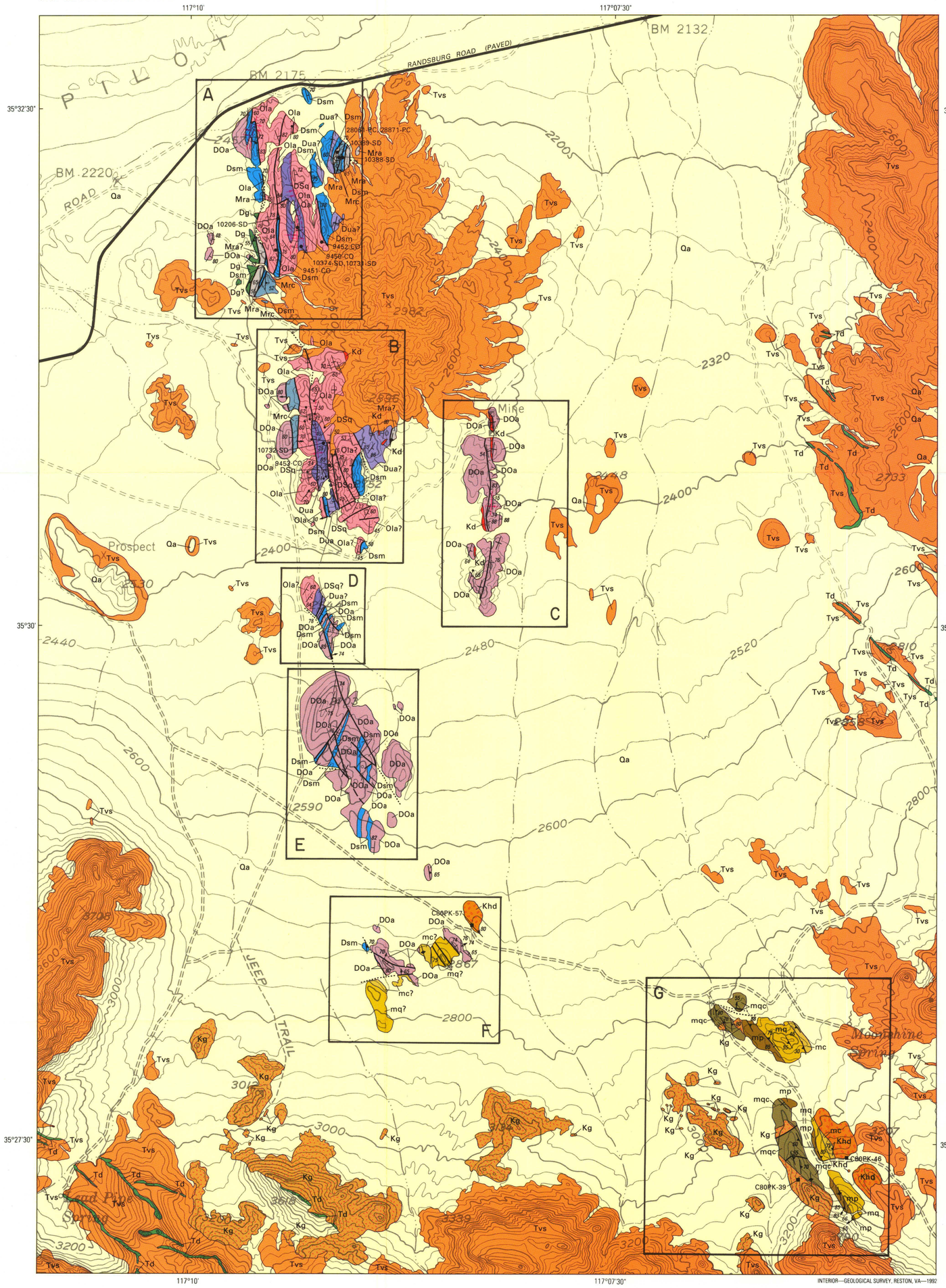
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

BULLETIN 2015
PLATE 1



Base from U.S. Geological Survey, 1: 62,500, Wingate Pass, 1950; Pilot Knob, 1954, Polyconic projection

