter directly from digital files. Dimensional calibration may vary between electronic plotters and between X and Y directions on the same plotter, and paper may change size due to atmospheric conditions; therefore, scale and proportions may not be true on plots of this map.

For sale by U.S. Geological Survey, Information Services, Box 25286, Federal Center, Denver, CO 80225, 1–888–ASK–USGS

Digital files available at http://pubs.usgs.gov/sim/3298/

Suggested citation: Stone, P., Stevens, C.H., Belasky, P., Montanez, I.P., Martin, L.G., Wardlaw, B.R., Sandberg, C.A., Wan, E., Olson, H.A., and Priest, S.S., 2014, Geologic map and upper Paleozoic stratigraphy of the Marble Canyon area, Cottonwood Canyon quadrangle, Death Valley National Park, Inyo County, California: U.S. Geological Survey Scientific Investigations Map 3298, scale 1:24,000, 59 p., http://dx.doi.org/10.3133/sim3298.

ISSN 2329–132X (online)