Tfbm Lava flows of Bagley Meadows--Resistant, light- to medium-gray or pink, locally vesicular or amygdaloidal, locally flow foliated lava flows of dacitic composition. Contain abundant phenocrysts of plagioclase, pyroxene, sanidine, olivine, and Fe-Ti oxides. Considered to be an extrusive equivalent of the resurgent pluton (Tim)

Tdbf Dacite of Big Flat--Resistant, light- to dark-gray, pink, and tan, locally vesicular or amygdaloidal, flow-layered volcanic dome and stubby dacitic lava flows. Lithologically similar to the sanidine-bearing dacitic lava flows (Tsd), but constitutes a separate mappable sequence. Contains moderately abundant phenocrysts of plagioclase, sanidine, pyroxene, and biotite, and minor Fe-Ti oxides and olivine

Trbf Rhyodacite of Burnt Flat--Moderately resistant, purplish-gray and light-gray lava flows of rhyodacitic composition. Contains small phenocrysts of plagioclase and sanidine, subordinate pyroxene, and minor biotite and Fe-Ti oxides

INTRUSIONS RELATED TO THE MONROE PEAK CALDERA (MIOCENE)

Timp Intrusive rocks of Monrovian Park--Resistant light-gray and grayish-green, medium- to coarse-grained massive monzonite porphyry and quartz monzonite porphyry. Ranges from porphyritic to equigranular. Contains plagioclase, orthoclase, pyroxene, hornblende, quartz, and Fe-Ti oxides, and minor biotite. Intrusive into the main phase (Tim)

Tif Intrusive rocks of First Lefthand Fork of Monroe Creek--Resistant, tan, grayish-green and yellowish-tan, slightly altered monzonite porphyry. Contains phenocrysts of plagioclase, pyroxene, and altered ferromagnesian minerals, and minor Fe-Ti oxides and orthoclase

Tim Intrusive rocks undivided--Generally resistant, light-gray and grayish-green, monzonite porphyry and subordinate quartz monzonite porphyry. Constitutes the main resurgent phase of the intrusions related to the Monroe Peak caldera. Contains large phenocrysts of plagioclase and orthoclase, with smaller pyroxene and biotite, in a groundmass dominated by orthoclase, Fe-Ti oxides, and quartz. A fine-grained more potassic phase is present near the upper parts of most of the intrusion. A coarse-grained phase from Dry Canyon has a fission-track age of 21.5±0.8 m.y. (C. W. Naeser, written commun., 1979)

Tib INTRACALDERA BRECCIA (MIOCENE)--Soft to moderately resistant, gray to brown, pebble- to boulder-sized breccia and conglomerate. Exposed at several localities along the margins of the Monroe Peak caldera. The deposits are crudely bedded or unbedded and consist of rounded to angular clasts. Clasts on the northern margin are Bullion Canyon Volcanics (Tb) and on the southern margin are mostly volcanic rocks of Little Table (Tltv or Tlta). All margins have subordinate amounts of the intracaldera facies of Osiris Tuff (Toi). The deposits probably represent landslides, fanglomerate, talus, and mudflows that sloughed off the walls of the developing caldera

OSIRIS TUFF (MIOCENE)

Toi Intracaldera facies--Soft to moderately resistant, light-purple, medium-purplish-gray, and pink lava flows and ash-flow tuffs that are petrographically similar to the rock of the Osiris Tuff outflow facies (To). Confined to the Monroe Peak caldera, which is the source of the Osiris Tuff

To Outflow facies--Gray and reddish-brown, densely welded, crystal-rich ash-flow tuff. Phenocrysts consist of andesine and subordinate sanidine, pyroxene, and minor biotite, and Fe-Ti oxides. K-Ar age is about 22 m.y. (Fleck and others, 1975)

Tsp VOLCANIC ROCKS OF SIGNAL PEAK (MIOCENE AND OLIGOCENE)--Resistant, dark-gray, black, and red, commonly vesicular or amygdaloidal, andesitic lava flows. Include subordinate, soft to moderately resistant, red and gray flow breccia and volcanic mudflow breccia. Flows and breccia clasts contain abundant phenocrysts of plagioclase, pyroxene, olivine, and Fe-Ti oxides

Tvd VOLCANIC DOME OR LAVA FLOWS (OLIGOCENE)--Resistant, tan, light-yellow, and light-gray, locally flow layered dacitic volcanic dome or stubby lava flow containing abundant phenocrysts of plagioclase, pyroxene, and hornblende and minor biotite and Fe-Ti oxides. Intertongues with upper part of volcanic rocks of Koosharem and lower part of volcanic rocks of Signal Peak

