UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

OPEN-FILE REPORT O-93-2
PRELIMINARY GEOLOGIC MAP OF THE BURNT FLAT QUADRANGLE
MALHEUR COUNTY, OREGON
1993

BY MARK L. FERNS/CHRISTOPHER WILLIAMS

BURNT FLAT QUADRANGLE
OREGON—MALHEUR CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1971. Field checked 1972

Projection snd 10,000-foot grid ticks: Oregon coordinate system, south zone (Lambert conformal conic) 1000-metre Universal Transverse Mercator grid ticks, zone 11, shown in blue. 1927 North American datum

Fine red dashed lines indicate selected fence lines

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET

OREGON DEPARTMENT OF GEOLOGY
AND MINERAL INDUSTRIES

Field work conducted 1991/1992

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Interstate Route — U. S. Route — State Route

BURNT FLAT, OREG.
N4315—W11745/7.5
1972
AMS 2470 IV SE—SERIES V892

Funded jointly by the Oregon Department of Geology and Mineral Industries, the Oregon State Lottery, and the U. S. Geological Survey COGEOMAP Program.

OPEN-FILE REPORT O-93-2
PRELIMINARY GEOLOGIC MAP OF THE
BURNT FLAT QUADRANGLE
MALHEUR COUNTY, OREGON

By Mark L. Ferns/Christopher Williams

1993

Field work conducted in 1991/1992
Map Scale: 1:24,000

Funding Statement: Funded jointly by the Oregon Department of Geology and Mineral Industries, the Oregon State Lottery, and the U. S. Geological Survey COGEOMAP Program as part of a cooperative effort to map the west half of the 1° by 2° Boise sheet, eastern, Oregon.

Qal Alluvium (Quaternary) Unconsolidated deposits of sand and gravel along modern stream channels.

Qf Alluvial fan deposits (Quaternary) Mainly unconsolidated and poorly sorted accumulations of coarse gravel deposited along the flanks of Cedar Mountain. Includes deposits of colluvium and slope wash along the north flank of Burnt Flat.

Qss Lacustrine sediments (Quaternary) Mainly unconsolidated lacustrine deposits of light colored fine sand and silt, may include evaporite deposits.

Qsl Lacustrine and eolian deposits (Quaternary) Mainly unconsolidated lacustrine deposits of pale brown fine to medium grained sand deposited along the south margin of Piute Lake. Includes rounded gravels along ancient shorelines and wave cut terraces. Also includes higher elevation deposits of wind-blown sand marginal to the shoreline.

Tbcm Basalt and basaltic andesite flows of Cedar Mountain (Miocene) Mainly dark bluish-black, plagioclase-phyric basaltic andesites. Includes aphyric platy andesites and glomeroporphyritic flows with olivine and plagioclase phenocrysts and hypersthene-phyric basaltic andesites.

Ttdv Tuffaceous siltstones, sandstones, and ashflow tuff (Late Miocene) Mainly pale yellowish-white to white, tuffaceous siltstones. Includes a light gray vitric welded ashflow tuff about 3 feet thick which is locally exposed near the top of the unit. Ashflow contains less than 1% lithic fragments and about 3% sanidine and quartz phenocrysts approximately 3mm in diameter. Accessory minerals include a green pleochroic clinopyroxene. The ashflow is peralkaline with normative acmite (Analyses, Table 1) and is chemically and petrographically identical to the 9.2 Ma Devine Canyon Tuff mapped by Greene (1973) west of Crowley.

Tst Tuffaceous siltstones and diatomite (Middle to Late Miocene) Light gray to bluish-gray waterlain vitric tuffs and interbedded white diatomite and diatomaceous tuffs. Upper part of unit includes pumaceous gravels with abundant basalt, rhyolite, and dull to glossy black obsidian clasts. Equivalent to the Butte Creek Volcanic Sandstone of Kittleman and others (1965, 1967). Unit is about 100 feet thick in the quadrangle.

