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PRELIMINARY GEOLOGIC MAP OF THE BROWN MOUNTAIN 7.5′ QUADRANGLE, JACKSON AND KLAMATH COUNTIES, OREGON

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Introduction

The Brown Mountain Quadrangle (BMQ) is located directly on the north - south oriented axis of High Cascade volcanoes that stretch from British Columbia, Canada to Mount Lassen in northern California. Figure 1 provides exact location information on several levels; where in the Pacific Northwest to where in south-central Oregon and to the local geographic context in which the BMQ is situated. Topographically the elevation ranges in the BMQ from 4190 feet where the South Fork of the Little Butte Creek exits the quadrangle flowing to the west, to 7311 feet, the summit of Brown Mountain, the highest point in the quadrangle. That means there are 3121 feet of topographic relief within the BMQ. Naturally anyone who has either read about or visited regions within the higher portions of the Cascade Mountains knows that the landscape is an interesting mix of volcanic and glacial features, often referred to by the imagination-inciting phrase "fire and ice". However, in the BMQ physical and visual evidence of the "ice" part of the phrase is relegated to the very highest segment of Brown Mountain, particularly on the north and northeast facing slopes. The "fire" part of the phrase is most easily visualized in the northeastern quarter of the quadrangle that is dominated by numerous blocky andesite flows that radiate outward from the summit. As andesite stratovolcanoes go Brown Mountain is quite atypical because the proportionality of lava flows to pyroclastic material is highly skewed towards lava flows.

All the other topographic high points in the BMQ are less than 6200 feet in elevation. Prominent volcanic vents like Robinson Butte, Burton Butte, and Old Baldy (see Figure 1) extruded much lava over large areas of the BMQ. These high points have one thing in common. They are all located just outside of the quadrangle boundaries. Cox Butte and Brush Mountain, which extruded basaltic andesite and basalt respectively, are two prominent named volcanic vents that reside within the quadrangle. Several cinder pits / rock quarries used exclusively for road building aggregate are found scattered through the quadrangle, the largest of which is the Big Elk cinder pit located in the extreme northwest portion the quadrangle, approximately one mile SSE of the Robinson Butte summit.

The Pacific Crest Trail crosses the BMQ from south to north (see Figure 1). There are several points of easy access to the PCT. One is where Oregon highway 140 crosses the PCT north of Brown Mountain and south of Mt. McLoughlin and another is where the Dead Indian Memorial highway crosses the PCT. At both locations small paved parking lots are available for vehicles. Also the trail from Fish Lake to Lake of the Woods intersects the PCT which provides through hikers an opportunity to re-supply and use the shower and laundry facilities at the small stores located at both popular fishing locations.

A comment on nomenclature: when geoscientists classify igneous rock samples they often come at it from two points of view. One is based on identifying the visible minerals in a hand sample (a modal mineral classification) and the other is based on a chemical analysis of that sample (a chemical classification of igneous rocks – see Figure 2 as an example). Naturally the latter is more precise and rigorous and the former is looser and less precise and is open to more opinions. The most common volcanic rock names (basalt, basaltic andesite, andesite, dacite, rhyolite) define a sequence in which the iron – magnesium bearing silicate minerals (olivine, orthopyroxene, clinopyroxene, hornblende, biotite) are most abundant on the left side of the sequence, forming upwards of 50 to 60 percent of the minerals present and decreases to nearly zero to the right, namely, in rhyolite. The remaining 40 to 50 percent of the rock consists mostly of plagioclase feldspar, non-iron magnesium bearing silicate mineral, and a few percent of chromium, iron, titanium dominated oxide minerals. With regard to rock chemistry silica (SiO_2) increases from basalt to rhyolite and correlates directly with increasing viscosity and greater explosivity.

Table 1, which accompanies the geologic map of the BMQ, contains the chemical and age data for all the analyzed rock samples. Figure 1 also depicts the location of all the samples for which age dates exist, both within the BMQ as well as immediately adjacent to it. Figure 2 is a total alkali ($Na_2O + K_2O$) versus SiO_2 diagram that summarizes the rock names that are most germane for the volcanic materials present in the BMQ. In addition the chemical data is displayed for each stratigraphic unit that is defined below using an individualized symbol that is summarized in the legend that accompanies Figure 2.

Broad Overview of the Geology of the Brown Mountain Quadrangle

The geology of the BMQ encompasses the latest 22 million years (Ma) of earth history. To be scrupulously honest it is more accurate to say 99+ percent of the rocks outcropping within the BMQ are 6.2 Ma old or younger with just a small sliver of the early Miocene Heppsie Formation. These Miocene-age volcanic rocks are exposed in the South Fork of the Little Butte Creek drainage just before the stream crosses into the adjoining Robinson Butte quadrangle on the far western margin of the BMQ. The Heppsie Formation is the youngest segment of the Little Butte Volcanic Series that in turn is classified as part of the Late Early Western Cascade period of volcanism as defined by Priest (1990). The uppermost section of the Heppsie Formation in this region consists of a poorly to moderately welded ash-flow tuff unit that is well exposed in the north valley wall of the South Fork of the Little Butte Creek in the eastern one-third of the Robinson Butte quadrangle. Locally this ash flow unit is several hundred feet thick and takes on a crude columnar jointing pattern where welding has been moderate. To accurately picture how this material was both erupted and deposited on the earth's surface, one needs to envision the famous eruption of Vesuvius volcano in Italy in 79 AD as described by Pliny the younger, the eruption and near total destruction of Mount Mazama, nearly 7000 years ago, or the much more recent eruption of Mount Pinatubo in the Philippine Islands in 1991.

Resting on top of the Heppsie Formation in this region with an unconformity or age gap of 13 to 15 million years are lavas that belong to the early segment of High Cascades volcanism as summarized by Priest (1990). In this portion of the Cascades Mountains latest Miocene to Holocene volcanism is completely dominated by lavas and vent pyroclastics. Whereas pyroclastic flow activity characterized the youngest segment of Heppsie time, the latest 6 to 7 Ma of geologic time has seen very little of this kind of violent volcanic activity with the one very notable exception being Crater Lake / Mount Mazama volcano and its pyroclastic flow dominated eruptive history ~7000 years ago. Geologically-speaking the extrusive rocks that are so ubiquitous in the quadrangle are latest Miocene (7.246 to 5.332 Ma), Pliocene (5.332 to 1.806 Ma), and Pleistocene (1.806 to 0.0115 Ma) in age (see Gradstein, Ogg, and Smith, 2004 for details). Mertzman (2000) and Mertzman (unpublished data, 2007) provide many new age dates, derived from both a whole rock K-Ar method as well as 40Ar/39Ar technology, that have been measured through June, 2007.

Glacial activity over the past 1 to 2 Ma has only affected the very highest point in the quadrangle; namely, the summit region of Brown Mountain volcano. Evidence for glacial activity can be seen on the north and northeast segment of the Brown Mountain summit crater.

Explanation of Map Units

Qal **Alluvium (Holocene)** Unconsolidated sediment found in close proximity to modern drainages.

Volcanic Rocks

Qbv, Qav **Basaltic to basaltic andesite / andesite vent deposits (Pleistocene)** Poorly lithified to unconsolidated lapilli to ash-sized cinders black to brown to red in color with lesser amounts of similarly colored lava spatter, bombs, and scoria. These deposits mark volcanic vents areas that are often cinder cones.

