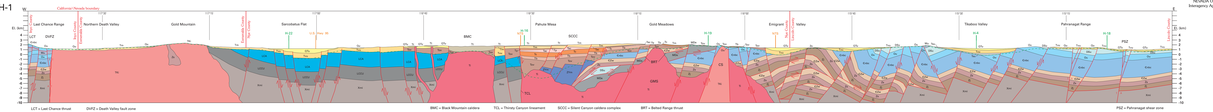
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with
OFFICE OF ENVIRONMENTAL MANAGEMENT, NEVADA STATE MANAGEMENT,
U.S. DEPARTMENT OF ENERGY,
NATIONAL NUCLEAR SECURITY ADMINISTRATION
NEVADA OPERATIONS OFFICE, under
Interagency Agreement DE-AI08-96NV11962

MISCELLANEOUS FIELD STUDIES MAP MF–2370
SHEET 2 OF 3
Version 1.0
Pamphlet accompanies map

H-1



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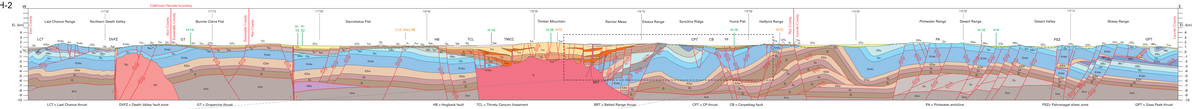

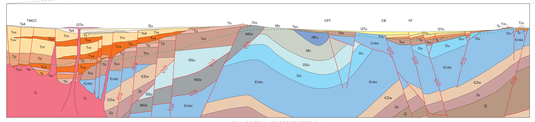

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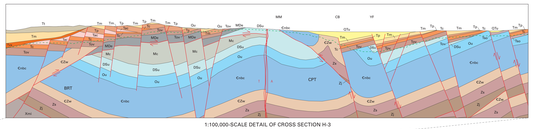

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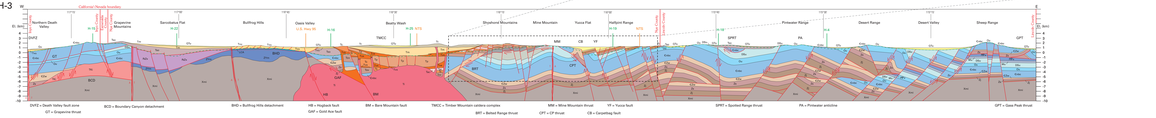

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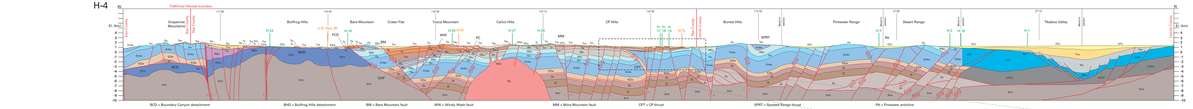

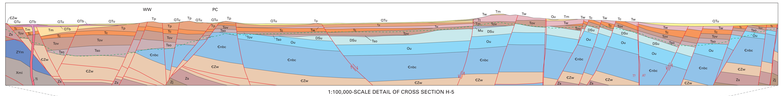

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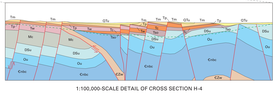

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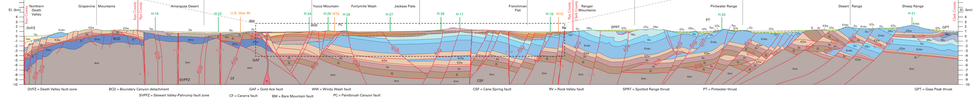

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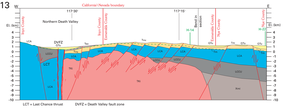

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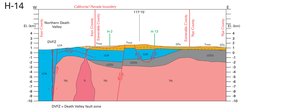

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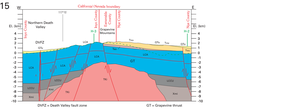

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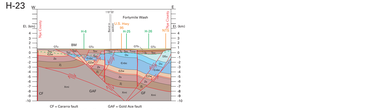

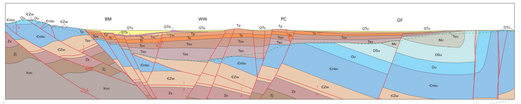

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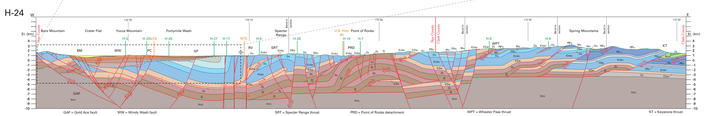