VOLCANIC ROCKS OF KOOSHAREM (MIOCENE AND OLIGOCENE)--Mostly lava flows, flow breccia, and volcanic mudflow breccia. Flows and breccia clasts contain mostly small phenocrysts of plagioclase, subordinate pyroxene and Fe-Ti oxides, minor olivine, and locally, minor hornblende and biotite in an aphanitic matrix. Alluvial facies rocks exposed within the Monroe Peak caldera are tentatively correlated with the volcanic rocks of Koosharem on the basis of lithologic and petrographic similarities, but it is possible that they instead are correlative with the volcanic rocks of Little Table, with which they also are lithologically and petrographically similar

Tka Alluvial facies--Soft to moderately resistant, tan, light-gray, reddish-brown, red, and black, well-bedded volcanic mudflow breccia, conglomerate, and subordinate brown flow breccia and lava flows. Includes a local light-gray rhyodacitic lava flow

Tkv Vent facies--Soft to resistant, reddish-brown, dark-brown, light- to dark-gray, and red, locally vesicular or amygdaloidal, andesitic lava flows, and subordinate flow breccia and volcanic mudflow breccia. Includes several thin red-brown crystal-poor densely welded ash-flow tuff units in upper part

Tb BULLION CANYON VOLCANICS HETEROGENEOUS LAVA FLOWS AND VOLCANIC BRECCIA (OLIGOCENE)--Heterogeneous lava flows and volcanic breccias[1]

Tcc VOLCANIC ROCKS OF CLIFF CANYON, ALLUVIAL FACIES (OLIGOCENE)--Soft to moderately resistant, light- to medium-gray, well-bedded volcanic mudflow breccia and subordinate medium- to coarse-bedded volcanic conglomerate, sandstone, and conglomeratic sandstone and minor flow breccia and lava flows. Clasts and lava flows are of dacitic composition and consist of dark, mostly crystal poor and aphanitic flow rock containing sparse small phenocrysts of plagioclase, hornblende, biotite, and pyroxene; clasts of the Needles Range Formation also occur in the unit

Tn NEEDLES RANGE FORMATION (OLIGOCENE)[3]

VOLCANIC ROCKS OF LANGDON MOUNTAIN (MIOCENE)--Mostly volcanic mudflow breccia, flow breccia, and lava flows of dacitic composition that overlie and are interbedded with the upper part of both the Mount Dutton Formation (Td) and the volcanic rocks of Little Table (Tlta, Tltv) . The rocks are part of a stratovolcano centered at or near Langdon Mountain. Contain phenocrysts of hornblende, subordinate plagioclase and pyroxene, and minor Fe-Ti oxides

Tlmv Vent facies--Resistant, pink, tan, light-gray, purplish-gray, locally amygdaloidal lava flows

Tlma Alluvial facies--Soft to moderately resistant, light-gray or tan, or much less commonly red, pink, or purplish-gray, volcanic mudflow breccia and sparse flow breccia, lava flows, and fluviatile conglomerate and sandstone

Tw VOLCANIC ROCKS OF WILLOW SPRING, ALLUVIAL FACIES (MIOCENE)--Soft to moderately resistant, black, reddish-brown, and light-gray volcanic mudflow breccia of dacitic composition, and subordinate lava flows, flow breccia, and fluviatile sandstone and conglomerate. Commonly clasts consist of a granular black glass containing phenocrysts, but the glass may be partly to totally devitrified. Phenocrysts consist of plagioclase and pyroxene, and minor Fe-Ti oxides and hornblende

VOLCANIC ROCKS OF LITTLE TABLE (MIOCENE AND OLIGOCENE)--Mostly andesitic lava flows, volcanic mudflow breccia, and flow breccia that are interbedded with, pinch out southward against, and locally underlie the Mount Dutton Formation and are interbedded with and underlie the lower parts of the volcanic rocks of Langdon Mountain. Contains phenocrysts of plagioclase and generally subordinate pyroxene and Fe-Ti oxides and minor olivine

Tlta Alluvial facies--Soft to resistant, tan, light-green, light- to medium-gray, reddish-brown, purplish-gray, yellow, pink, and orange volcanic mudflow breccia, and sparse flow breccia, lava flows, and fluviatile conglomerate and sandstone

Tltv Vent facies--Resistant, tan, khaki, dark-gray to dark-brown lava flows, tuff lava, flow breccia, and volcanic mudflow breccia

Td MOUNT DUTTON FORMATION (MIOCENE AND OLIGOCENE)--Soft to moderately resistant, tan, pink, light-gray, or less commonly pale-green or light-purple, volcanic mudflow breccia and sparse flow breccia, lava flows, local ash-flow tuff, and fluviatile conglomerate and sandstone. Flow rock and clasts in the breccia are characterized by several lithologies that are dacitic to andesitic in composition and have few phenocrysts; many rocks are aphanitic. Phenocrysts consist largely of plagioclase and either hornblende or pyroxene and minor Fe-Ti oxides. Age range differs slightly in the various assemblages