Qabm **Andesite of Brown Mountain (Upper Pleistocene)** Numerous blocky lava flows of aphanitic andesite originate from Brown Mountain. The outermost carapace of the blocky flow material is medium to dark gray in color and dominated by open vesicles that are 1 to 2mm in diameter and can be stretched out into an ellipsoid in the flow direction. The flow interiors where visible are significantly lighter in color and are universally characterized by platy flow jointing with 2 to 3 cm separating the joint planes. Hand samples contain 10 to 20 percent microphenocrysts between 0.4 and 1 mm, with plagioclase feldspar being the most abundant mineral, followed by orthopyroxene and clinopyroxene. Minor olivine and opaque oxide minerals are also present. The age of the Brown Mountain volcanic activity is less than 100,000 years old, most likely between 50,000 and 25,000 years old based on geomorphologic evidence. Vestiges of Late Pleistocene glacial and periglacial activity are confined to the summit region of Brown Mountain, in particular, on the northern and northeastern sides just below the summit crater.

Qbbb **Basalt of Burton Butte (Middle Pleistocene)** Light gray to dark bluish gray in hand sample color, lava samples are consistently lighter in color than that of pyroclastic samples. Burton Butte cinder / scoria cone, the source of these lavas, is located in the adjoining quadrangle to the east, the Lake of the Woods, South quadrangle. Pahoehoe lava flows from Burton Butte spread westward nearly six miles, down the paleo-drainage now occupied by the Beaver Dam Creek all the way to Deadwood Prairie. Most samples have a diktytaxitic (sponge-like) texture with a larger sized set of vesicles present, several mm to one centimeter in diameter, that are often lined to partially filled with secondary mineralization, mostly carbonate with some silica and zeolitic minerals infrequently present. The larger sized set of vesicles is often stretched out to provide a lineation parallel to the last flow direction of the lava. Plagioclase, 0.5 to 2mm in diameter, is the most abundant mineral with 15 to 25 percent olivine and a similar amount of clinopyroxene present, filling in the interstices between the tabular laths of plagioclase. Chromite, present within early-formed olivine crystals, together with titanomagnetite and ilmenite, are the opaque minerals that constitute 8 to 10 percent of the minerals present in these basaltic lavas. Several whole rock K-Ar ages are available for this unit and are characterized by relatively large + or – values. These relatively large error limits are due in part to the low whole rock K_2O values for the Burton Butte basalt samples, <0.3%. One $^{40}Ar/^{39}Ar$ age has been quite recently determined and is preferable over all the others. Burton Butte volcanic activity is 0.33 ± 0.12 Ma old.

Qbrb **Basalt of Robinson Butte (Middle Pleistocene)** Light gray to dark bluish gray in hand sample color, lava samples are consistently lighter in color than that of pyroclastic samples. Robinson Butte cinder / scoria cone, the source of these lavas, is located in the adjoining quadrangle to the west, the Robinson Butte quadrangle. Three to five meter thick lava flows with pahoehoe surfaces are abundant. Vesicles 5 to 10 mm long and stretched out in the direction of flow and partially lined with vapor phase deposited secondary minerals, are common. The lavas have a glomeroporphyritic texture with olivine (1 to 3 mm in maximum dimension) constituting 10 to 15 percent of each hand sample. Poikilitic within early-formed olivine crystals are chrome-spinel inclusions. Abundant clinopyroxene (1 to 3 mm) and plagioclase (0.5 to 1 mm) phenocrysts constitute nearly 50 percent of a hand sample and are present in clumps as well as individual crystals. The groundmass is primarily intersertal in nature. One whole rock K-Ar age is available for this unit, 0.40 ± 0.30 Ma. One $^{40}Ar/^{39}Ar$ age has been quite recently determined and is preferable because of its much better precision. Robinson Butte volcanic activity is 0.36 ± 0.06 Ma old. From a geologist’s or hiker’s point of view it is very interesting to note that the volcanic activity at Robinson Butte and Burton Butte are virtually identical in age, which suggests these two volcanoes could have simultaneously been erupting basaltic lava onto the southern Oregon landscape. Since the chemical compositions of basaltic lavas from Robinson and Burton Buttes are easily distinguishable, one implication is that the plumbing systems for each of these two volcanoes are separate and distinct.

Tpbbm **Basalt of Brush Mountain (Upper Pliocene)** The Brush Mountain volcanic vents are aligned in a NNW-SSE direction in the extreme south-central part of the BMQ, extending into the Little Chinquapin Mountain quadrangle. Numerous basaltic lava flows are found in both quadrangles that emanate from these linearly arrayed vents. Brush Mountain basalts are medium gray in color as lavas and considerably darker gray as the lavas become more vesicular in nature. These extrusive rocks are porphyritic with 10 to 15 percent phenocrysts with plagioclase feldspar somewhat more abundant than olivine. These two minerals occur separately and in glomeroporphyritic clumps that can range up to 3 mm in diameter. Pyroxene is mostly confined to the matrix. The olivine is partially altered to iddingsite, a characteristic that causes the olivine phenocrysts to be much more darkly colored than the typical lime green color; it also causes olivine to be iridescent, particularly in shades of purple on newly broken surfaces. Two whole rock K-Ar ages are available for this unit, 2.22 ± 0.12 Ma and 1.97 ± 0.08 Ma old.

Tpbao **Basaltic Andesite of Old Baldy (Middle Pliocene)** The singular topographic high point known as Old Baldy is located at the western tip of an east-west oriented ridge that on its eastern extent is composed of latest Miocene hornblende andesite. Earlier in the twentieth century a USFS fire lookout tower was located at the top of Old Baldy. Presently the PCT crosses this ridge several hundred meters to the west of Old Baldy. This ridge is the drainage divide between the South Fork of the Little Butte Creek and its tributaries which eventually end up in the Rogue River and the streams that drain Johnson Prairie to the south that empty into Jenny Creek and then the Klamath River. Every hand sample of Old Baldy basaltic andesite has 5 to 10 glomeroporphyritic clumps, 5 to 8 mm in diameter, that are composed of plagioclase, far and away the most abundant mineral present in the Old Baldy lavas, and olivine. The abundance of olivine diminishes rapidly once the microphenocrysts and the matrix are examined because pyroxene, particularly clinopyroxene, becomes the dominant mafic mineral present. Acicular to lath-like plagioclase in the matrix of the samples is a particularly noticeable trait when examining them with a hand lens. Two whole rock K-Ar ages are available for this unit, 2.78 ± 0.10 Ma and 2.63 ± 0.32 Ma old.

Tpbcb **Basalt of Cox Butte (Middle Pliocene)** The vents of the Cox Butte volcano are located somewhat west of center in the BMQ. It abuts the voluminous basaltic andesite to andesite lava flows of the somewhat older Ichabod Spring Formation to the north. Cox Butte lavas are light to medium gray in color, often with conspicuous flow jointing present with 5 to 10 cm separating each of the shear planes. Three to five percent clinopyroxene and olivine phenocrysts are visible, each up to 3 mm long, with the olivine being partially to completely altered to iddingsite. Tabular shaped crystals are lined up to produce a flow lineation. Plagioclase, which is most abundant mineral present, is $\leq$ 1 mm in diameter, effectively concentrated in the matrix. One very interesting petrographic feature concerning Cox Butte lavas concerns the larger clinopyroxene crystals. When examined with the petrographic microscope rather than being an individual crystal, the clinopyroxene grains are mosaics of dozens of smaller pyroxene crystals, resembling bathroom tile as a first-order comparison. These multi-grained crystals may not actually be Cox Butte magmatic material, but rather fragments of pre-existing rock that became included in Cox Butte magma on its way to the surface. One whole rock K-Ar age is available for this unit, 2.96 ± 0.06 Ma old.