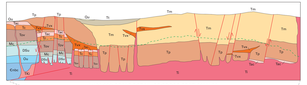

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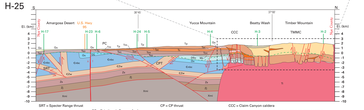

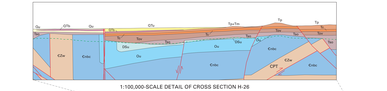

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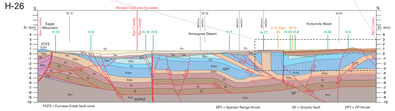

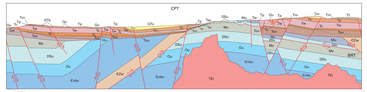

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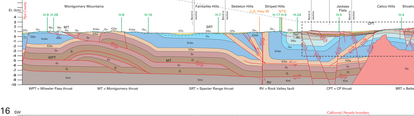

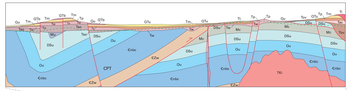

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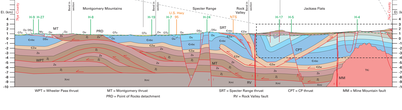

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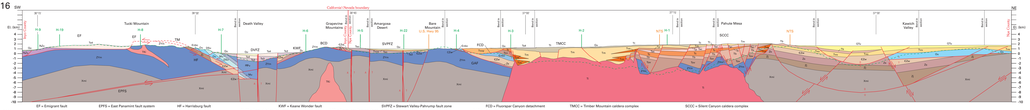
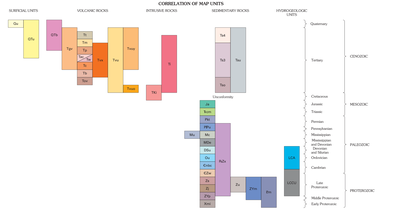


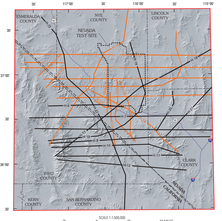
SCALE 1:250 000

0 5 10 MILES

0 5 10 KILOMETERS

CORRELATION OF MAP UNITS





EXPLANATION

- Lines of section featured on sheet 2
- Lines of section featured on sheet 3
- State boundary
- Von Schmidt line (historical line)
- County boundary
- Nevada Test Site boundary
- Interstate highway
- State highway
- Area depicted on the five index maps (figs. 3-7)

INDEX TO CROSS-SECTION LINES FEATURED ON SHEET 2

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qu **Undifferentiated Quaternary deposits**

QTu **Undifferentiated Quaternary and Tertiary deposits (Holocene to Pliocene, but may locally include Miocene and Oligocene deposits)**

BEDROCK UNITS

VOLCANIC ROCKS

QTb **Basalts lava flows, undivided (Pleistocene to Miocene)**

Volcanic rocks of the Death Valley vicinity.

Tgv **Volcanic rocks (Pliocene and Miocene)**—Volcanic rocks associated with the central Greenwater Range, including the Greenwater Volcanics and Greenwater Rhyolite. Includes the 6.9- to 5.4-Ma Greenwater Volcanics (Pliocene) of the Death Valley area and the 12- to 9-Ma dacite rocks in Death Valley and the Grapevine Mountains area.

Volcanic rocks of the Nevada Test Site and vicinity.

Ts **Stonewall Flat Tuff (Miocene), Thirsty Canyon Group (Miocene), and younger volcanic rocks, undivided**—Includes Fortymile Canyon assemblage and rocks that fill most of the Timber Mountain caldera.

Tvs **Timber Mountain Group (Miocene)**

Tsd **Intrusives and caldera margin rhyodacites, undivided (Miocene)**

Tp **Paintbrush Group (Miocene)**

Tac **Calico Hills Formation (Miocene)**

Tm **Wahmonie and Salyer Formations, undivided (Miocene)**

Tcs **Crater Flat Group (Miocene)**

Tb **Belted Range Group (Miocene)**

Tmr **Older ash-flow tuffs and lava sequences (Miocene)**—Includes Little Ridge Tuff, Tannen Formation, Tub Spring Tuff, tuff of Yucca Flat, and other volcanic rocks older than the Belted Range Group.

Tvu **Volcanic rocks (Miocene to Oligocene)**—Includes all volcanic rocks associated with the southeastern Nevada volcanic field and also older volcanic rocks not associated with southeastern Nevada volcanic field, including Rope Wash Tuff, Tub Spring Tuff, Ash Meadows Tuff, and tuff of Yucca Flat (Minor, 1993; Ekren and Sargent, 1965). Where subsurface information is available, will be subdivided into younger and older units.