Tbmv Mafic flows of Mooreville (Middle - Late Miocene) Bluish-black to bluish-gray, platy tholeiitic andesite, basaltic andesite, and basalt flows.

Includes distinctive glomeroporphyritic flows with plagioclase phenocrysts as large as 2 cm in diameter, plagioclase and orthopyroxene glomerocrysts, and rare quartz xenocrysts. At least three flows with an aggregate thickness of 200 feet exposed in the Mustang Butte quadrangle to the south. Upper flows include diktytaxitic olivine basalts. Unit includes tholeiitic basalts and ferro-andesites (Ferns, 1992; Ferns and Williams, 1993).

Tif Intermediate lavas of Fangollano (Middle to Late Miocene) Bluish black, coarsely phyric, porphyritic vitrophyre of ferrolatite composition. Unit is a single flow, with about 20% phenocrysts as large as 2 cm in diameter. Typically contains about 5% xenoliths of olivine basalt and diorite. Phenocrysts and/or xenocrysts are commonly partially resorbed and include plagioclase, potassium feldspar, augite, orthopyroxene, and olivine. Flow is a ferro-latite in composition (65.4% SiO_2; 14.2% Al_2O_3; 5.81% FeO*; 3.75% Na_2O, 3.80% K_2O) and is petrographically and chemically similar to the Square Mountain ferrolatite (Bonnichsen and others, 1988).

[illegible] Wildcat Creek Welded Ash-Flow Tuff (middle Miocene?) Pale red to grayish-red and light gray, welded lithic ashflow tuff. Mainly crystal-poor, with sparse phenocrysts of sanidine, plagioclase, and clinopyroxene. Typically contains abundant flattened pumice clasts. Chemically a low-silica peralkaline rhyolite with 400 ppm Zr (Ferns and Williams, 1993; Evans, unpublished analyses). Underlies the Devine Canyon Tuff and overlies Tbcm flows. Includes the Wildcat Creek Welded Ashflow Tuff as defined by Kittleman and others (1965, 1967). Also includes parts of the unnamed tuffs near Crowley as mapped by Kittleman and others (1965, 1967).

Tbv Mafic vent complex (middle Miocene) Poorly consolidated accumulation of red and black scoria and cinders with interbedded lava flows. Scoria includes black and red bombs up to 1 meter in thickness. Unit includes interbedded lava flows and is interpreted to be a vent for the Tba flows to the north. Associated lava flows at the vent are high silica basalts (Analyses BAB-321, Table 1).

Tba Basalt, basaltic andesite and andesite flows (middle to upper Miocene) Mainly red-weathering, gray to bluish-gray, sparsely phyric, holocrystalline lava flows. Includes trachytic andesite flows with plagioclase and rare olivine and clinopyroxene phenocrysts and pilotaxitic andesite with orthopyroxene microphenocrysts. Unit is made up of calc-alkaline lava flows ranging from high-silica basalt (SiO_2 > 52%) to high-silica andesite (62% SiO_2) (Brooks, 1992, Ferns and Williams, 1993). Includes at least 3 flows exposed northeast of Turnbull Mountain, where unit is about 200 feet thick and unconformably overlies middle Miocene basalts of unit Tbmg. Middle Miocene age based on stratigraphic position beneath Barstovian vertebrate locality near Skull Springs, north of the quadrangle boundary. (Kittleman and others, 1965). Unit is correlative in part with the "unnamed igneous complex" of Kittleman and others (1965, 1967) and may be equivalent to the "red andesite" unit mapped by Brooks (1992) in the Rufino Butte quadrangle to the northeast.

