

Description of Map Units

- Qal** QUATERNARY ALLUVIUM, UNDIVIDED
Red to orange, poorly consolidated to unconsolidated clay, silt, and sand, forming terraces, valley fill, and recent stream fill adjacent to buttes. No sedimentary structures are seen within these deposits.
- Qes** QUATERNARY EOLIAN SAND SHEET DEPOSITS
Red to orange, unconsolidated clay, silt, and sand forming reactivated and active dunes. This includes barchan-type dunes that are mostly stabilized by vegetation, as well as large dunes that are unconsolidated and form nearly parallel dune faces. Support moderate growth of grass and small high-desert shrubs that help stabilize or trap accumulating deposits.
- Qd** QUATERNARY DUNE SAND AND SAND SHEET DEPOSITS
Light red, fine-grained quartz sand locally derived mainly from other surficial units whose sediment is easily eroded by wind. Originally those sand grains were derived from erosion of nearby bedrock outcrops of Moenave, Kayenta, and Bidahochi Formations and include fragmented grains of volcanic rock. Form lumpy, undefined sand-dune or sand-sheet deposits commonly concealed beneath moderate growths of grass, sagebrush, and pinon pine/juniper woodlands at higher elevations of volcanic mesas and buttes.
- Qae** QUATERNARY MIXED ALLUVIUM AND EOLIAN DEPOSITS
Gray, light red, and brown clay, silt, and fine- to coarse-grained sand interbedded with lenses of pebbly gravel. Contain black, white, and gray angular to sub-rounded volcanic fragments locally derived from nearby volcanic outcrops. Unit has accumulated by both alluvial and eolian processes resulting in an interbedded sequence of thin-bedded mixed clay, silt, sand, and small gravel typical of young fluvial and eolian deposits. Often overlapped by young or fresh eolian sand deposits. Support light to moderate growths of grass, cactus, and small high desert shrubs.
- Qc** QUATERNARY COLLUVIUM, UNDIVIDED
Slump deposits (torva blocks) consisting of Tl, Tt, and Tlt adjacent to buttes. Stratigraphic relations of bedding are maintained and Tl lies over Tt and Tlt as seen on the adjacent butte from which the slump was derived. Most colluvium are slightly rotated, indicating a curvilinear plane of slumping.
- Tm** TERTIARY MARL ROCKS
Varicolored (green, pink, white, tan, brown), poorly consolidated to moderately consolidated mudstone, siltstone, and sandstone. Occurs only locally in small outcrops.
- Tc** TERTIARY SEDIMENTARY CRATER ROCKS, UNDIVIDED
Tan to yellowish-white, laminated to medium-bedded lime-siltstone, with very thinly interbedded mudrock and crinkly-laminated travertine with variable amounts of pyroclastic and epiclastic material ranging from fine to coarse. Locally interbedded with mafic tuffs. Localized ripple marks. Located in vent zones. Generally forms circular outcrops with inward-dipping beds; locally show soft-sediment deformation. Few outcrops of white-gray, massive, medium-grained limestone.
- Tt** TERTIARY BEDDED TUFF
Gray to tan, thin to thick bedded, well-sorted and clast-supported to moderately to poorly sorted and matrix-supported, tuff and lapilli tuff. Clasts within beds are angular to sub-rounded and include juvenile lava ranging from scoria to non-vesicular fine to coarse lapilli, non-vesicular to slightly vesicular fine to medium blocks/bombs, crystals of pyroxene, amphibole, and plagioclase, and accidental lithic clasts of red, well sorted, quartz arenite (Jurassic Moenave Formation), light-colored (tan, white, pink, green) mudstone and siltstone (Tertiary Bidahochi Formation), and basalt. Beds range from structureless to cross-bedded or reverse graded. Matrix is fine ash to coarse ash.
- Tbt** TERTIARY BEDDED TUFF TO BEDDED LAPILLI TUFF (BLACK)
Dark gray to black, thin to thick bedded, ranges from well sorted and clast-supported to poorly to moderately sorted and matrix-supported, tuff and lapilli tuff. Clasts are sub-angular to rounded and consist of scoria ranging from fine to medium lapilli, non-vesicular to vesicular fine to medium blocks/bombs, and accidental lithic clasts of red, well sorted, quartz arenite and light-colored mudstone and siltstone. Matrix is fine ash to coarse ash.
- Tl** TERTIARY LAVA FLOW TO LAVA LAKE
Dark gray to black, massive, non-vesicular to vesicular, glassy to medium-grained porphyritic monochile, nephelinitic, and basaltic lava flows or lava lakes. Phenocrysts range from 5-30% and consist of olivine, clinopyroxene, orthopyroxene, kaersutite, plagioclase, and possibly some feldspathoid crystals. Phenocrysts range in size from less than 1 mm up to 4 cm in diameter, although most are < 2 cm.
- Ts** SCORIA TO SCORIAEVOUS TUFF
Reddish brown to reddish black, massive to crudely stratified, vesicular, clast-supported medium lapilli to large block, scoriaeous tuff to scoriaeous tuff breccia with visible individual scoria lapilli and blocks/bombs. Interbedded with the scoriaeous tuff and tuff breccias is reddish gray, massive, slightly vesicular spatter-fed lava flow. Where present, the spatter-fed lava flow contains clasts of the same lava ranging in size from fine lapilli to medium blocks and bombs.
- Tlt** LAPILLI TUFF TO LAPILLI BRECCIA
Buff to gray, massive to poorly bedded, poorly sorted, matrix-supported, fine to coarse basalt tuff to lapilli tuff breccia. Clasts are sub-angular to rounded and consist of fine to coarse scoria lapilli, non-vesicular, fine to medium juvenile blocks/bombs, rare amphibole and pyroxene crystals, and accidental lithic clasts of red, well sorted, quartz arenite and light-colored (tan, white, pink, green) mudstone and siltstone. Matrix is fine ash to coarse ash. This unit is also found as dark brown to orange brown, massive to moderately bedded, poorly sorted to very poorly sorted and matrix-supported, moderately sorted and clast-supported, crystal-rich, medium to coarse lapilli tuff with similar characteristics as listed above.