Tvm **Volcanic rocks, undivided (Miocene to Miocene)**—Includes Crater Flat Tuff and younger rocks, but can be restricted to sections F-G, H-H, and H-22 where these sections cross northwestern part of Amargosa Desert.

Tvo **Older volcanic rocks, undivided (Miocene to Oligocene)**—Can be restricted to north end of sections H-19, unit is used for Miocene and Oligocene volcanic rocks not associated with southeastern Nevada volcanic field, including Rainier Mesa Tuff, Tub Spring Tuff, and Fraction Tuff (Minor and Sargent, 1993; Minor and Mankinen, 1993; Ekren and Sargent, 1965).

INTRUSIVE AND METAMORPHIC ROCKS (MESOZOIC TO CRETACEOUS)

Ti **Intrusive rocks (Miocene and Oligocene)**—Intrusive rocks of Tertiary age. Includes granite and rhyolite intrusive rocks of the Black Mountains intrusive complex, Willow Spring Diorite and granite of North Mountain and Pahamint Mountains, Injuahamel Granodiorite of the Funeral Mountains, and other Tertiary intrusive rocks and related and intrusive rocks at the Nevada Test Site (associated with the Timber Mountain Group, Calico Hills Formation and Wahmonie Formation [Miocene]). Locally includes minor associated extrusive rocks.

Tki **Intrusive rocks (Oligocene to Cretaceous)**—Intrusives and dikes of Cretaceous age or Tertiary age that are older than the Belted Range Group. Includes dikes in the Panamint Range and plutons north of Yucca Flat at the Nevada Test Site.

CONTINENTAL SEDIMENTARY ROCKS (PLIOCENE TO QUAOCENE)

Tsd **Unit 8 (Pliocene? to Miocene)**—Late sparsentrained to post-entrained sedimentary rocks of Stonewall Flat, Rock Valley, and Jackass Flats. Includes the Funeral Formation (Pliocene? and Pliocene) of the Furnace Creek basin.

Tsb **Unit 3 (predominantly Miocene)**—Miocene sparsentrained and (or) syntectonic sedimentary rocks of Amargosa Desert, Sarcobatus Flat, Rock Valley, and Jackass Flats (Pliocene to Oligocene?) and Furnace Creek Formation (Pliocene? and Miocene) within the Furnace Creek basin.

Tmr **Older Tertiary sedimentary rocks, undivided (Pliocene? to Eocene)**

Tsu **Tertiary sedimentary rocks, undivided (Pleistocene? to Eocene)**

SEDIMENTARY AND METASEDIMENTARY ROCKS (MESOZOIC TO PROTEROZOIC)

JT **Aztec Sandstone (Lower Jurassic)**—Exposed in the eastern and southern Spring Mountains.

TRc **Chinle Formation (Upper Triassic) and Moenkopi Formation (Middle? and Lower Triassic), undivided**—Exposed in the eastern Spring Mountains.

Pzf **Kaibab and Toroweap Formations, undivided (Lower Permian)**—Includes Permian outlcrops that underlie the Toroweap Formation. Exposed in the Spring Mountains.

PzQt **Tectonically disrupted Paleozoic and Late Proterozoic sedimentary rocks, undivided**—Includes Late Proterozoic and Paleozoic sedimentary rocks that are tectonically dismembered and (or) pervasively brecciated in the upper plates of extensional detachment faults. Use is restricted to the Death Valley area.

PzMz **Permian and Pennsylvanian rocks, undivided**—Pennsylvanian and Permian rocks, undivided, including the Tonopah Formation (Permian and Pennsylvanian), exposed in the Last Chance Range and Cottonwood Mountains, the Bird Spring Formation (Lower Permian to Pennsylvanian), exposed in the Spring Mountains, the Tonopah Formation (Permian and Pennsylvanian), exposed in the Grapevine Mountains, Lower Permian and Pennsylvanian, exposed in the Nevada Test Site.

Mzc **Mississippian rocks, undivided**—Mostly carbonate rocks. Includes the Meiser Limestone (Upper and Lower Mississippian), exposed in the Montgomery Mountains, the Perdido Formation (Upper and Lower Mississippian), exposed in the Mississippian Range, exposed in the Pahrump Range, various Mississippian carbonate units in the Spotted Range, and carbonate rocks of the Perdido Formation and Tin Mountain Limestone (Upper and Lower Mississippian), exposed in the Funeral and Chaves Ranges. In Kawich Peak (Joint Ammo) Spring Mountain, includes the Indian Limestone (Lower Mississippian to Middle Devonian).