Tr Littlefield Rhyolite (Middle to Late Miocene) Purplish-gray, porphyritic rhyolite lava flow, weathers to shades of red. Generally a lithoidal rhyolite with approximately 5 - 10% plagioclase phenocrysts. Isolated exposures in northeaster part of the quadrangle are lithologically and chemically similar to the large rhyolite lava flows mapped by Evans (1990) and Ferns and O'Brien (1992) to the north. Equivalent to the Littlefield Rhyolite of Kittleman and others (1965, 1967)

Tbmg Basalt of Malheur Gorge (middle Miocene) Dark-gray, coarsely plagioclase-phyric lava flows and autoclastic breccias that weather to various shades of red and brown and form ledges 3 to 12 m thick. Includes massive basalt, platy basalt, and vesicular, glassy basalt breccias. Lower part of section on Road Canyon includes coarsely plagioclase-phyric basalt flows with as much as 50% plagioclase phenocrysts as long as 2.5 cm. Stratigraphically higher flows at Road Canyon are platy and aphyric. Includes holocrystalline and hyalocrystalline flows with sparse phenocrysts of plagioclase (labradorite), olivine, and ilmenite. Over 250 m of flows with interbedded palagonitic sediments are exposed on Road Canyon where the unit includes thin, lenticular deposits of subaerial tuff and scoria. Coarsely plagioclase-phyric flows on Road Canyon contain about 47.8% to 49% SiO_2, 17.0% to 20.1% Al_2O_3, and 9.2% to 12.0% Fe_2O_3 (Ferns and Williams, 1993a, b,). Middle Miocene age based on K/Ar dates of about 15.5 - 17 Ma (Fiebelkorn and others, 1982). Western exposures are correlative with the Steens Basalt of Fuller (1931), the "unnamed igneous complex" of Kittleman and others, (1965, 1967) and the basalt of Malheur Gorge of Evans (1990).

GEOLOGIC SUMMARY

The map area lies along the western edge of the Ore-Ida Graben (Ferns and others, 1993a, b). Oldest rocks exposed in the quadrangle are aphyric and plagioclase-phyric basalts (Tbmg) which form a section over 250 meters thick. Two different lithologies are exposed on Road Canyon; a lower unit made up mainly of aphyric basalts/andesites; and an upper unit made up of interbedded aphyric and (predominantly) coarsely plagioclase-phyric flows similar in chemistry and petrography to the Steens Basalt of Fuller (1931). Both lithologies appear as flows and autobreccias with intervening weathered zones underlain by palagonitized tuffs.

The unit is part of the extensive middle Miocene tholeiitic flood basalt province that cover much of eastern Oregon and lies in the transition zone between the plagioclase-phyric Steens Basalt to the south and the more voluminous Columbia River Basalt Group to the north. Abundance of palagonitized autobreccias and tuffs suggest that the flows at Road Canyon interacted with water.

A rhyolite flow (Tr) exposed east of Turnbull Mountain is the southernmost exposure of the Littlefield Rhyolite of Kittleman and others (1965, 1967). The rhyolite is one of a series of large-volume rhyolite lava flows that erupted from vents to the north, contemporaneous with initial subsidence along western edge of the Ore-Ida Graben.

An erosional unconformity separates Tbmg and Tr from younger volcanic units. Calc-alkaline basaltic andesite and andesite flows (Tba) erupted from vents (Tbv) to the north. Ttwc, the Wildcat Creek Welded Ash-Flow Tuff (Kittleman and others, 1965, 1967) erupted from a vent to the northwest, following the main pulse of calc-alkaline volcanism.

Younger rhyolite volcanism to the west (Ferns and Williams, 1993) was accompanied by renewed tholeiitic magmatism at about 12 Ma. Olivine basalt and plagioclase-phyic ferroandesites (Tbmv) partially covered an areally-restricted ferrolatite flow (Tif).

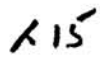
Tbcm flows (mainly basaltic andesites and andesites) from a large mafic shield volcano at Cedar Mountain to the east (Ferns, 1992a) advanced westward into a shallow basin, partially filled with Tst sediments. Lowlands peripheral to the volcano were covered by the distal edge of the Devine Canyon Ash-Flow Tuff at about 9.2 Ma.