Tpbdp **Basalt of Daley Prairie (Middle Pliocene)** The vents for the Daley Prairie lavas are a series of spatter and scoria cones aligned in a predominantly east-west orientation and are located to the east of Cox Butte. A hand-sample of Daley Prairie basalt is light to medium gray in color and has 12 to 15 percent green olivine phenocrysts that are 1 to 3 mm in diameter. The olivine crystals occur singularly and in clumps creating a glomeroporphyritic texture. Some of the olivine crystals are dark brown around the margins as a result of alteration to iddingsite, a secondary assemblage of minerals that form at warm but low temperature when the lava is completely solidified. Iron-rich oxides and clay minerals are the dominant constituents in iddingsite. The Daley Prairie basalt is termed an olivine-phyric basalt because all the other silicate and oxide minerals present in the extrusive rock are confined to the fine grained matrix of the sample; thus, leaving olivine as the only visible mineral in the hand specimen. In thin section the olivine crystals have included within them small <0.1 mm in diameter crystals of spinel, a chemically complex oxide mineral that has a general formula of AB_2O_4 where A is Fe^{+2} and Mg^{+2} and B is Cr^{+3} and Al^{+3} and Fe^{+3} in various amounts. The texture indicates the spinel mineral grains crystallized from the molten magma before the olivine crystals, which eventually grew around and enclosed the spinel crystals. An early-formed mineral subsequently surrounded by a later-formed mineral forms what is termed a poikilitic texture. Olivine-rich basaltic lavas like those of the Daley Prairie unit are thought to have likely traveled to the Earth's surface from the asthenosphere where they were formed. They seemed to have been able to make this nearly 100 km trip with little in the way of chemical interaction with the rocks in which they were in continuous contact. Two whole rock K-Ar ages are available for this unit, 3.16 ± 0.12 Ma and 2.77 ± 0.05 Ma old.

Tpais **Andesite of Ichabod Spring (Middle Pliocene)** Whereas the physical appearance of the preceding unit is exclusively dominated by olivine phenocrysts, the Andesite of Ichabod Spring is dominated by abundant phenocrysts of plagioclase and pyroxene. A minority of lavas included within this unit is basaltic andesite in bulk composition and can often be distinguished by the presence of 1 to 2 percent olivine phenocrysts in addition to the primary constituents plagioclase and pyroxene. Twenty to thirty percent plagioclase phenocrysts, more often in lath-like elongate crystals ranging in size up to 5 mm in length with striations present parallel to the long direction of the grains, dominate the physical appearance of these lavas. Also present are dark green to nearly black clinopyroxene and dark brown to nearly black orthopyroxene phenocrysts that range in size up to 4 mm, constituting between 5 and 10 percent of the volume of a hand sample. With some frequency these larger phenocrysts have their long axes aligned parallel to the direction in which the lava was flowing producing what is termed a trachytic texture. Many of these lavas flowed from east to west across the BMQ from vents located on the western margin of the Lake of the Woods South quadrangle. Two whole rock K-Ar ages are available for this unit, 3.42 ± 0.06 Ma and 3.25 ± 0.05 Ma old.

Tpafl **Andesite of Fish Lake (Lower Pliocene to Lower Pleistocene)** This unit primarily consists of andesite lava flows but intercalated amongst the andesite flows are more mafic flows of basaltic andesite, much like the Andesite of Ichabod Spring. These andesites are quite porphyritic with plagioclase phenocrysts, singularly and in glomeroporphyritic clumps up to 7 and 8 mm in diameter, that amount to between 30 and 40 percent of a typical hand specimen. Both orthopyroxene and clinopyroxene are present usually amounting to 5 to 7 percent of the hand sample. Olivine is either absent or present at a level of no more than 1 to 2 percent. On the whole outcrop of this unit is relatively limited and leaves the impression that it is more weathered due to iron staining in and along fracture surfaces that pass through the rock. No vents for these lavas were discovered. Three whole rock K-Ar ages are available for this unit, 3.97 ± 0.08 Ma, 3.56 ± 0.06 Ma, and 1.67 ± 0.03 Ma old.

Tpbmp **Basalt of Moon Prairie (Lower Pliocene)** These olivine-phyric lavas form the far southwest corner of the map area and have flowed from vents located further to the west in the Robinson Butte quadrangle. Spheroidal weathering is encountered at most of the outcrops of this unit. Olivine forms 15 to 20 percent of a hand sample as phenocrysts 1 to 4 mm in diameter, many of which are partially to completely altered to iddingsite. Numerous small grains of spinel are poikilitically enclosed within the olivine crystals. Plagioclase feldspar is the most abundant mineral present but is confined to the matrix as elongate rectangular (laths) that are flow aligned to produce a trachytic texture. Present as microphenocrysts and small-sized crystals clinopyroxene is the only readily identifiable pyroxene present in these light gray colored basaltic lavas. One $^{40}Ar/^{39}Ar$ age is available for this unit, 4.51 ± 0.01 Ma old.

Tmaob **Andesite of Old Baldy East (Upper Miocene)** This unit is atypical for this particular segment of the Cascade volcanic province in that the silicate mineral hornblende, a double chain hydrous ferromagnesian mineral is present as scattered 3 to 5 mm long phenocrysts that constitute 2 to 3 percent of a hand sample. Strong chemical zoning is apparent in plagioclase feldspar, the most abundant present in this andesite unit. It is present as singular phenocrysts and in glomeroporphyritic clumps 1 to 3 mm in diameter that constitute 10 to 12 percent of the lava and thoroughly dominates the matrix in terms of abundance. Orthopyroxene is a significant mineral as well, constituting 7 to 10 percent of the total volume of the rock in crystals ranging up to 2 mm in diameter. Once again spheroidal weathering is a ubiquitous physical feature observed at most outcrops of this unit. One whole rock K-Ar age is available for this unit, 5.77 ± 0.09 Ma old.

Tmbab **Basaltic Andesite of Beaver Dam Creek (Upper Miocene to Lower Pliocene** Once again spheroidal weathering is the order of the day when it comes to examining outcrops of this unit. Nearly every outcrop has one or more very good examples of this weathering phenomenon. Individual rounded boulders will frequently display distinctive weathering rinds when broken open, with the most intensively weathered material near the outside surface of the sample becoming less intensively weathered as one penetrates further into the rock mass. Compositionally speaking this unit has a majority of lavas that are basaltic andesite in composition; however, there are minor but persistent basaltic lavas present as well. These light gray basalts are consistently of the olivine-phyric type with the flow aligned phenocrysts of olivine ranging from 2 to 4 mm in length and constituting nearly 20 percent of the volume of a hand sample. Many of these olivine crystals have been partially to substantially altered to iddingsite. Compared to these basaltic lavas the flows of basaltic andesite are much darker bluish-gray in color even though they are higher in silica content than the basaltic lavas. The basaltic andesite lavas have fewer phenocrysts. Plagioclase feldspar and olivine phenocrysts, 1 to 3 mm in diameter, constitute 3 to 5 percent of the volume of a hand sample and are nearly equal in abundance. Pyroxene and much additional plagioclase are confined to the sample matrix that is much finer grained than in the basaltic lavas. Hence, when breaking the basaltic andesite lava in to smaller chunks conchoidal fracture surfaces are very abundant. Two whole rock K-Ar ages are available for this unit, 5.82 ± 0.17 Ma and 4.60 ± 0.34 Ma old.

