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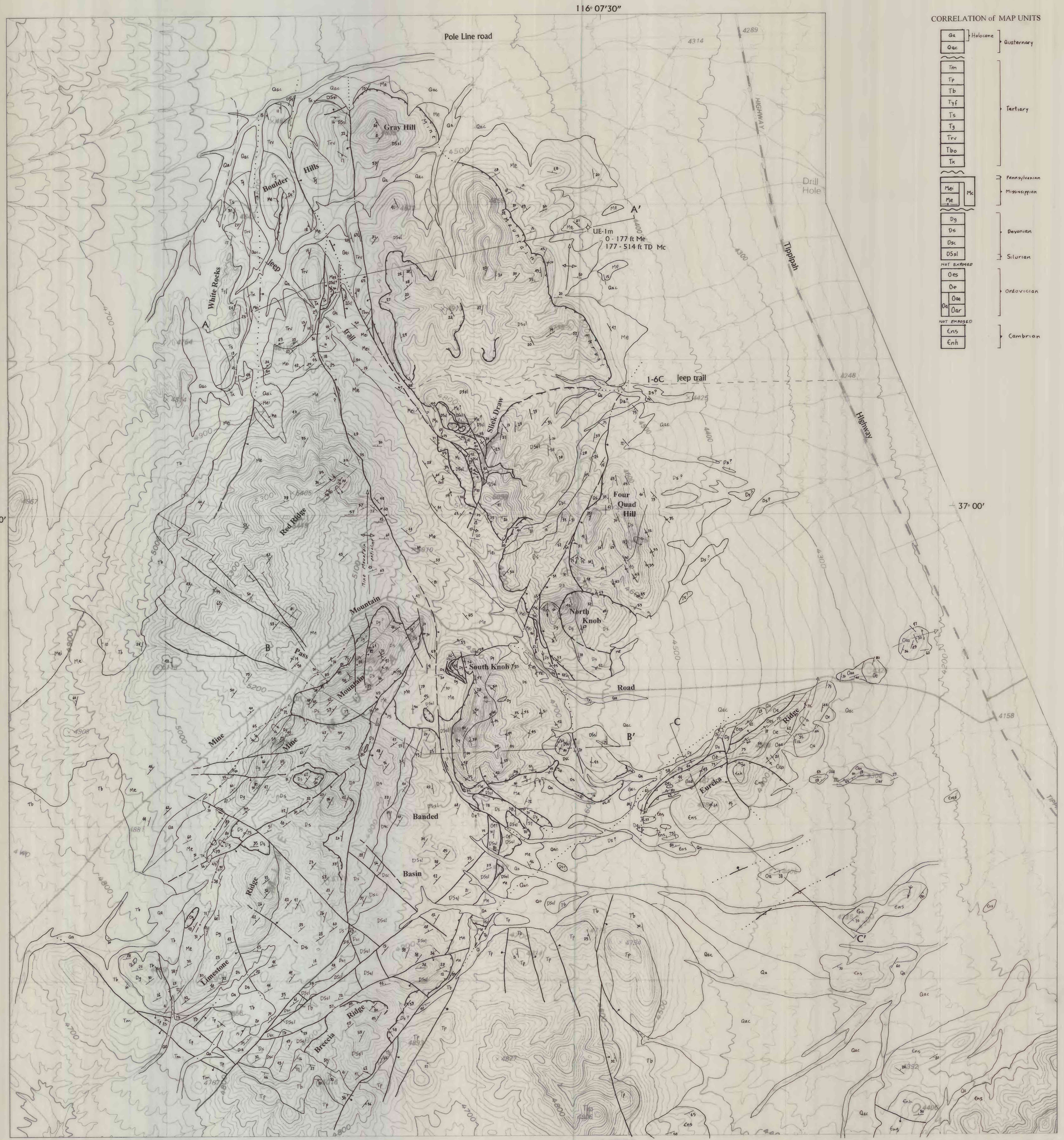

Map base from photocomposite of 1:24,000-scale topographic maps for the Mine Mountain, Tippipah Spring, Yucca Flat, and Yucca Lake quadrangles, enlarged to 1:12,000 scale; Universal Transverse Mercator projection, Zone 11; 1,000-meter grid is based on Nevada State Plane Coordinate System, Central zone. 1927 North American datum

Geology mapped by Cole (1987-1997) and Cashman (1996-1997), with assistance from P.L. Guth (1987); geology of volcanic rocks in the southern part of the map adapted from Orkild (1968) and McKeown and others (1976).