Large pluvial lakes (Qss and Qsl)) covered much of the quadrangle in the late Pleistocene. The sand and gravel facies (Qss) mark the north shoreline of the large pluvial Turnbull Lake, which extended to the southwest. This lake partially-filled a large, Late Tertiary structural basin that formed along the east edge of the Steens Mountain. Colluvium and alluvial fan deposits (Qf) in the southeastern part of the quadrangle may cover an outlet to the lake, down the ancestral Owyhee River to the northeast.

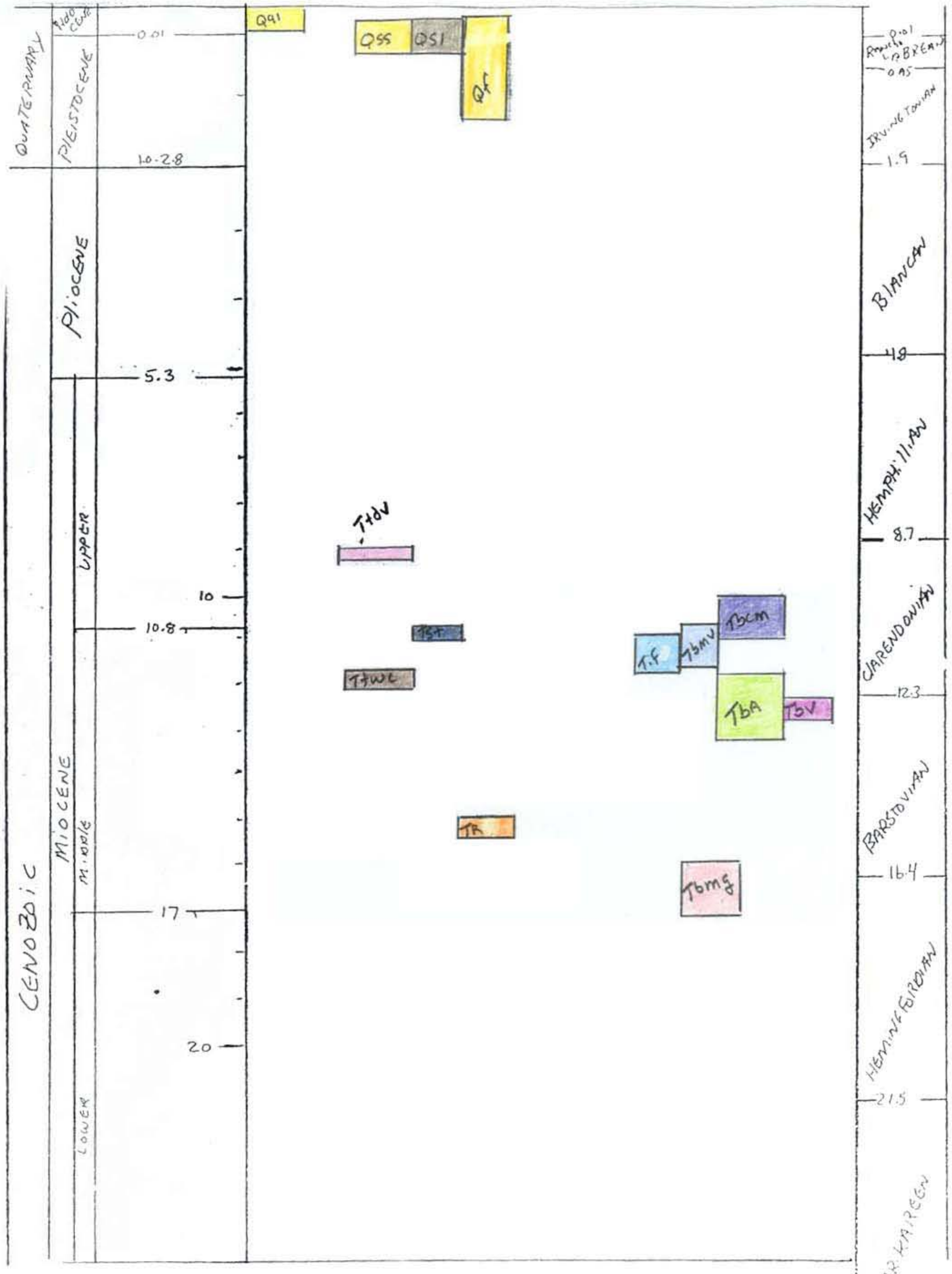
MAP SYMBOLS

Contact -- approximately located 

Fault contact -- dashed where approximately located, dotted where concealed. Ball and bar on down throw side

Strike and dip of beds 

Location of whole rock sample analyzed in Table 1



TIME ROCK CHART BURNT FLAT

Bonnichsen, Bill, Leeman, W.P., Jenks, M.D., and Honjo, N., 1988, Geologic field trip guide to the central and western Snake River Plain, Idaho, emphasizing the silicic volcanic rocks; in Link, P.K. and Hackett, W.R., editors, Guidebook to the geology of central and southern Idaho: Idaho Geological Survey Bulletin 27, p. 247-281.

Brooks, H.C. 1992, Preliminary geologic map of the Rufino Butte Quadrangle, Malheur County, Oregon: Oregon Department of Geology and Mineral Industries Open-File Map O-92-17, scale 1:24,000

Evans, J.G., 1990, Geology and Mineral Resources Map of the South Mountain Quadrangle, Malheur County, Oregon: Oregon Department of Geology and Mineral Resources Geological Map Series GMS-67, scale 1:24,000.

Ferns, M.L., 1992a, Preliminary geologic map of the Mustang Butte Quadrangle, Malheur County, Oregon: Oregon Department of Geology and Mineral Industries Open-File Map O-92-11, scale 1:24,000

