ARIZONA GEOLOGICAL SURVEY
Contributed Map CM-00-A
One sheet, no additional text

MAP OF THE VOLCANIC GEOLOGY OF THE CASTLE BUTTE TRADING POST VICINITY, HOPI BUTTES (Tsézhin Bii), NAVAJO NATION, ARIZONA

By

Jason A. Hooten
1999

Plate 1

DESCRIPTION OF MAP UNITS

Qal **UNDIVIDED ALLUVIUM** - Includes alluvial terraces, valley fill, and recent stream deposits

Qc **COLLUVIUM DEPOSIT** - Includes talus and cliff debris

Qls **LANDSLIDE DEPOSIT**

VENT 10 (Wide Butte) - Porphyritic basanite[1] containing phenocrysts of olivine and clinopyroxene. Divided into three parts.

Tsc_{10} **Bedded scoria & agglutinate** - Highly welded layers of spatter and agglutinate

Tl_{10} **Lava** - 15-20 meter thick basanite flow. Pronounced horizontal jointing

Tt_{10} **Palagonitic Tuff** - Moderately welded coarse ash to lapilli tuff. Local bomb-rich layers. Multiple units of both fallout and surge deposits.

VENT 9 (Round Butte) - Porphyritic basanite[1] containing phenocrysts of olivine and clinopyroxene. Divided into two parts:

Tsc_9 **Bedded scoria & agglutinate** - Welded layers of spatter and agglutinate

Tl_9 **Lava** - 20-25 meter thick basanite lava flow. Pronounced horizontal jointing

VENT 8 (Open Sky) - Porphyritic melanephelinite[1] containing phenocrysts of olivine and clinopyroxene. Divided into three parts:

Tsc_8 **Bedded scoria & agglutinate** - Welded layers of highly vesicular spatter and agglutinate

Tl_8 **Lava** - Multiple stacked melanephelinite flow units. Total thickness >75 meters. Upper units display prominant columnur jointing

Tt_8 **Palagonitic Tuff** - Moderately welded coarse ash to lapilli tuff. Local bomb-rich layers. Multiple units of both fallout and surge deposits

VENT 7 (Tode Baho Tsiquini) - Porphyritic monchiquite containing phenocrysts of olivine and clinopyroxene. Divided into four parts:

Tcf_7 **Crater Fill** - Undivided epiclastic and lacustrine crater filling rocks. Includes tan to white thin-bedded calcareous laminates, travertine/tufa deposits, and moderately sorted, bedded tuffaceous conglomerates and sandstones. Intense soft-sediment deformation within calcareous laminates.

Tl_7 **Lava** - Irregular lenses and tabular shaped intrusions of monchiquite which cut all other volcanic units

Tag_7 **Vent Agglomerate** - Massive, poorly sorted, well-bedded, moderately to poorly welded spatter, aerodynamically shaped bombs with breadcrust shells, and highly vesicular scoriaceous deposits

Tt_7 **Palgonitic Tuffaceous Breccia** - Moderately welded, crystal-rich tuffaceous breccia. Crudely bedded in places.

VENT 6 (Arch Rocks) - Porphyritic monchiquite containing phenocrysts of olivine and clinopyroxene. Divided into three parts:

Tsc_6 **Bedded scoria & agglutinate** - Welded layers of highly vesicular spatter and agglutinate

Tl_6 **Lava** - 10-15 m thick monchiquite flow, prominent columnar jointing

Ts_6 **Scoriaceous Tuff** - Moderately sorted, juvenile-rich lapilli tuff. Juvenile clasts range from highly vesicular scoria to dense, non-vesicular pyroclasts

VENT 5 (Chezhin Chotah Butte) - Porphyritic basanite containing phenocrysts of olivine and clinopyroxene. Divided into two parts:

Tsc_5 **Bedded scoria & agglutinate** - Welded layers of highly vesicular spatter and agglutinate

Tl_5 **Lava** - 20-30 m thick multiple, stacked basanite flows

VENT 4 (Castle Butte Trading Post Maar) - Reworked palagonitic tuff containing pyroclasts of juvenile lavas with phenocrysts of olivine and clinopyroxene. Includes one part:

Tcf_4 **Crater Fill** - Undivided epiclastic and lacustrine crater filling rocks. Includes tan to white thin-bedded calcareous laminates, travertine/tufa deposits, and moderately sorted, bedded tuffaceous conglomerates and sandstones. Intense soft-sediment deformation within calcareous laminates.