GEOLOGIC MAP OF THE MINE MOUNTAIN AREA, NEVADA TEST SITE, SOUTHERN NEVADA

By
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1997

CORRELATION of MAP UNITS

Qa
Qac
Holocene
Quaternary
Tm
Tp
Tb
Tyf
Ts
Tg
Trv
Tbo
Tx
Tertiary
Pennsylvanian
Mei
Me
Mc
Mississippian
Dg
Ds
Dsc
DSsl
Devonian
Silurian
NOT EXPOSED
Oes
Oe
Oaa
Oa
Oar
Ordovician
NOT EXPOSED
Єns
Єnh
Cambrian

DESCRIPTION OF MAP UNITS

Qa **Alluvium** (Holocene)--Unconsolidated deposits in active stream channels

Qac **Alluvial fan deposits, colluvium, and other surficial deposits** (Quaternary)--Unconsolidated to weakly consolidated materials located outside of active stream channels

Tm **Timber Mountain Group** (middle Miocene)--Rhyolitic welded ash-flow tuff; chiefly Ammonia Tanks Tuff in the southern Mine Mountain area; variable thickness (Wahl and others, 1997)

Tp **Paintbrush Group** (middle Miocene)--Rhyolitic welded ash-flow tuff; chiefly Topopah Springs Tuff and some Tiva Canyon Tuff in the southeastern Mine Mountain area; variable thickness (Wahl and others, 1997)

Tb **Bedded tuff** (middle Miocene)--Non-welded pyroclastic deposits that underlie the Paintbrush Group; moderately to well bedded deposits, variable zeolitic alteration; variable thickness

Tyf **Tuff of Yucca Flat** (middle Miocene)--Rhyolitic ash-flow tuff; weakly to partially welded; contains common lithic fragments and conspicuous biotite; widespread zeolitic alteration; more than 30 m thick; exposed only in the White Rocks area northwest of Mine Mountain (Wahl and others, 1997)

Ts **Volcaniclastic sandstone** (middle Miocene)--Pale yellow, pink, and tan well bedded sandstone with granule conglomerate beds; contains common detrital quartz and feldspar derived from Miocene volcanic rocks and conspicuous clasts of Eleana Formation siltstone and chert litharenite; deposits locally show planar and trough cross-beds, and moderate clast sorting; includes some thin pyroclastic tuff beds; about 25 m thick; exposed only in the White Rocks area northwest of Mine Mountain, beneath the Tuff of Yucca Flat

Tg **Boulder conglomerate** (middle Miocene)--Consists of well rounded boulders and cobbles of Paleozoic rock units, including Eleana chert litharenite and pebble conglomerate, Eureka Quartzite, Tippipah Limestone, and various types of limestone and dolomite; boulders typically 10 to 40 cm in diameter, maximum 150 cm; unit weathers to bouldery lag deposit; poorly lithified and matrix not observed; bedding discernible only in aerial photographs and appears to be planar and parallel to basal contact; unit lies directly on non-welded ash of the Redrock Valley Tuff; exposed only in the Boulder Hills area northwest of Mine Mountain; maximum thickness about 105 m.

The central Tg outcrop contains an elongate slab, enclosed parallel to bedding in the conglomerate, that consists of Eleana sandstone-siltstone on the west and brecciated Simonson Dolomite on the east. This slab apparently was transported as a coherent block into the channel that was accumulating the surrounding conglomerate, perhaps as a gravity-slide block

Trv **Redrock Valley Tuff** (middle Miocene)--Red-brown, crystal-rich rhyolitic ash-flow tuff; moderately to strongly welded where thickest on the east (about 135 m), and progressively less welded where thin on the west (less than 5 m) in the White Rocks area; contains abundant phenocrysts of feldspar and biotite; uppermost 1 to 2 m is pale lavender non-welded tuff with similar phenocryst assemblage as underlying welded tuff; exposed only in the northern Mine Mountain area (Wahl and others, 1997)

Tbo **Older bedded tuff** (middle Miocene)--White, biotite-bearing rhyolitic tuff; locally preserved beneath the Redrock Valley Tuff; less than 5 m thick

Tx **Sedimentary and colluvial breccia** (Tertiary)--Discontinuous, weakly to moderately bedded unit consisting of angular clasts and some subrounded cobbles of various Paleozoic units in red-brown fine-grained calcareous or silty matrix; lies directly on Paleozoic rocks and clast population generally resembles the Paleozoic formations immediately below (Eleana clasts on top of Eleana; dolomite clasts on top of Simonson or Sevy Dolomite); clast sorting, rounding, and grading generally poor; matrix is generally rare and massive, but locally preserves fine laminations where it appears to have washed into place after surrounding clasts had been deposited