Tmbpb **Basalt of Pole Bridge Creek (Upper Miocene to Lower Pliocene)** The Basalt of Pole Bridge Creek outcrops rather spectacularly in the region near the confluence of Beaver Dam Creek, Pole Bridge Creek, and the South Fork of the Little Butte Creek in the extreme west-central portion of the quadrangle. On the east side of the intersection the bluffs are held up by basalt lava flows and are capped by younger basaltic andesite lavas. Individual bluffs have relief ranging from 35 to 60 meters. The maximum thickness of the Basalt of Pole Bridge Creek is on the order of 70 to 80 meters. It thins rapidly to the west so that in the Short Creek drainage in the Robinson Butte quadrangle, 2 to 2.5 km further to the west, the Basalt of Pole Bridge Creek has thinned to zero and the 0.4 Ma old Robinson Butte Basalt lies directly upon early Miocene volcanic rocks of the Heppsie Formation. On the outcrop, lava flows range from platy jointed near the base of the flow, with individual plates 1 to 3 cm thick, to essentially massive in the interiors. Individual hand samples are light gray in color and often possess two generations of vesicles. The first generation of vesicles is larger, forming spherical to oval shaped voids that are 0.2 to 0.5 cm in effective diameter. The second generation of vesicles is pinhead in size and spherical in shape. Both vesicle types are quite fresh; that is, both are unfilled and unlined by secondary minerals in most locations. The flows range from nearly aphyric; that is, phenocryst-free, to containing 20 to 25 percent small phenocrysts ranging between 1 and 2 mm in maximum dimension and consisting in order of decreasing abundance plagioclase, clinopyroxene. olivine, and opaque minerals. In many instances the olivine phenocrysts have been substantially altered through high temperature oxidation and have an appearance in thin section analogous to wormy wood. The opaque minerals are unusually abundant in this formation (10 to 12 percent of total mineralogy) and crystallized early as evidenced by their inclusion within all the silicate minerals listed above. Also unusual is both the size and abundance of clinopyroxene crystals, in this case nearly equal in abundance to that of olivine. Many basalts of similar silica content from this region of the Cascades are dominated by olivine with clinopyroxene relegated to a microphenocryst and / or matrix constituent. Several whole rock K-Ar ages have been determined on lava samples from this formation. The radiometric ages range from 6.14 ± 0.15 to 4.35 ± 0.04 Ma old.

Tmvhf **Heppsie Formation (Lower Miocene)** The Heppsie Formation constitutes the youngest portion of the Little Butte Volcanic Series. In this segment of the Formation's outcrop area the older extrusive rocks are dominated by basalt, basaltic andesite, and andesite lava flows whereas in the younger, upper portion, poorly to moderately welded pyroclastic flow and air-fall tuffaceous material dominate. These latter extrusive materials are andesite to dacite in terms of their bulk composition. On the outcrop the lavas are greenish-brown in surface coloration often with several meters or more of soil developed in situ. In the more mafic lava flows of this formation the dominant ferromagnesian mineral, olivine, has been mostly to completely converted to iddingsite as a result of relatively low temperature oxidation and hydration. The most abundant mineral present in these lavas is the nonferromagnesian mineral plagioclase feldspar. It is often unaltered but in numerous locations it is cut by small cracks and veins filled by sericite mica and calcite plus a little quartz (?).

Where the ash flow tuff member of the Heppsie Formation has been exposed by erosion and due to its inherent structural weakness, numerous landslides and slumps have their beginnings at or near the contact between younger more massive basaltic lava flows and the older poorly welded ash flow tuffs. In the adjacent Robinson Butte quadrangle (see Figure 1) several good examples of arcuate headwall slump structures can be easily found in the canyon of the South Fork of the Little Butte Creek. As one road-building civil engineer said to me (S.A.M.) two summers ago while working on a bridge replacement project across the South Fork, "Nothing in this valley is actually stable. Everything is moving downhill pretty fast, particularly in the spring as the winter snows melt." Also, numerous excellent examples of landslides / slump development can be found in the Klamath River canyon along the California – Oregon border beginning just below the John C. Boyle Powerhouse at what is known as the Caldera Rapid. In this region a very similar layering of geologic rock units occurs as in the South Fork of the Little Butte Creek: older siliceous poorly welded tuffaceous material is overlain by younger thick occurrences of mafic lava flows. It is likely that the same mechanism of slope failure is occurring in both areas, giving rise to landslides / slumps that set the stage for rapids to form in the streams that are flowing through the valleys. A half-dozen age dates for various Heppsie Formation samples, both whole rock K-Ar and $^{40}Ar/^{39}Ar$ ages, are available. However, none are from the minute exposures in the BMQ. The measured ages range from 21.73 ± 0.14 Ma to 19.93 ± 0.07 Ma old.

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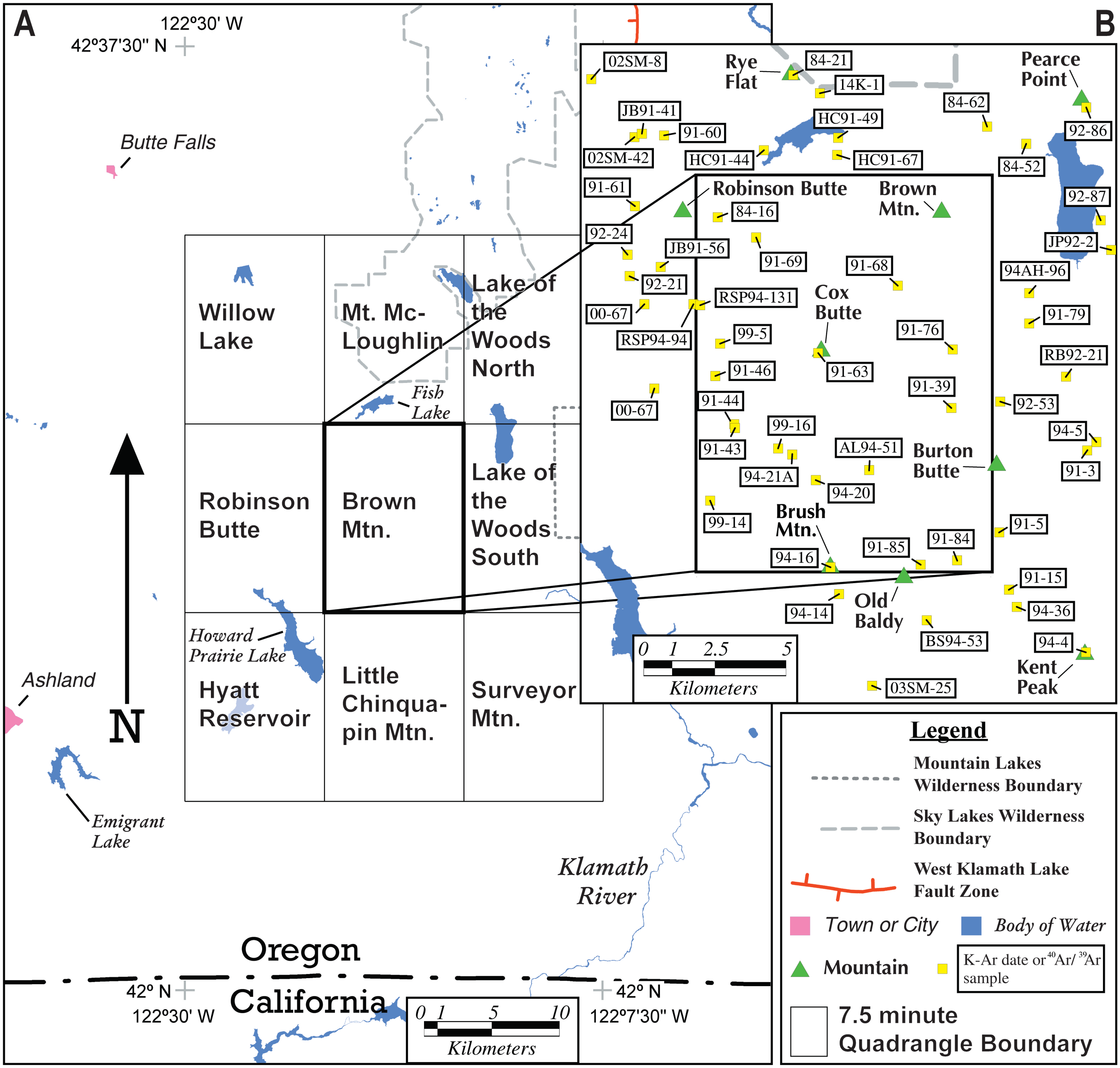