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- Strike and Dip of Bedding
- Approximate Vent Locations*
- Extent of Exposed Maar Crater Deposits (Certain)
- Extent of Exposed Maar Crater Deposits (Approximate)
- Extent of Exposed Maar Crater Deposits (Concealed/Inferred)
- Dike
- Accurately Located Geologic Contact
- Approximately Located Geologic Contact
- Navajo Boundary
- Road, Unmaintained

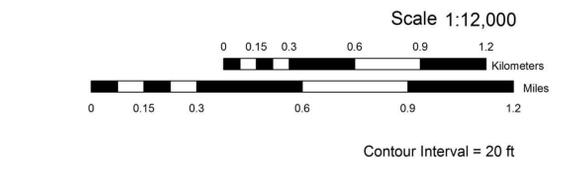
*The vent numbering system corresponds to vent descriptions in "Marginal deposits of maar volcanoes in the First Flat Mesa Area, Hopi Buttes Volcanic Field, Navajo Nation, Arizona," 2011, M. Zelawski, M.S. Thesis, Northern Arizona University.

Citation for this map:
Zelawski, M., 2010, Geologic Map of the First Flat Mesa Area, First Flat Mesa, Na Ah Tee Canyon and the Hauke Mesa 7.5' Quadrangles, Hopi Butte (Tsézhin Bii'), Navajo Nation, Arizona

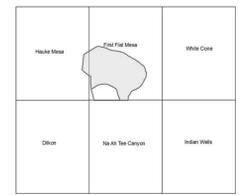
Geology mapped by Mallory Zelawski, 2009-2010.
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2000-meter Universal Transverse Mercator grid ticks, 1983 North American Datum, zone 12S.

Field work on the Navajo Nation was conducted under a permit from the Navajo Nation Minerals Department. Any persons wishing to conduct geologic investigations on the Navajo Nation must first apply for, and receive, a permit from the Navajo Nation Minerals Department, P.O. Box 1510, Window Rock, Arizona 86515, telephone number (928) 871-6587.



USGS QUADRANGLE INDEX



Geologic Map of the First Flat Mesa Area, First Flat Mesa, Na Ah Tee Canyon, and Hauke Mesa 7.5' Quadrangles, Hopi Buttes (Tsézhin Bii'), Navajo Nation, Arizona

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