UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

GENERAL GEOLOGIC MAP OF DEATH VALLEY, CALIFORNIA

SCALE 1:96 000

2 1 0 2 4 6 MILES

2 1 0 2 4 6 KILOMETERS

CONTOUR INTERVALS 40 AND 80 FEET
DOTTED LINES REPRESENT HALF-INTERVAL CONTOURS
DATUM IS MEAN SEA LEVEL

Base from U.S. Geological Survey topographic quadrangles

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1965—GE4356

Geology by Charles B. Hunt, 1956–61

EXPLANATION

SALINE DEPOSITS

Carbonate zone — *Brine salinities 0.5 to 4.0 percent*

Sulfate zone — *Brine salinities 3 to 6 percent*

Carbonate and sulfate zone, undifferentiated — *Brine salinities 3 to 6 percent*

Chloride zone — *Brine salinities 6 to 33 percent*

Recent

Qcsi — **Silt facies**
Silty playa or lake beds impregnated with younger carbonate salts and capped by crust of rock salt in blister forms 1 to 3 inches thick. Sulfates occur as nodules ½s to ½ inch in diameter in layer ½ inch thick about 3 inches below surface. Ground generally damp and frequently wet, partly by flooding by surface water but mostly by ground water. Vegetation pickleweed

Qcs — **Sand facies**
Younger carbonate salts impregnating sandy playa or lake deposits of late Pleistocene age; commonly a caliche-like layer of salt, 1 to 3 inches thick, 2 to 6 inches below the surface. Ground elevated, subject only to flooding by runoff originating on this surface. Vegetation includes several species of phreatophytes

Qsg — **Massive gypsum**
Two to 6 feet thick, capped by anhydrite and (or) bassanite 3 to 8 inches thick. Thin veins of rock salt. At surface is light-brown silty layer 1 to 2 inches thick containing various salts and clastic minerals, probably eolian. Deposits underlain by damp or wet silt. Elevated and protected against flooding. Vegetation lacking

Qsm — **Marsh deposits**
Qsm, *mostly sulfate salts, some rock salt*
Qcm, *marshes with sodium carbonate and other carbonate salts; restricted to east side of Cottonball Basin Ground generally wet. Total dissolved solids in ground water less than 6 percent. Vegetation chiefly pickleweed; saltgrass and rush in carbonate marshes*

Qcm

Qch — **Saline facies**
Qch, *carbonate zone*
Qsh, *sulfate zone*
Surface layer is brown silt 6 to 18 inches thick containing sulfate salts. Underlain by irregular slabby rock salt 1 to 3 feet thick. At base is silt. Low parts subject to flooding by rise of ground water during protracted wet periods; runoff is by solution pits. Vegetation sparse pickleweed

Qhs — **Silty rock salt, smooth facies**
Surface layer is brown silt 2 to 18 inches thick containing sulfate and borate salts; thins pansward. Underlain by smooth layer of rock salt 2 to 18 inches thick that thickens pansward. At base is silt. Subject to some flooding by runoff originating on this surface. Total dissolved solids in ground water mostly in range 8 to 15 percent. Vegetation lacking

Qhr — **Silty rock salt, rough facies**
Two to 3 feet thick; capped by brown silty layer 1 to 2 inches thick containing sulfate and borate salts. Surface rough. Elevated and protected against flooding. Total dissolved solids in ground water mostly in range 12 to 25 percent. Vegetation lacking

Qh — **Massive rock salt**
Four to 6 feet thick. Other salts and silts lacking. Surface rough. Elevated and protected against flooding. Ground water nearly saturated. Vegetation lacking

Qhe — **Eroded salt**
Silty rock salt, 1 to 15 inches thick; overlies silt. Reworked from other chloride-zone deposits. Subject to occasional flooding. Vegetation lacking

QUATERNARY

NONSALINE DEPOSITS

Recent

Qd — **Dune sand**
In active dunes. Contains artifacts representing the bow-and-arrow and pottery occupations. Surface rarely flooded; ground water shallow and generally less than 0.3 percent total dissolved solids. Vegetation mesquite

Qf_a Qf — **Fan gravel and flood-plain deposits**
Qf_a, *fan gravel. Loose gravel in washes and on small fans along large washes. Mostly cobbles and pebbles, well rounded. Not much sand or silt, few boulders except on fans of Starvation and Hanaupah Canyons. No desert varnish or weathering rind except in immediate vicinity of reworked older deposits. Flooded only by runoff from cloudbursts. Ground water deep. Vegetation mostly less xerophytic species*
Qf, *flood-plain deposits of sand and silt. Surfaces on saltpan have extensive salt crusts and are seasonally flooded and without vegetation. Deposits at Mesquite Flat and along the Amargosa River are older, mostly a few feet higher than present drainage, and are rarely flooded; vegetation phreatophytes*