Mc **Chainman Shale** (Mississippian and Lower Pennsylvanian)--Green-brown to maroon thin bedded shale with scant, discontinuous beds of fine siltstone, and discrete beds of bioclastic limestone, impure quartzite, and chert-granule conglomerate; sparse outcrop in shale, which forms slopes and swales with characteristic spongy feel under foot; surface is covered by pencil-shaped shards of shale and dismembered fragments of more competent silty beds. Only identified in outcrop in the Slick Draw area, where it appears to lie conformably on the Chesterian-age Eleana limestone unit Mei, but the contact may be structural (see text)

Chainman Shale in drillhole UE-1m is predominantly shale with thin cross-bedded siltstone layers and rare beds of pebbly mudstone. Thickness inestimable due to structural complications, but estimated to exceed 1,200 m in the Syncline Ridge area to the north (fig. 1; Trexler and others, 1996)

Eleana Formation (Mississippian)--Eleana Formation (Poole and others, 1961; Trexler and Cashman, 1997) in the Mine Mountain area differs from the Eleana farther north and west in that it is finer-grained overall, contains less pebble conglomerate, is conspicuously thinner, and its base is no older than late Kinderhookian (middle Lower Mississippian). Description of 1,050 m measured section from the Mine Mountain area is presented in Trexler and others (1996), along with biostratigraphic data. Three units recognized in the map area:

Mei **Limestone unit i** (Chesterian; Upper Mississippian)--Brown- and orange-weathering bioclastic limestone beds interstratified with varicolored siltstone; limestone beds typically 10-30 cm thick, locally as thick as 70 cm; clasts consist of chert granules, crinoid columnals, and fragments of brachiopods, bryozoans, corals, and echinoderm spines; clasts generally poorly sorted and graded; thickness approximately 150 m

Me **Siltstone and sandstone unit** (Upper Kinderhookian to Chesterian; Mississippian)--Brown, red-brown, and gray-green chert-lithic siltstone, sandstone, and conglomerate with some bedded chert, bioclastic limestone, and micritic limestone. More than 80 percent of the section is indistinguishable siltstone and fine sandstone; a more resistant purplish-gray zone of siliceous siltstone was identified in the measured section at 650 to 680 m above the base (Trexler and others, 1996). Granule conglomerate and litharenite beds contain subrounded clasts of varicolored chert; bedding characteristics suggest deposition from submarine turbidite mudflows. Thickness approximately 1,000 m (Trexler and others, 1996)

--o-- **Sandy limestone unit** (Upper Kinderhookian; Lower Mississippian)--Narrow 5 m zone consisting of as many as four discrete gray limestone beds, approximately 25 m above the base of the Eleana Formation (Trexler and others, 1996), exposed just west of the Mine Mountain crest. Limestone beds are 10 to 40 cm thick, medium grained grainstones with locally conspicuous rounded, frosted brown quartz grains concentrated on bedding surfaces; local intraformational rip-up clasts noted in lower 2 limestone beds; highest limestone is locally capped by silicified crinoid and bivalve fossils and weathers pink-gray. Interbedded with green and brown siliceous shale

Dg **Guilmette Formation** (Middle and Upper Devonian)--Gray, thick-bedded, cliff-forming limestone, with dolomitic limestone, quartzite, and sandy limestone; thick beds locally contain biohermal accumulations of stromatoperoids, corals, brachiopods, and bryozoans; sandy beds contain well rounded, frosted quartz grains. Quartzite beds are especially common near the top of the Guilmette and some show internal breccia fabrics that suggest block-caving over karst-dissolution voids (Trexler and others, 1996). The age of the upper Guilmette in this area is not known; the stratigraphic base of the Guilmette Formation, regionally marked by yellow-weathering silty-sandy beds (Hurtubise and du Bray, 1992) is not identifiable in this area, and so the mapped contact is the lowest occurrence of massive gray limestone; most likely, the lower Guilmette is dolomitized and some has been mapped with the upper Simonson Dolomite. Thickness of the limestone part of the Guilmette is approximately 210 m on Limestone Ridge

No sedimentologic features were noted in the Guilmette that might correlate with the Alamo megabreccia of the Pahranagat Range (70 km northeast of Mine Mountain), interpreted to have formed in response to an early Late Devonian bolide impact (Warme and Sandberg, 1996)