Ferns, M.L., 1992b, Preliminary geologic map of the Mustang Butte Quadrangle, Malheur County, Oregon: Oregon Department of Geology and Mineral Industries Open-File Map O-92-11, scale 1:24,000

Ferns, M.L., and O'Brien, J.P., 1992a, Geology and Mineral Resources Map of the Namorf Quadrangle, Malheur County, Oregon: Oregon Department of Geology and Mineral Industries Geological Map Series GMS-70, scale 1:24,000.

Ferns, M.L. and Williams, C.P., 1993b, Preliminary Geologic Map of the Crowley Quadrangle, Malheur County, Oregon: Oregon Department of Geology and Mineral Industries Open-File Map O-93-4, scale, 1:24,000.

Ferns, M.L., Brooks, H.C., Evans, J.G., and Cummings, M.L., 1993a, Geologic Map of the Vale 1:100,000 Quadrangle, Malheur County Oregon and Owyhee County Idaho: Oregon Department of Geology and Mineral Industries Geological Map Series GMS-77, scale 1:100,000.

Ferns, M.L., Evans, J.G., and Cummings, M.L., 1993b, Geologic Map of the Mahogany Mountain 1:100,000 Quadrangle, Malheur County Oregon and Owyhee County Idaho: Oregon Department of Geology and Mineral

Industries Geological Map Series GMS-78, scale 1:100,000.

Fiebelkorn, R.B., Walker, G.W., MacLeod, N.S., McKee, E.H., and Smith, J.G., 1982, Index to K-Ar age determinations for the State of Oregon: U.S. Geological Survey Open-File Report 82-596, 40 p.

Fuller, R.E., 1931, The geomorphology and volcanic sequence of Steens Mountain in southeastern Oregon: University of Washington Publication in Geology, Vol. 3, no. 1, 130 p.

Greene, R.C., Walker, G.W., and Corcoran, R.E., 1972, Geologic map of the Burns quadrangle, Oregon: U.S. Geological Survey Miscellaneous Investigations Map I-680, scale 1:250,000.