Geology mapped in 1980, 1982, and 1986

APPROXIMATE DECLINATION, 1992

SCALE 1: 24 000

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

MAP LOCATION

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1992

GEOLOGIC MAP OF PRE-TERTIARY ROCKS IN PILOT KNOB VALLEY, CALIFORNIA

By
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1992

CORRELATION OF MAP UNITS

SURFICIAL DEPOSITS

Qa — QUATERNARY

Unconformity

INTRUSIVE ROCKS / **VOLCANIC AND SEDIMENTARY ROCKS**

Td, Tvs — TERTIARY

Angular unconformity

Kg — CRETACEOUS

Khd — CRETACEOUS

Kd — CRETACEOUS(?)

METASEDIMENTARY AND METAVOLCANIC ROCKS

Mra, Mrc — Lower Mississippian — MISSISSIPPIAN

Angular unconformity

Dg — Upper Devonian(?) — DEVONIAN(?)

Dsm — Middle Devonian — DEVONIAN

Dua — Middle and (or) Lower Devonian — DEVONIAN

DSq — Lower Devonian and (or) Silurian — DEVONIAN AND (OR) SILURIAN

Ola — ORDOVICIAN

DOa — DEVONIAN, SILURIAN(?), AND ORDOVICIAN

mc, mq, mp, mqc — AGE UNCERTAIN

DESCRIPTION OF MAP UNITS

Qa — **Alluvium (Quaternary)**—Unconsolidated to poorly consolidated, poorly sorted silt, sand, and gravel deposited as alluvial fans and in intermittent stream channels. Older deposits within this unit form benches or terraced surfaces above level of modern drainage. In northwest corner of map area, older gravel (not mapped separately) protrudes through younger alluvial-fan deposits to form a low discontinuous ridge that may represent a pressure ridge along Garlock fault. Alluvial deposits are younger than Christmas Canyon Formation (Smith and others, 1968)

INTRUSIVE ROCKS

Td — **Dikes (Tertiary)**—Silicic intrusive rocks, finely crystalline, weathers pale yellow brown. Form northwest-trending, hypabyssal dikes that intrude Cretaceous granodiorite and Tertiary volcanic rocks in southern and eastern parts of map area. Dikes are 1 to 30 m wide and as much as 1.5 km long. Some dikes have black, glassy, chilled margins

Kg — **Granodiorite (Cretaceous)**—Medium-gray- to yellow-brown-weathering, medium-grained, equigranular granodiorite. Contains plagioclase (60 percent), quartz (20 percent), alkali feldspar (10 percent), biotite (5.5 percent), hornblende (2.5 percent), sphene, apatite, and zircon. Exposed discontinuously between Moonshine and Lead Pipe Springs; intrudes metasedimentary sequence west of Moonshine Spring

Khd — **Hornblende diorite (Cretaceous)**—Dark-gray, medium- to fine-grained, equigranular rock containing plagioclase (15 to 65 percent), hornblende (20 to 80 percent), biotite (0 to 12 percent), potassium feldspar (0 to 2 percent), and opaque oxide minerals (1 to 5 percent). Chlorite and calcite present locally as alteration products. Unit is inferred to intrude metasedimentary rocks south of Moonshine Spring

Kd — **Andesitic dikes (Cretaceous?)**—Porphyritic intrusive rocks of intermediate composition. Forms hypabyssal dikes intruding metasedimentary rock sequence. Dikes range from less than 1 m to approximately 10 m wide, and some dikes are longer than 1 km. Dike rocks are strongly altered and weather yellow brown to red brown. Phenocrysts are altered to sericite pseudomorphs after plagioclase laths as much as 2 mm long. Relict zoning and twinning rarely are preserved. Phenocrysts form 50 to 80 percent of rock volume. Matrix consists of secondary sericite and opaque minerals, with sparse quartz, calcite, and, in some samples, chlorite

VOLCANIC AND SEDIMENTARY ROCKS

Tvs — **Volcanic and sedimentary rocks, undivided (Tertiary)**—Upper part of unit consists of resistant, reddish-brown, welded to moderately welded ash-flow tuff. Lower part of unit consists of pale-yellowish-brown, bedded ash-flow and ash-fall(?) tuff. Lower part locally contains poorly consolidated fluvial silt, sand, and gravel deposits. Bedded tuffs are flat lying and rest with angular unconformity on pre-Cenozoic rocks