Mz **Mesozoic rocks, undivided**—Includes rocks in the Funeral Range, and the eastern Nevada Test Site (Frenchman Ridge, CP Hills, and Calico Hills). Includes the Rocky Wash Quartzite.

DMzu **Devonian Formation (Mississippian and Upper Devonian)**—Exposed in the Nevada Test Site area. Minor or cross sections of the central portion of Belted Range Group.

DSu **Devonian and Silurian rocks, undivided**—Includes Devonian and Silurian Dolomite (Middle and Lower Devonian), Sixty Dolomite (Lower Devonian), and Lakeview Dolomite (Silurian).

Ou **Ordovician rocks, undivided**—Includes Ely Springs Dolomite (Upper Ordovician), Eureka Quartzite (Upper and Middle Ordovician), and Pogonip Group (Middle and Lower Ordovician).

Ꞓ **Nopah (Upper Cambrian), Bonanza King (Upper and Middle Cambrian), and Carrara (Middle and Lower Cambrian) Formations, undivided**

Ꞓc **Carrara Formation (Middle and Lower Cambrian) and Cambrian Formations (Lower Cambrian to Late Proterozoic), undivided**

Zs **Stirling Quartzite (Late Proterozoic)**

Zj **Johnnie Formation (Late Proterozoic)**

Zs **Stirling Quartzite and Johnnie Formation, undivided (Late Proterozoic)**—Use is restricted to the vicinity of the Spring Mountains in Icemall of Keystone thrust and Keystone thrust sections H-24 and H-25.

Zsj **Stirling Quartzite and Johnnie Formation (Late Proterozoic) and Pahrump Group (Middle to Late Proterozoic), undivided**—Use is restricted to those areas where these rocks are indistinguishable from one another. Includes minor younger igneous rocks. Use is restricted to the Spring Mountains and Pahrump Range.

Zp **Metasiltite and igneous rocks, undifferentiated (Late Proterozoic to Early? Proterozoic)**—Includes all Proterozoic rocks, use is restricted to sections H-22 and H-23.

Zpu **Noonday Dolomite (Late Proterozoic) and Pahrump Group (Middle and Late Proterozoic), undivided**

Ann **Metasiltite and igneous rocks, undifferentiated (Early? Proterozoic)**

HYDROGEOLOGIC UNITS (PALEOZOIC TO PROTEROZOIC)

[Use is restricted to those sections or parts of sections where abundant Quaternary cover (for example, section H-22 and northeastern end of section H-29) or lack of detailed map data (for example, sections H-14 and H-15) prevent more detailed stratigraphic subdivision]

CCU **Lower carbonate-rock aquifer (Cretaceous to Cambrian)**—Includes Paleozoic carbonate rocks and Cretaceous carbonate rocks. Includes Ꞓc, Ꞓ, Ou, Dsu, and Dmzu.

LCSU **Lower clastic confining unit (Late Proterozoic to Lower Cambrian)**—Predominantly clastic rocks, equivalent to the quartzite confining unit of Laczniak and others (1996).

EXPLANATION OF SYMBOLS USED ON CROSS SECTIONS

[These sections use no direct subsurface data, such as borehole data, below about 2 km; all contacts and faults below this depth are interpreted. Confidence in the geologic interpretation naturally decreases with depth. Only highly reliable contacts and faults are shown on sub-level.]

Contact between lithologic or hydrogeologic units — *Dashed where inferred*

Normal fault or detachment fault—*Dashed where inferred*; barbs indicate direction of relative vertical movement. D and U indicate relative down and up motion, respectively, for normal faults that are subparallel to the line of section. Dashed where projected above land surface

Strike-slip fault—*A* and *T* indicate direction of relative movement seen from and toward the observer, respectively

Profile representing the inferred base of the Cenozoic section, based upon inversion of regional gravity data—After Blakely and others (1999)

Tie point—Intersection of two cross sections. Tie points are accurate to viewer at scale of 1:750,000 of accompanying index maps. All coordinates of individual cross section tie points are reported in metadata that supports the associated digital files

Tie point with boundary of Nevada Test Site

Tie point with U.S. Highway 95

Tie point with county boundary

Bend in cross section—All bends in cross sections are shown. Some subtle bends are not discernible to viewer at scale 1:750,000 of accompanying index maps. Location of all sections (section bends) are reported in metadata that supports the associated digital files

INTERPRETIVE GEOLOGIC CROSS SECTIONS FOR THE DEATH VALLEY REGIONAL FLOW SYSTEM AND SURROUNDING AREAS, NEVADA AND CALIFORNIA

By
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2003

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