Pleistocene and Recent

Qt — **Travertine**
At active springs and dried springs

Pleistocene

Upper Pleistocene

Qe_3 — **Younger of the upper Pleistocene fan gravels**
Mostly pebble- to cobble-size gravel. Stones strongly varnished but are firm; many lack weathering rinds. Surfaces of the deposits mostly less than 10 feet above present washes; occur as fans within present washes. Faulted but not noticeably tilted. Surfaces protected from floods have desert pavement; eroded surfaces are gullied and mantled with Recent cobbles and boulders in embankments along edges of gullies. Vegetation xerophytic

L — **Lake deposits (Lake Manly)**
Mostly loose shingled pebble-size gravel; little sand or silt; few cobbles. Occur in small bars and embankments; locally cemented with lime carbonate caliche

Qe_2 — **Older of the upper Pleistocene fan gravels**
Bouldery deposits in old fans. Fan form distinct, but much dissected. Commonly tilted as well as faulted. Surfaces 50 to 75 feet above present washes. Distinct weathering rind on boulders and cobbles and these much disintegrated regardless whether of carbonate, quartzite, or igneous rock; surface strewn with angular blocks, slabs, and flakes. Varnish less distinct than in younger fan gravel. Some layers cemented with caliche. Interwash surfaces form smooth pavement. Includes bed of volcanic ash in Six Spring Canyon. Vegetation lacking except for xerophytes along washes

Pliocene and Pleistocene(?)

QTb_1 QTg_1 — **Funeral Formation**
QTg_1, *mostly bouldery, moderately well cemented fanglomerate*
QTb_1 *interbedded basalt; local*
Surfaces commonly deeply dissected, and original fan or other form is obscure. Materials at surface are angular blocks, slabs, and chips. Weathering rind deep. Extensively tilted, and locally steeply so; much faulted. Below 2,000 feet altitude, vegetation is lacking except for xerophytes along washes

Miocene or Pliocene

Tf — **Furnace Creek Formation and equivalent beds**
Mostly light-colored fine-grained playa deposits, some conglomerate, and some basalt. Thickness 5,000 feet

Miocene(?)

Ts — **Sedimentary rocks**
Mostly conglomerate, grit and sandstone; some shale and limestone. Thickness 4,000 feet

Oligocene(?)

Tsr — **Sedimentary rocks**
Mostly conglomerate, grit, and sandstone. Probably includes equivalents of Titus Canyon Formation of Stock and Bode (1935). Thickness more than 1,500 feet

TERTIARY AND QUATERNARY(?)

Tv — **Volcanic rocks, undivided**
Mostly volcanic rocks; in north part of Black Mountains where referred to as Artist Drive Formation, includes some interbedded sedimentary rocks. Thickness 5,000 feet

Tg — **Granitic intrusions**
Occur in large intrusions (laccoliths?) at Skidoo and Hanaupah Canyon, and as small intrusions. Composition mostly monzonite or quartz monzonite; some alaskite; in part porphyritic, in part gneissic

Td — **Dikes and other small intrusions**

TERTIARY

QUATERNARY

Middle and Upper Devonian

Dl — **Lost Burro Formation**
Light-gray dolomite and limestone with thin beds of quartzite and shale; some chert. Thickness 2,000 feet

Silurian and Lower Devonian

DSh — **Hidden Valley Dolomite**
Light-gray massive dolomite. Thickness 600 to 750 feet

SILURIAN AND DEVONIAN

Upper Ordovician

Oes — **Ely Springs Dolomite**
Dark-gray thick-bedded dolomite. Thickness 400 to 800 feet

Middle and Upper(?) Ordovician

Oa — **Eureka Quartzite**
Massive quartzite; nonfossiliferous. Thickness 250 to 350 feet

Lower and Middle Ordovician

Op — **Pogonip Group**
Well-bedded limestone and sandstone and dark massive dolomite, underlain by interbedded limestone, sandstone, and shale; some beds red. Thickness 1,500 feet

ORDOVICIAN

Upper Cambrian

Cn — **Nopah Formation**
Mostly brown sandy dolomite and alternating black and cream-colored dolomite. Lower 100 feet shaly and contains Upper Cambrian fossils. Thickness 1,000 feet

Middle and Upper Cambrian

Cb — **Bonanza King Formation**
Upper part is brownish thick-bedded dolomite. At middle is light-tan shale interbedded with platy limestone and sandstone and containing Middle Cambrian fossils. Lower part is interbedded dark limestone and light-colored dolomite underlain by massive dark dolomite. Thickness 3,500 feet

Lower and Middle Cambrian

Cc — **Carrara Formation**
Interbedded limestone, dolomite, and variegated shale and siltstone. Middle Cambrian fossils. Thickness 300 feet

CAMBRIAN

Lower Cambrian and Lower Cambrian(?)