METASEDIMENTARY AND METAVOLCANIC ROCKS

Robbers Mountain Formation (Lower Mississippian)— Divided into:

Mra — **Meta-argillite member**—Platy meta-argillite and silty meta-argillite; weathers to variations of pale red, pinkish gray, pale yellow brown, and light gray. Sparse layers of fine-grained quartzite, gritty quartzite, and pebble conglomerate as much as 2 cm thick present throughout unit. Unit forms slopes and saddles. Contains Early Mississippian (Kinderhookian) conodonts

Mrc — **Metaconglomerate member**—Grayish-red to grayish-red-purple, flattened-pebble metaconglomerate. Clasts include pebbles of argillite and chert, as well as sparse but diagnostic cobbles of upper Middle Devonian sandy marble unit (Dsm). Metaconglomerate is clast supported with a matrix of meta-argillite containing sparse quartz grains. Beds of orange silty dolomitic marble as much as 10 cm thick and platy meta-argillite as much as 1 m thick are intercalated with metaconglomerate near base of unit. Basal contact is an unconformity

Dg — **Greenstone unit (Upper Devonian?)**—Greenstone and phyllitic greenstone. Dark-green rock poorly exposed in low knolls in southwestern part of area A; recognized mainly from float. Locally greenstone is vesicular or contains calcite-filled amygdules. Some exposures contain lenses of light-gray, fine- to medium-grained calcitic marble

DOa — **Meta-argillite, undivided (Devonian, Silurian?, and Ordovician)**—Olive-gray to olive-black meta-argillite in layers 1 to 50 cm thick. Meta-argillite intervals generally are tens of meters thick. Locally contains intercalated beds of calcareous silty meta-argillite, dolomitic marble, and (or) calcitic marble a few centimeters to 1 m thick. Designation used only where there is no lithostratigraphic or biostratigraphic basis for interpreting specific stratigraphic position or age of a meta-argillite interval. Meta-argillite may intertongue locally with greenstone unit (Dg), sandy marble unit (Dsm), and quartzite and meta-argillite unit (DSq)

Dsm — **Sandy marble unit (Middle Devonian)**—Medium-gray sandy calcitic marble, silty calcitic marble, and calcareous quartzite. Predominantly sandy marble. Poorly bedded to well bedded; beds are as thick as 2 m, but more commonly are 20 to 50 cm thick. Massive to laminated, locally crosslaminated. Distinctive fine and medium sand-sized, rounded, frosted quartz grains present in a fine-grained recrystallized calcite matrix. Where quartz grains are clast supported, calcareous matrix may be partly or entirely replaced by silica. Relative proportions of quartz grains to calcareous matrix vary from bed to bed and laterally within beds. Weathers yellowish orange to light brown. Locally altered to dolomite. Lower contact abruptly gradational. Unit contains late Middle Devonian conodonts

Dua — **Upper meta-argillite unit (Middle and (or) Lower Devonian**—Divided into three subunits where defined in area B. Upper subunit, 24 m thick, is olive-gray to olive-black meta-argillite in layers 1 to 20 cm thick. Uppermost 3 cm contains thin beds of calcareous silty meta-argillite and calcitic marble. Middle subunit, 5 m thick, contains interbedded meta-argillite, calcitic marble, and dolomitic marble in beds 5 to 10 m thick. Marble, which forms 25 to 50 percent of subunit, is fine grained and laminated. Marble is medium gray where calcitic and moderate brown where dolomitic. Lower subunit, 21 to 30 m thick, is same lithology as upper subunit. Several beds of moderate-brown dolomitic marble 15 to 20 cm thick present in middle part of lower subunit. Base of unit appears conformable where not faulted

DSq — **Quartzite and meta-argillite unit (Lower Devonian and (or) Silurian)**—Beds of pale-reddish-brown to moderate-reddish-orange, fine- to medium-grained quartzite, 5 to 30 cm thick, intercalated with moderate- to light-olive-gray, platy argillite. Quartzite beds, which are interpreted as turbidites or contourites, variously are massive, laminated, crosslaminated, or graded. Sparse beds of massive moderate-brown dolomitic marble as much as 10 cm thick also present within this unit. Thickness in area B is greater than 90 m. Base of unit appears conformable in unfaulted section