Tda Antimony Tuff Member (Oligocene)--Resistant, orange, red, pink, light-purple, khaki, and tan, densely welded, crystal-poor ash-flow tuff, containing medium-grained phenocrysts of plagioclase and sanidine and minor pyroxene and Fe-Ti oxides. Contains drawn-out pumice lenticules. Locally includes a black basal vitrophyre as much as several meters thick. K-Ar age is 25.4 m.y. (H. H. Mehnert, written commun., 1981)

Tdk Kingston Canyon Tuff Member (Oligocene)--Resistant, dark-purplish-red or light-purple, densely welded, crystal-poor ash-flow tuff containing sparse small phenocrysts of plagioclase and minor biotite, pyroxene, Fe-Ti oxides, and sanidine. Contains drawn-out pumice lenticules and angular lithic fragments. Locally includes a black basal vitrophyre. K-Ar age is about 26-25 m.y. (Fleck and others, 1975)

Tbb BUCKSKIN BRECCIA (OLIGOCENE)--Mostly soft, light-gray conglomerate and volcanic mudflow breccia characterized by light-gray to light-green pebbles, cobbles, and boulders of a porphyritic plutonic rock probably derived from the Spry intrusion (Anderson and Rowley, 1975; Grant, 1979)

PREVOLCANIC SEDIMENTARY ROCKS

TPs TERTIARY, MESOZOIC, AND PALEOZOIC SEDIMENTARY ROCKS

Tcg CONGLOMERATE (OLIGOCENE TO PALEOCENE)--Light-gray to buff pebble conglomerate containing rounded clasts of sandstone and limestone derived from Mesozoic and Paleozoic rocks. Locally contains tuffaceous sandstone

Ja ARAPIEN FORMATION (MIDDLE JURASSIC)--Light-gray limestone and shale and locally interbedded red to brown sandstone and intraformational limestone conglomerate layers

JTrn NAVAJO SANDSTONE (JURASSIC AND TRIASSIC?)--Fine-grained, buff, well-sorted, crossbedded sandstone. The crossbedding dips south. Occurs locally as large blocks in stocks and lava flows

TrPs TRIASSIC AND PERMIAN SEDIMENTARY ROCKS--Includes the Triassic Chinle and Moenkopi Formations, Permian Kaibab Limestone, Toroweap Formation, and Queantoweap Sandstone of McNair (1951). Most exposed along the eastern front of Deer Trail Mountain

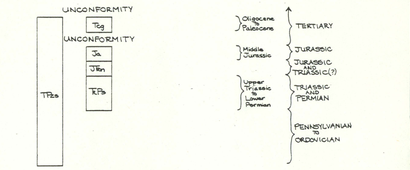

Figure 3.-- CORRELATION OF TERTIARY TO ORDOVICIAN PREVOLCANIC SEDIMENTARY MAP UNITS

CONTACT

GRADATIONAL CONTACT BETWEEN INTRUSIVE AND EXTRUSIVE PARTS OF THE SAME ROCK UNIT--Approximately located

FAULT--Dotted where concealed. Bar and ball on downthrown side

THRUST FAULT--Open pattern and dots where projected beneath cover Teeth point toward upper plate

STRIKE AND DIP OF BEDDING OR LAVA FLOWS
Inclined
Overturned

STRIKE AND DIP OF COMPACTION FOLIATION

TOPOGRAPHIC WALL OF CALDERA--Solid where it follows a contact; broken where concealed

BREAKAWAY SCARP AT HEAD OF A COHERENT BLOCK OF SLUMPED BEDROCK

QUARTZ VEINS

ALLUNITE VEINS

ARGILLIC AND ADVANCED ARGILLIC ALTERATION

[1]See description in "Eastern assemblage."
[2]See description in "Central and southern assemblage."
[3]See description in "Northern assemblage."

REFERENCES

Anderson, J. J., and Rowley, P. D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Anderson, J. J., Rowley, P. D., Fleck, R. J., and Nairn, A. E. M., Cenozoic geology of southwestern High Plateaus of Utah: Geological Society of America Special Paper 160, p. 1-52.

Bassett, W. A., Kerr, P. F., Schaeffer, O. A., and Stoenner, R. W., 1963, Potassium-argon dating of the late Tertiary volcanic rocks and mineralization of Marysvale, Utah: Geological Society of America Bulletin, v. 74, no. 2, p. 213-220.

Best, M. G., McKee, E. H., and Damon, P. E., 1980, Space-time-composition patterns of late Cenozoic mafic volcanism, southwestern Utah and adjoining areas: American Journal of Science, v. 280, p. 1035-1050.