Czw — **Zabriskie Quartzite and Wood Canyon Formation**
Zabriskie Quartzite; massive quartzite, granulated due to shearing. Thickness 100 to 1,000 feet. Age is Early Cambrian
Wood Canyon Formation, in descending order; dolomite and quartzite, 400 feet thick; olenellid-bearing shale, 500 feet thick; quartzite with shale towards base, 1,650 feet thick. This quartzite and shale are Lower Cambrian (?)

CAMBRIAN AND CAMBRIAN(?)

Pzs — **Stirling Quartzite**
Brown-weathering quartzite at top, underlain by interbedded purple shale and quartzite and, at base, well-bedded and crossbedded, partly conglomeratic quartzite. Thickness 1,500+ feet

Pzc — **Johnnie Formation**
Interbedded purple shale and quartzite underlain in succession by massive beds of dolomite, yellow shale, and, in lower part, interbedded sandstone, quartzite, and dolomite. Thickness 4,000 feet

pCn — **Noonday Dolomite**
In southern Panamint Range mostly light-gray bedded dolomite; upper part is massive gray dolomite. In central Panamint Range, including Tucki Mountain, and in Funeral Mountains contains much limestone, and is questionably assigned to Noonday Dolomite; corresponds to Telescope Peak Group of Murphy (1932). Scolithus? tubes. Thickness 800 feet

UNCONFORMITY

Pahrump Series

pCk — **Kingston Peak (?) Formation**
Quartzite, argillite, conglomerate, some distinctive metaconglomerate having quartzite pebbles stretched three or four times their thickness. Thickness 3,000+ feet

pCc — **Crystal Spring Formation**
Cherty beds at top underlain in succession by massive dolomite, thin-bedded dolomite, quartzite, and, at base, conglomerate. Intruded by numerous diabase sills that are older than Kingston Peak (?) Formation. Thickness excluding diabase, 1,500 feet

PRECAMBRIAN

pCm — **Metamorphic rocks**
Basement complex; mostly schist and gneiss

pCa pCab — **Amargosa thrust complex**
pCa, *a complex of rocks under the Amargosa thrust fault including metamorphic rocks intruded by granitic rocks and by a still younger northward-trending dike swarm. At north end includes a chaotic mixture of volcanic rocks interlayered with slabs of Paleozoic rocks*
pCab, *major breccia zones apparently related to Amargosa thrust complex*
Both pCa *and* pCab *include units that may be equivalent in age to parts of Artist Drive Formation*

PENNSYLVANIAN, MISSISSIPPIAN AND PERMIAN

MISSISSIPPIAN

PIPMr — **Rest Spring Shale and younger formations at east foot of Tucki Mountain**
Rest Spring Shale (Mississippian and Pennsylvanian?) is shale, siltstone, some quartzite, and pebbly conglomerate; little limestone; 750 feet thick. South of Shoreltown is limestone, with some shale, about 1,000 feet thick and mostly Pennsylvanian. At Shoreltown and to north is mostly limestone conglomerate, 3,000 feet thick, largely or wholly of Permian age

Mt — **Tin Mountain Limestone and overlying limestone**
Tin Mountain Limestone is dark gray and fine grained; upper part cliff forming with red shale partings and lenses of chert; lower part contains some light-brown to red limy shale; thickness 1,000 feet. Overlying limestone consists of interbedded limestone, shale, siltstone, sandstone, chert, and conglomerate; 700 feet thick

MISSISSIPPIAN AND PENNSYLVANIAN

CARBONIFEROUS

Contact
Dashed where approximately located; dotted where concealed

Normal high-angle fault, showing dip
Dashed where approximately located; dotted where concealed. U, upthrown side; D, downthrown side

Thrust fault, showing dip
Dashed where approximately located; dotted where concealed. Sawteeth on upper plate

Anticline
Showing trace of axial plane and bearing and plunge of axis

Syncline
Showing trace of axial plane and bearing and plunge of axis

Strike and dip of beds

Strike and dip of overturned beds

Strike of vertical beds

Surface mine working or quarry

Adit

Spring

Grave

F 61 — Location of fossil collection referred to in text