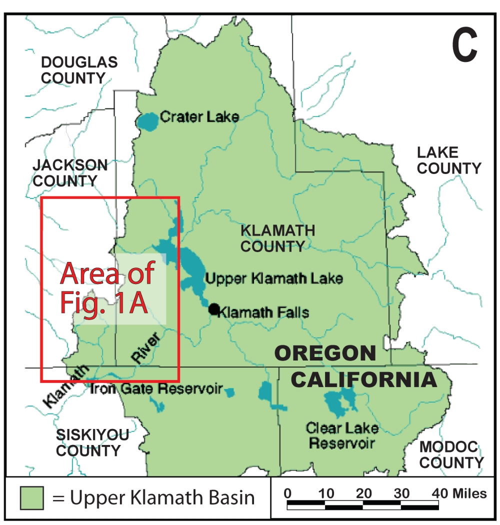

Figure 1. This series of location maps (A through D) provides a broad context in which to place the Brown Mountain geologic map. (Figures 1C and 1D were modified from U.S. Geological Survey, 2006).

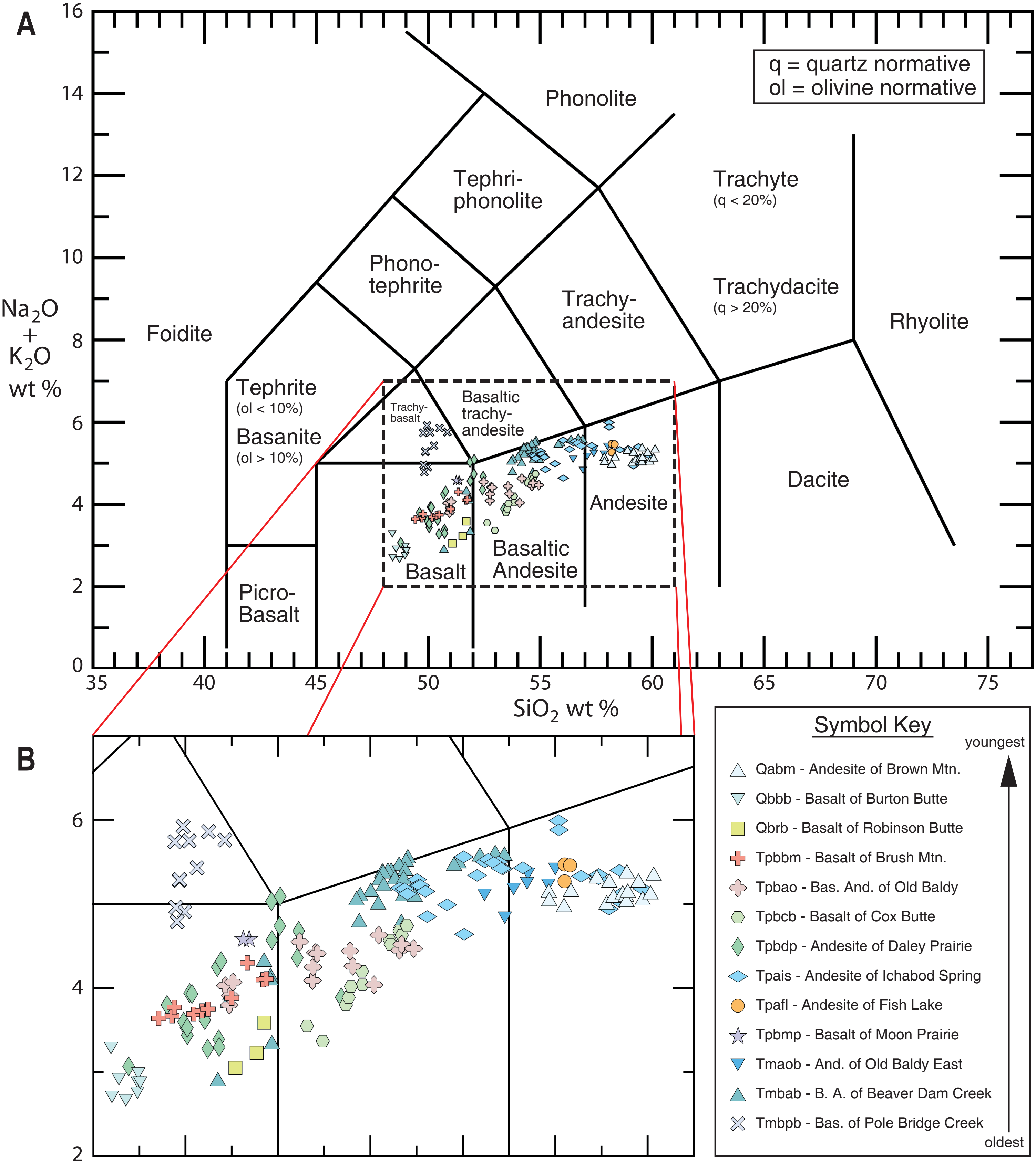

Figure 2. IUGS (International Union of Geological Sciences) classification system for volcanic rocks, which is based on total alkali ($Na_2O + K_2O$) vs. silica (SiO_2) content, with the data from analyzed Brown Mountain quadrangle samples (Table 1) superimposed (see Le Maitre, 2002).

Table 1 (page 1). Whole rock chemical data and Potassium-Argon (K-Ar) ages ([a] indicates an Argon-Argon age) for the samples from the Brown Mountain quadrangle, Jackson and Klamath Counties, Oregon. The major element oxides are presented in weight percent and the trace elements are reported in parts per million (ppm). The chemical data are X-ray fluorescence (XRF) analyses and were measured in the X-ray laboratory of the Department of Earth and Environment, Franklin and Marshall College, Lancaster, Pennsylvania. The UTM coordinate values are according to the UTM Zone 10 (NAD 27 for US) projection.
All UTM coordinates have been rounded to the nearest 10 m. The 1/4 of 1/4, 1/4, Section (Sec.), Township (T.), and Range (R.) columns are location descriptors of the Public Land Survey System (PLSS).
In the Lithology column (Lith.), TrB = Trachybasalt (SiO_2 = 45-52%; $Na_2O+K_2O \geq 5.0\%$), B = Basalt (SiO_2 = 45-52%), BA = Basaltic Andesite (SiO_2 = 52-57%), and A = Andesite (SiO_2 = 57-63%).
See Figure 2 and Le Maitre (2002) for details regarding lithological classification. Please consult the detailed write-up or the geologic map for the full unit names. Please note that this table is 3 pages long.