Clark, E. E., 1977, Late Cenozoic volcanic and tectonic activity along the eastern margin of the Great Basin, in the proximity of Cove Fort, Utah: Brigham Young University Geology Studies, v. 24, pt. 1, p. 87-114.

Cunningham, C. G., Naeser, C. W., Ludwig, K. R., Weiland, E. F., Mehnert, H. H., Steven, T. A., and Rasmussen, J. D., 1981, Geochronology of hydrothermal uranium deposits and associated igneous rocks in the eastern source area of the Mount Belknap Volcanics, Marysvale, Utah: Submitted to Economic Geogy.

Cunningham, C. G., and Steven, T. A., 1979, Mount Belknap and Red Hills calderas and associated rocks, Marysvale volcanic field, west-central Utah: U.S. Geological Survey Bulletin 1468, 34 p.

Cunningham, C. G., Steven, T. A., and Naeser, C. W., 1978, Preliminary structural and mineralogical analysis of the Deer Trail Mountain-Alunite Ridge mining area, Utah: U.S. Geological Survey Open-File Report 78-314.

Evans, S. H., Jr., 1980, Summary of potassium/argon age dating--1979: Topical Report 78-28392.a.11.1, Department of Geology and Geophysics, University of Utah (available from Department of Energy as ID0/DOE/ET/28392-41), 23 p.

Fleck, R. J., Anderson, J. J., and Rowley, P. D., 1975, Chronology of mid-Tertiary volcanism in High Plateaus region of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geological Society of America Special Paper 160, p. 53-62.

Grant, T. C., 1979, Geology of the Spry intrusion, Garfield County, Utah: Kent, Ohio, Kent State University, unpublished M.S. thesis, 59 p.

McNair, A. H., 1951, Paleozoic stratigraphy of northwestern Arizona: American Association of Petroleum Geologists Bulletin, v. 35, no. 3, p. 503-541.

Rowley, P. D., Steven, T. A., Mehnert, H. H., 1981 in press, Origin and structural implications of Upper Miocene rhyolites in Kingston Canyon, Piute County, Utah: Geological Society of America Bulletin.

Shuey, R. T., Caskey, C. F., and Best, M. G., 1976, Distribution and paleomagnetism of the Needles Range Formation, Utah and Nevada: American Journal of Science, v. 276, p. 954-968.

Sigmund, J. M., 1979, Geology of a Miocene rhyodacite lava flow, southern Tushar Mountains, Utah: Kent, Ohio, Kent State University, unpublished M.S. thesis, 35 p.

Steven, T. A., Cunningham, C. G., Naeser, C. W., and Mehnert, H. H., 1979, Revised stratigraphy and radiometric ages of volcanic rocks and mineral deposits in the Marysvale area, west-central Utah: U.S. Geological Survey Bulletin 1469, 40 p.

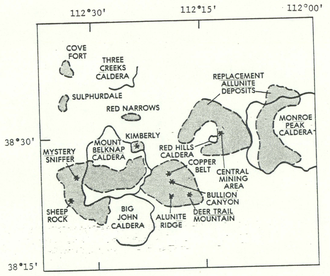

Figure 4.-- INDEX SHOWING LOCATION OF CALDERAS, MAJOR MINING CENTERS (STARRED), AND PRINCIPAL ALTERED AND (OR) MINERALIZED AREAS (STIPLED)

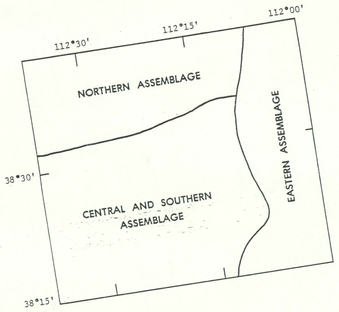

Figure 5.-- INDEX SHOWING GENERAL AREAS UNDERLAIN BY DIFFERENT ASSEMBLAGES OF FUNDAMENTALLY INTERMEDIATE-COMPOSITION VOLCANIC ROCKS

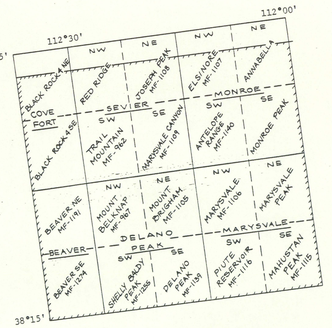

Figure 6.-- INDEX SHOWING 1:24000 UNEDITED ADVANCE TOPOGRAPHIC QUADRANGLES USED IN PREPARING BASE FOR THIS MAP (hachured outline) AND RECENTLY PUBLISHED U.S. GEOLOGICAL SURVEY MISCELLANEOUS FIELD STUDIES MAPS OF THIS AREA