Ola — **Lower meta-argillite unit (Ordovician)**—Divided into three subunits where defined in area B. Upper subunit, 10 m thick, consists of light-olive-gray to olive-black, thin-bedded, meta-argillite. Lower 2 m of subunit contains thin beds of moderate-brown, fine- to medium-grained dolomitic marble. Middle subunit, 3 to 5 m thick, consists of moderate-brown, fine- to medium-grained, poorly bedded to nonbedded dolomitic marble. Conodonts from middle subunit indicate a Caradocian through Ashgillian (middle Middle to Late Ordovician) age. Lower subunit, more than 145 m thick in area B, consists of light-olive-gray to olive-black meta-argillite and argillaceous metachert, which weathers light gray, moderte brown, or dark reddish brown. Meta-argillite forms layers 1 to 50 cm thick. Lower subunit forms moderate ridges and slopes with ribs of resistant, strongly silicified meta-argillite. Nature of basal contact not known

Quartzite of Moonshine Spring (age uncertain)—Divided into:

mc — **Calcsilicate rock unit**—Greenish-gray and light-brown banded calcsilicate rock. Rocks are mottled to irregularly layered. Sparse beds of medium- to coarse-grained calcitic and dolomitic marble present in middle part of unit in area G. Lower contact abruptly gradational

mq — **Quartzite and micaceous quartzite unit**—Pale- to moderate-yellowish-brown, fine-grained, nonbedded to poorly bedded micaceous quartzite and orthoquartzite. Some intervals display pale and moderately hued color bands from 1 to 5 m wide. Also contains local intervals of phyllite or meta-argillite

mp — **Phyllite unit**—Greenish-gray to moderate-bluish-gray, light- to moderate-brown-weathering phyllite. Nonbedded, platy splitting along foliation. Moderately strong lineation. Locally contains porphyroblasts of andalusite. Layers of thinly laminated, fine-grained quartzite locally intercalated with phyllite. Basal contact appears gradational

mqc — **Orthoquartzite and metaconglomerate unit**—Massive, fine-grained, pale- to dusky-yellowish-brown orthoquartzite and orthoquartzite-pebble metaconglomerate. Nonbedded to poorly bedded. Orthoquartzite locally is color banded or laminated. A 1-m-thick interval of thinly layered calcitic marble present within orthoquartzite in northern part of area G, and sparse intervals of meta-argillite, micaceous quartzite, and pebble metaconglomerate as much as several meters thick are intercalated throughout orthoquartzite lithology. Lower part of unit consists predominantly of metaconglomerate with pebble- to cobble-sized orthoquartzite clasts. Conglomeratic intervals commonly are flattened with clasts having a 4:1 ratio of long:short axes

Contact

Fault—Dashed where approximately located; dotted where concealed; arrow indicates dip direction

Strike and dip of layering

Inclined—Stratigraphic facing unknown

Inclined—Stratigraphic top inferred on basis of stratigraphic sequence

Vertical

Overturned—Stratigraphic top inferred on basis of stratigraphic sequence

Strike and dip of foliation

Inclined

Vertical

Inclined—Layering parallel to penetrative foliation

Bearing and plunge of lineation—Combined with bedding or foliation symbol at point of observation

Folds—Dashed where inferred

Anticline

Syncline

Overturned anticline

Overturned syncline

9450-CO — **Location of conodont sample**—Sample numbers correspond to U.S. Geological Survey collection numbers in appendix 1

C80PK-46 — **Location of sample for radiometric age determination**—Sample numbers correspond to those in tables 1 and 2

A — **Outcrop areas**—Discussed in text; letter designations (A to G) correspond to those used to identify measured stratigraphic sections in Smith and Ketner (1970)

Carr, M.D., Harris, A.G., Poole, F.G., and Fleck, R.J., 1992, Stratigraphy and structure of Paleozoic outer continental-margin rocks in Pilot Knob Valley, north-central Mojave Desert, California: U.S. Geological Survey Bulletin 2015.