Map no.	Sample no.	K-Ar Age([a]) Ma	1/4 of 1/4	1/4	Sec.	T. (S.)	R. (E.)	UTM E m	UTM N m	Unit	Lith.	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI (%)	Total (%)	Fe_2O_3T	Rb	Sr	Y	Zr	V	Ni	Cr	Nb	Ga	Cu	Zn	Co	Ba	La	Ce	U	Th	Sc	Pb	Yb	Be
1	RSP94-131	6.14 +/- 0.15	SW	SE	20	37	4	551610	4686880	Tmbpb	TrB	49.77	1.07	15.56	5.41	3.10	0.14	7.49	9.70	3.35	2.39	0.64	0.74	99.36	8.86	22.4	2246	19.2	140	210	115	231	2.8	18.4	101	78	33	1925	41.3	103.7	4.5	8.2	36	7.4	1.8	1.5
2	99-5	4.35 +/- 0.04[a]	NE	SE	29	37	4	552300	4685530	Tmbpb	B	49.98	1.17	15.83	2.68	5.82	0.15	7.87	9.59	3.60	1.31	0.58	0.87	99.45	9.15	20.6	973	17.2	149	233	77	236	10.8	22.4	88	83	31	725	34	63	2.6	9.7	20	4	--	--
3	99-17	--	SW	SE	29	37	4	551730	4685210	Tmbpb	B	49.79	1.09	15.09	3.06	5.55	0.14	9.14	9.31	3.80	1.16	0.75	0.56	99.44	9.23	8.3	1177	12.4	136	231	142	369	16.6	22.6	75	106	38	459	35	63	1.3	8.3	20	5	--	--
4	00-51	--	SW	SE	29	37	4	551770	4685050	Tmbpb	B	49.82	1.13	15.20	5.76	3.57	0.14	8.77	8.51	3.61	1.18	0.74	1.08	99.51	9.73	12.4	1208	13	141	203	171	379	13.0	21.3	77	109	36	445	34	61	2.2	4.9	21	4	--	--
5	00-38	--	SW	SE	20	37	4	551740	4686620	Tmbpb	TrB	49.87	1.06	15.21	5.84	2.68	0.14	7.46	9.25	2.99	2.29	0.63	2.14	99.56	8.82	28.0	2163	24.2	137	176	101	207	8.8	17.9	122	79	35	2007	50	114	1.6	9.6	16	13	--	--
6	00-39	--	NW	NE	29	37	4	551710	4686420	Tmbpb	TrB	49.87	1.07	15.37	7.27	1.62	0.15	6.90	9.03	2.98	2.31	0.62	2.41	99.60	9.07	29.9	1984	23.9	139	157	98	200	8.6	17.5	85	86	33	2030	45	106	2.3	9.9	20	11	--	--
7	00-35	--	NW	SE	20	37	4	551770	4687110	Tmbpb	TrB	49.95	1.25	15.36	7.12	1.76	0.13	6.83	7.70	3.47	2.45	0.74	2.71	99.47	9.08	30.3	1487	17.8	206	160	123	243	11.7	20.9	76	105	35	1421	49	109	2.6	11.3	14	10	--	--
8	02-46	--	NW	SE	20	37	4	551710	4687300	Tmbpb	TrB	50.08	1.15	15.16	5.69	2.72	0.13	7.62	7.43	3.43	2.32	0.71	3.27	99.71	8.71	32.3	1175	14.8	185	198	127	278	9.8	21.6	91	100	32	860	43	83	2.4	9.5	16	6	--	--
9	00-40	--	NW	NE	29	37	4	551590	4686330	Tmbpb	TrB	50.25	1.07	15.58	7.23	1.68	0.14	7.03	9.25	3.36	2.07	0.57	1.32	99.55	9.10	18.6	2218	22.5	133	166	93	187	8.4	17.9	101	75	33	1610	39	92	1.8	6.2	19	12	--	--
10	00-36	--	SW	SE	20	37	4	551760	4686950	Tmbpb	TrB	50.50	1.15	14.98	5.94	2.85	0.13	8.23	8.24	3.70	2.16	0.67	0.99	99.54	9.11	29.7	1502	15.8	178	176	164	283	10.7	19.9	105	98	38	983	43	91	1.9	9.3	17	10	--	--
11	00-37	--	SW	SE	20	37	4	551800	4686820	Tmbpb	TrB	50.85	1.12	14.67	5.80	2.91	0.13	8.93	8.09	3.65	2.11	0.65	0.65	99.56	9.03	29.1	1483	16	175	167	218	339	10.6	19.7	95	97	39	1045	38	86	2.3	10.0	15	9	--	--
12	91-44	4.60 +/- 0.34	SE	NW	4	38	4	552800	4682680	Tmbab	B	50.70	0.68	16.10	2.40	5.90	0.15	9.11	10.68	2.49	0.40	0.15	0.91	99.67	8.96	5.3	566	16.3	32	247	127	482	2.6	18.2	70	64	39	181	6	13	1.5	4.0	32	3.6	1.2	1.3
13	91-43	5.82 +/- 0.17	SE	NW	4	38	4	552820	4682570	Tmbab	BA	54.01	1.14	17.10	5.60	3.68	0.12	3.50	7.26	3.85	1.29	0.50	1.57	99.62	9.69	12.1	811	37.4	130	192	25	63	7.7	21.8	34	79	26	513	23	49	1.6	3.2	19	5.7	2.3	1.7
14	91-46	5.08 +/- 0.13	SE	NE	32	37	4	552140	4684400	Tmbab	BA	54.20	1.15	17.75	3.52	4.50	0.14	4.38	7.87	4.10	1.18	0.50	0.76	100.05	8.52	11.1	920	33.5	118	194	27	64	8.0	22.7	36	71	21	497	22	49	1.7	4.1	21	4.9	2.9	1.8
15	HP94-32	--	NE	SW	10	38	4	554640	4680600	Tmbab	B	50.92	1.06	17.14	0.78	7.25	0.16	7.26	9.33	3.17	0.65	0.25	1.03	99.00	8.84	8.1	588	19.9	83	171	73	307	4.7	17.8	75	62	29	308	10.9	29.6	1.4	1.9	22.9	6.8	--	--
16	HP94-43	--	SE	SW	10	38	4	554560	4680350	Tmbab	B	50.97	1.05	17.59	1.30	7.76	0.15	6.97	9.45	3.35	0.56	0.25	0.83	100.23	9.92	7.5	546	18.9	75	228	109	204	4.9	17.8	11	80	33	248	7.8	20.1	1.0	1.3	28.1	5.1	1.5	1.2
17	HP94-22	--	NE	NW	9	38	4	552980	4681410	Tmbab	B	51.70	0.82	17.57	4.37	4.21	0.15	7.01	8.76	3.67	0.64	0.20	0.50	99.60	9.05	7.3	782	12.7	47	199	171	323	3.1	17.4	76	76	35	307	9.5	29.2	1.5	1.6	31.8	6.1	--	--
18	00-54	--	SW	SE	5	38	4	551920	4681790	Tmbab	B	51.84	0.85	17.53	3.63	5.06	0.14	7.15	8.42	3.46	0.67	0.21	0.62	99.58	9.25	8.6	804	15.8	61	191	146	276	2.8	18.6	85	80	38	317	12	23	<0.5	<0.5	25	4	--	--
19	91-41	--	SE	SW	4	38	4	552830	4681900	Tmbab	B	51.84	0.86	16.64	4.14	4.70	0.14	7.59	8.75	3.41	0.68	0.19	0.58	99.52	9.36	9.7	825	16.1	31	218	128	298	2.5	18.2	55	71	37	336	8	18	1.1	--	24	--	--	--
20	99-22	--	NW	NW	33	37	4	552650	4684800	Tmbab	B	51.87	0.65	15.98	1.05	7.12	0.14	9.66	9.25	2.89	0.44	0.13	0.74	99.92	8.96	1.8	676	12.4	43	214	113	417	3.7	18.9	75	68	34	151	6	17	0.9	3.6	24	3	--	--
21	HP94-21	--	SW	NE	9	38	4	553240	4681070	Tmbab	BA	53.70	1.03	17.55	3.44	4.21	0.16	5.07	8.24	4.00	1.04	0.44	0.69	99.57	8.12	8.3	1071	18.2	107	178	57	115	6.3	18.6	67	82	21	422	18.1	43.2	1.1	2.7	20.9	6.2	--	--
22	HP94-7D	--	NW	SE	9	38	4	553550	4680760	Tmbab	BA	53.76	1.13	17.29	3.92	4.21	0.15	5.36	8.22	3.76	1.02	0.45	0.49	99.76	8.60	8.9	1010	21	121	185	58	91	6.5	19.6	60	79	41	373	16.9	44	0.8	0.9	21.5	4.7	--	--
23	02-47	--	NE	NE	20	37	4	552030	4687940	Tmbab	BA	53.78	1.10	17.46	4.14	3.82	0.15	4.32	7.64	3.93	1.16	0.49	1.25	99.24	8.39	10.8	872	22.9	137	183	36	64	9.0	20.4	81	75	25	506	22	44	<0.5	1.7	23	5	--	--
24	HP94-9	--	SE	NE	9	38	4	553740	4680950	Tmbab	BA	54.17	1.14	17.46	3.38	4.71	0.16	5.36	8.27	3.96	1.03	0.46	0.67	100.77	8.61	12.1	837	29.8	151	142	30	46	8.7	21.4	35	68	18	498	20.2	51.2	0.7	1.6	17.6	7.4	--	--
25	HP94-41	--	SW	SW	10	38	4	554150	4680080	Tmbab	BA	54.26	1.13	17.91	2.99	4.71	0.16	3.85	7.63	4.16	1.21	0.56	0.66	99.23	8.22	9.1	809	25	148	215	38	45	8.7	20.8	58	81	23	514	22.8	49.5	1.2	1.7	20.1	12.2	--	--
26	99-23	--	NW	NE	5	38	4	551580	4683130	Tmbab	BA	54.28	1.15	17.68	3.87	4.18	0.13	3.71	7.54	4.10	1.26	0.50	1.54	99.94	8.52	9.1	792	26.5	136	195	27	45	8.9	22.7	70	79	23	439	20	38	1.0	4.0	20	6	--	--
27	99-4	--	SE	NE	29	37	4	552040	4685850	Tmbab	BA	54.29	1.12	17.57	2.83	4.94	0.14	4.54	7.76	4.05	1.16	0.50	1.19	100.09	8.32	7.1	873	22.6	124	190	35	63	9.0	22.6	102	70	23	472	21	39	1.1	5.4	20	6	--	--