Kittleman, L.R., Green, A.R., Hagood, A.R., Johnson, A.M., McMurray, J.M., Russell, R.G., and Weeden, D.A., 1965, Cenozoic stratigraphy of the Owyhee region, southeastern Oregon: Eugene, Oregon, University of Oregon Museum of Natural History Bulletin 1, 45 p.

Kittleman, L.R., Green, A.R., Haddock, G.H., Hagood, A.R., Johnson, A.M.,, McMurray, J.M., Russell, R.G., and Weeden, D.A., 1967, Geologic map of the Owyhee region, Malheur County, Oregon: Eugene, Oregon, University of Oregon Museum of Natural History bulletin 8, scale 1:125,000.

MAP SYMBOLS

Contact -- approximately located

Fault contact -- dashed where approximately located, dotted where concealed. Ball and bar on down throw side

Strike and dip of beds

Location of whole rock sample analyzed in Table 1

Table 1 Major and Trace Element Analyses for Unaltered Rocks, Burnt Flat Quadrangle O-92-2

LAB #	1/4	1/4	Sec	T.S.	R.E.	Elev.	Lithology	Map Unit	SiO2 %	Al2O3 %	TiO2 %	Fe2O3 %	MnO %	CaO %	MgO %	K2O %	Na2O %	P2O5 %	LOI %	Cr ppm	Co ppm	Ni ppm	Cu ppm	Zn ppm	Rb ppm	Sr ppm	Y ppm	Zr ppm	Nb ppm	Ba ppm	Li ppm
AZB-112	SW	SW	35	26	40	4140	Welded tuff	Ttdv	73.5	10.6	0.229	1.89	0.07	0.38	0.36	4.49	2.36	0.09	3.47	11	<5	<5	16	215	146	11	195	1270	95	[illegible]	37
AZB-124	NE	NE	29	26	40	4120	Ferrolatite	Tif	64.1	13.9	1.03	1.75	0.12	3.59	1.35	3.67	3.61	0.14	1.39	14	12	17	20	95	113	249	36	258	21	1490	10
BAB-311	SW	NE	16	26	40	4300	Andesite	Tbcm	55.4	15.9	1.48	9.04	0.16	6.77	3.16	1.94	3.6	0.6	1	22	29	29	43	101	47	366	24	207	38	1040	14
BAB-317	SE	SE	28	25	40	4670	Airfall tuff	Tst	69	12.5	0.29	2.6	0.05	1.25	0.48	5.12	1.84	0.05	6.95	6	6	2	5	142	167	30	105	505	66	521	6
BAB-316	NE	SE	28	25	40	4870	Andesite	Tbcm	55.7	16	1.5	9.06	0.15	6.73	3.2	2.23	3.29	0.61	1.1	27	31	25	45	100	48	556	25	193	49	1130	9
BAB-319	SW	NW	30	25	40	5200	Basalt	Tbmg	47.8	16.1	1.9	12.8	0.19	9.56	5.04	0.64	3.01	0.34	1	-	-	-	-	-	17	433	<10	122	26	505	-
BAB-320	NE	SW	29	25	40	5200	Basalt	Tba	50.3	13.8	1.37	8.85	0.19	3.97	1.34	3	3.8	0.47	1.45	-	-	-	-	-	84	278	59	570	53	1570	-
BAB-321	NE	NE	29	25	40	4940	Basalt	Tbv	52.2	15.4	1.45	10.3	0.18	7.25	4.18	1.63	3.39	0.9	2.3	-	-	-	-	-	44	455	39	167	32	854	-
BAB-322	SW	SW	32	25	40	4740	Rhyolite	Tr	74.3	12	0.52	2.57	0.04	0.22	0.16	4.52	4.41	0.04	1.15	-	-	-	-	-	146	76	84	585	46	1500	-
BAB-323	NW	NE	7	26	40	4970	Andesite	Tbcm	55.5	16	1.51	8.82	0.16	6.85	3.21	2.02	3.69	0.59	0.85	-	-	-	-	-	35	585	23	212	16	905	-