Ds **Simonson Dolomite** (Middle Devonian)--Alternating dark gray and light gray dolomite and sandy dolomite; unit is well bedded and contains widespread fragments of tubular coral, and local biohermal accumulations of stromatoperoids, corals, brachiopods, and bryozoans; lower quarter is brownish, lower-middle quarter is light gray, and upper half consists of alternating light and dark gray dolomite beds. Intraformational conglomerate beds observed in the section west of Banded Basin. Maximum thickness at Limestone Ridge is approximately 300 m, but probably includes dolomitized beds in the lower Guilmette; no unbroken section exists in this area. The four-fold subdivision of the Simonson recognized east of the Nevada Test Site (Johnson and others, 1989; Hurtubise and Du Bray, 1992) is not present here; Stringocephalus sp. biozone only observed at one locality between Breccia Ridge and Limestone Ridge

Dsc **Silty-cherty unit** (Lower Devonian)--Brown- and orange-weathering, thin bedded silty dolomite with brown chert replacements forming irregular nodules, masses, and films in the rock; thickness approximately 45 m in Banded Basin. Unit appears thicker and more sandy in the southeast-facing panel located northwest of North Knob

DSsl **Sevy Dolomite and Laketown Dolomite** (Lower Devonian and Silurian)--Light gray, massive, medium- to coarse-grained dolomite; bedding is obscure and fossils are rare, but relics of tubular corals locally preserved; dark brown-gray beds in the lower parts of preserved sections near Breccia Ridge may mark the upper beds of the Laketown Dolomite; thickness may exceed 360 m in Banded Basin, but parts of section may be duplicated by unrecognized structure.

Oes **Ely Springs Dolomite** (Upper Ordovician)--Dark brownish gray, fine-grained limestone and cherty limestone; thick bedded; contains conspicuous coiled gastropod fossils (Maclurites sp.) as large as 10 cm in diameter; thickness unknown, no complete section preserved.

Oe **Eureka Quartzite** (Middle Ordovician)--White-, cream-yellow-, and orange-weathering, medium-grained orthoquartzite; contains well rounded, well sorted quartz grains in quartz cement; bedding obscure where silica cement is pervasive; thickness indeterminate due to structural dislocation, but approximately 30 to 40 m present on Eureka Ridge

Oa **Antelope Valley Limestone** (Middle and Lower Ordovician)--Medium- to dark-gray limestone and silty limestone in the upper part of the Pogonip Group. Where possible, mapped separately as:

Oaa **Aysees Member, Antelope Valley Limestone**--Medium- to dark-gray limestone, well bedded with yellow-orange silty partings; contains some oolitic and oncolitic beds, as well as a few conglomerate beds with sub-rounded, slabby limestone clasts; thickness indeterminate

Oar **Ranger Mountains Member, Antelope Valley Limestone**--Brown- and tan-weathering, flaggy, thin-bedded silty-sandy limestone; contains some trilobite debris, strongly plicated brachiopod valves, and a few straight-coned cephalopod fossils; incomplete section, thickness unknown

Nopah Formation (Upper Cambrian)--Dark gray, well bedded dolomite; mapped separately as:

Cns **Smoky Member, Nopah Formation**--Thick-bedded, dark gray dolomite with irregular patches of white dolomite crystals; ledgy outcrop, especially in sections with laminated beds; thickness estimated as more than 300 m in CP Hills to south (McKeown and others, 1976)

Cnh **Halfpint Member, Nopah Formation**--Brown-gray weathering, thin bedded cherty limestone and dolomite; beds typically 2 to 20 cm thick, marked by silty partings replaced by films and nodules of brown-tan chert; thickness unknown, but estimated to exceed 250 m

SYMBOLS

FAULTS

[dip of plane indicated by short arrow; symbols combined where evidence indicates mixed sense of displacement. Fault traces solid where exposed; dashed where inferred; dotted where covered]

- 50 — Thrust fault - teeth on upper plate
- 59 — Extensional normal fault - hachures on upper plate
- 70 — Normal fault - bar and ball on down-thrown side
- 60 — Strike-slip fault - arrows indicate sense of displacement

STRIKE AND DIP OF BEDS

- 25 Inclined
- 90 Vertical
- 72 Overturned

STRIKE AND DIP OF WELDING FOLIATION

- 15 Inclined

FOLD AXES [showing direction of plunge]

- Anticline
- Overturned anticline
- Syncline
- Overturned syncline
- Minor fold hinge - showing inflection of beds