28	HP94-48	--	NW	SE	16	38	4	553190	4679030	Tmbab	BA	54.38	1.12	17.46	3.12	4.71	0.15	4.27	7.58	4.12	1.26	0.57	0.66	99.40	8.35	12.2	843	23.3	152	142	31	53	8.3	21.2	39	76	17	512	20.4	49.2	1.5	1.1	19.2	6.9	--	--
29	HP94-52	--	SW	NW	9	38	4	552440	4681000	Tmbab	BA	54.45	1.10	17.57	2.98	4.70	0.15	3.94	7.52	4.13	1.25	0.55	0.89	99.23	8.20	11.4	822	28.2	148	152	26	66	8.5	20.4	69	72	18	546	22.8	48.4	0.3	1.8	18.5	8	--	--
30	00-59	--	SW	SE	33	37	4	553190	4683430	Tmbab	BA	54.53	1.15	17.78	3.10	4.80	0.15	3.93	7.65	4.03	1.26	0.50	0.74	99.62	8.43	11.6	812	24.1	149	184	32	59	7.1	20.8	77	82	21	478	22	43	0.6	<0.5	22	7	--	--
31	94-19	--	NW	NW	15	38	4	554230	4679890	Tmbab	BA	54.62	1.12	17.73	2.92	5.02	0.14	4.22	7.74	4.18	1.27	0.54	0.53	100.03	8.50	12.2	831	25	130	189	26	54	6.9	19.9	56	83	18	521	--	51	<.5	<.5	22	--	2.6	1.8
32	00-45	--	SW	SW	21	37	4	552660	4686590	Tmbab	BA	54.67	0.94	18.35	3.14	4.56	0.12	3.76	7.45	3.75	1.02	0.21	1.70	99.67	8.21	14.9	631	35	104	172	30	60	5.3	19.2	69	74	26	434	16	29	<0.5	0.8	23	5	--	--
33	99-6	--	NE	SE	29	37	4	552140	4685410	Tmbab	BA	54.71	1.00	18.36	2.77	5.25	0.14	4.05	7.19	4.17	0.92	0.24	1.42	100.22	8.60	10.5	648	20.9	83	204	38	30	5.1	22.1	87	78	25	373	11	23	1.4	6.0	21	4	--	--
34	00-56	--	SE	NE	4	38	4	553660	4682820	Tmbab	BA	54.72	1.13	17.57	2.91	5.07	0.14	4.03	7.58	4.04	1.25	0.49	0.69	99.62	8.54	11.0	851	22.7	144	176	38	65	7.8	20.7	78	81	23	497	20	42	<0.5	3.3	20	7	--	--
35	99-11	--	SE	SW	33	37	4	553110	4683620	Tmbab	BA	54.75	1.14	17.61	2.72	5.32	0.14	4.31	7.73	4.16	1.23	0.49	0.61	100.21	8.63	8.7	801	22.1	132	185	28	53	9.1	22.9	43	73	22	481	20	41	1.6	4.7	18	6	--	--
36	HP94-19	--	SE	SE	9	38	4	553990	4680260	Tmbab	BA	54.77	1.12	17.67	2.91	4.71	0.15	3.96	7.66	4.21	1.29	0.54	0.62	99.61	8.14	11.7	829	24	148	131	28	58	8.1	20.7	23	68	18	521	19.3	42.2	0.6	2.6	18.5	8.4	--	--
37	HP94-18C	--	NW	NW	15	38	4	554230	4679890	Tmbab	BA	54.81	1.11	17.65	3.15	4.54	0.15	3.90	7.61	4.23	1.31	0.56	0.89	99.91	8.20	11.9	798	24.2	145	173	35	49	8.6	19.5	101	80	17	482	18.8	43.5	1.2	1.8	19.1	6.2	--	--
38	99-13	--	NW	NW	3	38	4	554340	4683230	Tmbab	BA	54.96	0.96	17.68	3.38	4.32	0.13	4.63	7.99	4.11	0.97	0.29	0.65	100.07	8.18	10.3	776	18.8	94	210	36	76	6.7	22.5	87	76	24	421	14	30	1.1	5.3	21	8	--	--
39	00-61	--	SW	SE	32	37	4	551700	4683590	Tmbab	BA	55.81	0.93	19.11	3.04	4.06	0.11	2.62	7.44	4.25	1.20	0.22	0.89	99.68	7.55	19.1	748	21.2	102	186	22	36	3.8	20.6	96	72	18	470	12	23	0.5	1.5	19	7	--	--
40	00-60	--	NE	SW	33	37	4	552810	4683860	Tmbab	BA	55.91	0.92	19.07	3.23	3.81	0.11	2.70	7.53	4.26	1.22	0.23	0.63	99.62	7.46	19.6	746	20.6	103	194	23	40	3.8	21.0	91	75	19	481	9	24	0.9	0.7	21	7	--	--
41	00-31	--	NW	SE	4	38	4	553390	4682250	Tmbab	BA	56.37	0.99	17.29	3.28	4.15	0.14	3.93	6.86	4.16	1.40	0.31	0.92	99.80	7.89	18.0	819	27.7	127	138	46	62	6.6	20.2	47	68	24	664	18	40	0.6	1.3	19	5	--	--
42	00-57	--	SW	NW	3	38	4	554060	4682710	Tmbab	BA	56.70	0.99	17.40	2.65	4.54	0.14	3.81	6.72	4.16	1.43	0.32	0.68	99.54	7.70	20.7	785	28.8	141	164	48	92	5.9	20.6	84	78	22	624	5	12	<0.5	1.2	19	7	--	--
43	00-55	--	NW	NW	4	38	4	552710	4682950	Tmbab	BA	56.90	0.97	17.21	3.23	4.03	0.13	3.84	6.77	4.16	1.41	0.32	0.55	99.52	7.71	21.7	792	24.2	135	161	46	80	5.5	20.5	77	80	22	602	18	34	1.6	0.5	22	7	--	--
44	91-84	5.77 +/- 0.09	SE	NE	19	38	5	560640	4677920	Tmaob	A	57.41	0.78	17.50	4.27	2.49	0.08	3.08	6.46	4.13	1.25	0.25	1.82	99.52	7.04	9.7	1014	23.3	72	144	25	30	3.7	22.9	0	53	22	404	14	28	0.3	4.1	15	4.6	1.6	1.6
45	BS94-102	--	SW	NW	20	38	5	560680	4677920	Tmaob	BA	56.47	0.79	18.98	3.02	4.02	0.12	3.75	7.24	4.07	1.06	0.17	0.53	100.22	7.49	7.4	1003	16.2	64	149	23	14	3.9	20.3	36	67	18	297	9.5	22.5	0.5	--	15.4	4.9	1.4	0.9
46	94-8	--	SW	NW	20	38	5	560960	4677720	Tmaob	BA	56.91	0.74	18.72	3.33	3.62	0.13	3.21	6.84	3.88	0.98	0.22	0.97	99.55	7.35	5.4	1118	13.8	75	132	12	16	2.7	20.4	78	63	18	348	9	20	1.4	0.9	13	3	--	--
47	94-35	--	SE	SW	17	38	5	561420	4678600	Tmaob	A	57.10	0.77	19.00	2.70	4.08	0.13	3.47	7.11	4.14	1.06	0.21	0.91	100.68	7.23	6	1096	19.1	48	153	15	12	2.0	20.4	54	65	11	342	--	22	0.6	<.5	15	--	2.2	1.1
48	BS94-31	--	SW	NW	20	38	5	560990	4677800	Tmaob	A	57.39	0.72	19.33	3.08	3.69	0.11	2.96	6.88	4.18	1.09	0.21	0.72	100.36	7.18	6.7	1082	13.4	72	108	11	11	3.8	20.7	92	67	15	297	9.4	22.7	0.8	1.1	12.2	4.9	0.9	1.7
49	BS94-97	--	NW	NE	20	38	5	561470	4678230	Tmaob	A	57.85	0.72	19.50	2.64	4.06	0.12	2.92	6.63	4.18	1.07	0.21	0.93	100.83	7.15	6.7	1060	14.2	73	122	9	17	3.6	20.4	92	68	17	294	9.8	24.6	0.1	--	14.6	5.4	1.4	0.9
50	BS94-103	--	SW	NE	19	38	5	559930	4677950	Tmaob	A	58.00	0.73	19.08	3.44	3.18	0.12	3.04	7.80	4.28	1.16	0.20	0.77	101.80	6.97	3	534	23.3	60	225	87	15	3.8	15.2	69	66	32	148	6.7	21.1	--	0.1	38.8	5	1.4	1
51	99-14	4.51 +/- 0.01[a]	NE	NE	17	38	4	551960	4680020	Tpbmp	B	51.38	1.14	16.66	2.70	5.59	0.15	7.70	8.96	3.48	1.10	0.46	0.57	99.89	8.92	7.4	976	17.9	114	219	101	236	7.9	21.4	71	77	31	691	22	44	1.6	6.0	22	6	--	--
52	99-25	--	NW	NE	20	38	4	551740	4678100	Tpbmp	B	51.25	1.12	16.77	1.76	6.56	0.14	7.19	9.12	3.47	1.11	0.46	0.83	99.78	9.05	8.0	959	17.8	118	216	86	220	7.9	21.6	72	76	30	657	18	45	2.6	6.2	22	6	--	--
53	04-3	--	NE	NW	11	37	4	556290	4691070	Tpafl	A	58.20	0.83	17.34	3.28	3.13	0.11	4.00	6.53	3.94	1.33	0.24	0.69	99.62	6.76	20.6	844	17.6	120	126	50	63	4.1	19.7	253	61	19	502	--	--	<0.5	3.3	14	5	--	--
54	HC91-57	--	NE	NW	11	37	4	556070	4691180	Tpafl	A	58.20	0.85	17.37	3.99	2.67	0.11	3.48	5.98	4.06	1.41	0.23	2.10	100.45	6.96	22	827	30	115	145	44	82	--	--	--	--	23	485	24	35	--	--	17	--	--	--
55	HC91-60	--	NW	NE	11	37	4	556410	4691300	Tpafl	A	58.32	0.83	17.17	3.76	2.78	0.11	3.93	6.48	4.08	1.38	0.22	0.91	99.97	6.85	18	848	18	111	138	55	80	--	--	--	--	21	469	16	28	--	--	17	--	--	--
56	91-69	3.42 +/- 0.06	SE	NE	16	37	4	553580	4689270	Tpais	BA	56.77	1.01	17.15	3.30	4.10	0.12	4.02	6.96	4.01	1.49	0.26	0.58	99.77	7.86	24.8	599	34	132	181	38	91	5.3	21.2	90	73	22	478	15	33	1.7	4.8	23	6.1	1.8	1.5