VENT 3 (Castle Butte Trading Post Diatreme) - Porphyritic basanite containing phenocrysts of olivine and clinopyroxene. Divided into two parts:

Thb_3 **Hypabyssal Breccias** - Undivided autolithic and heterolithic breccias. Autolithic breccias contain angular clasts of basanite within basanite lava. Clasts are oriented sub-parallel to flowfabrics within surrounding hypabyssal intrusive. Heterolithic breccias contain angular clasts of the country rock within a poorly-sorted, coarse ash-sized tuffaceous matrix

Thi_3 **Hypabyssal Intrusive** - Shallow intrusive basanite lava. Prominent sub-horizontal flow fabric

VENT 2 (Cockscomb / Arrowhead Buttes) - Porphyritic basanite containing phenocrysts of olivine and clinopyroxene. Divided into two parts:

Thb_2 **Hypabyssal Breccias** - Undivided autolithic and heterolithic breccias. Autolithic breccias contain angular clasts of basanite within basanite lava. Clasts are oriented sub-parallel to flow fabrics surrounding hypabyssal intrusive. Heterolithic breccias contain angular clasts of the country rock within a poorly sorted, coarse ash-sized tuffaceous matrix

Thi_2 **Hypabyssal Intrusive** - Shallow intrusive basanite lava. Prominent sub-horizontal flow fabric

VENT 1 (French Butte) - Porphyritic basanite containing phenocrysts of olivine and clinopyroxene. Divided into three parts:

Tsc_1 **Bedded scoria & agglutinate** - Welded layers of highly vesicular spatter and agglutinate

Tl_1 **Lava** - Multiple stacked basanite flow units. Total thickness >30 meters. Upper units display prominent columnar jointing

Ts_1 **Scoriaceous Tuff** - Moderately sorted, juvenile-rich lapilli tuff. Juvenile clasts range from highly vesicular scoria to dense, non-vesicular pyroclasts

Tlb **LOWER MEMBER OF BIDAHOCHI FORMATION** - Tan to pink beds of well sorted, fine-grained mud and siltstones. Interbedded silicic ash tuff exposed throughout the study area

TrW **WINGATE SANDSTONE** - Red to orange, well-sorted, medium-grained sandstone. Large-scale cross bedding, sharp upper contact

TrC **CHINLE FORMATION** - White to tan, medium-grained, well-sorted, tabular-planar cross-bedded sandstone. Mapped by Akers et al. (1971) as Church Rock Member

Contact - Dashed where approximately located

Strike and dip of flow foliation

Strike and dip of bedded rocks

Approximate location of vent area

Dike

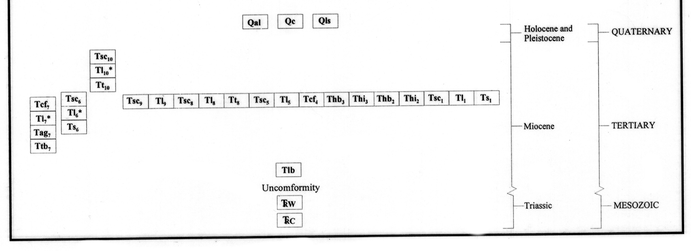
Sample location and $^{40}Ar/^{39}Ar$ age in Ma

Sample location and K-Ar age in Ma

1 Denotes rock names that were determined geochemically. All other rock names based on modal occurrences

CORRELATION OF MAP UNITS

Map area contains eruptive units from ten spatially separated clusters. Relative ages of map units that physically overlap within a cluster are known from field relations and are indicated by oldest units in farthest right correlation box. With the exception of dated volcanoes, the relative ages of separated volcanic centers are unknown. * denotes dated map units (K-Ar and Ar^{40}/Ar^{39} ages).



SCALE 1:12,000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

APPROXIMATE MEAN DECLINATION, 1972

ARIZONA

QUADRANGLE LOCATION

Topographic base from USGS French Butte, AZ, 7.5' Quadrangle

Geology mapped in 1998

ARIZONA GEOLOGICAL SURVEY
Contributed Map CM-00-A
One sheet, no additional text