UE-1m DRILLHOLE

[listing units penetrated between collar and TD = total depth; dimensions listed in feet as shown in original drilling records]

SHAFT

ADIT

SPRING

LOCATION OF MEASURED SECTION

[described and graphically summarized in Trexler and others, 1996]

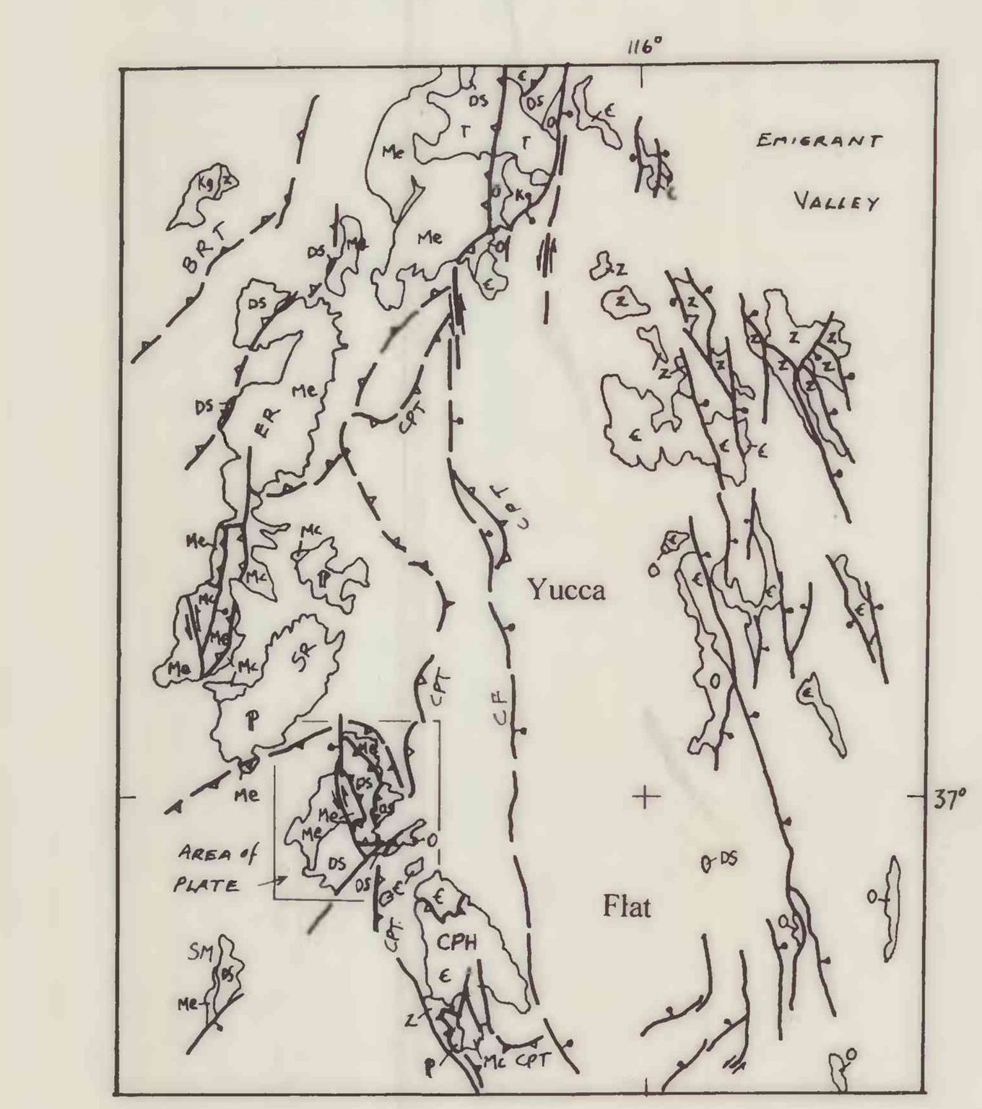

Figure 1.-- Sketch map of pre-Tertiary rocks in the Yucca Flat region showing location of the Mine Mountain area in relation to major structures: BRT = Belted Range thrust; CF = Carpetbag Fault; CPT = CP thrust system. Locations: CPH = CP Hills; ER = Eleana Range; SM = Shoshone Mountain; SR = Syncline Ridge. Map symbols: T = Tertiary rocks (where surrounded by older units); Kg = Cretaceous granite; IP = Pennsylvanian; Mc = Mississippian Chainman Shale; Me = Mississippian Eleana Formation; DS = Devonian and Silurian; O = Ordovician; C = Cambrian; Z = Late Proterozoic.