(continued on next page)

Table 1 (page 2).

Map no.	Sample no.	K-Ar Age Ma	1/4 of 1/4	1/4	Sec.	T. (S.)	R. (E.)	UTM E m	UTM N m	Unit	Lith.	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI (%)	Total (%)	Fe_2O_3T	Rb	Sr	Y	Zr	V	Ni	Cr	Nb	Ga	Cu	Zn	Co	Ba	La	Ce	U	Th	Sc	Pb	Yb	Be
57	91-68	3.38 +/- 0.06	SE	NE	24	37	4	558550	4687570	Tpais	A	58.07	0.84	17.54	3.02	3.82	0.12	3.40	6.56	4.67	1.32	0.18	0.86	100.40	7.27	23.6	640	26.6	98	158	17	48	4.2	21.6	57	69	23	455	16	31	2.4	3.4	17	7.2	1.9	1.7
58	91-67	--	NE	SE	23	37	4	556910	4687000	Tpais	BA	54.64	0.96	18.38	3.25	4.57	0.14	3.95	7.32	4.24	0.95	0.23	0.73	99.36	8.33	13.4	668	32.6	92	150	33	53	4.9	20.3	31	71	21	386	13	25	1.8	2.9	20	6	--	--
59	99-7	--	SW	SE	21	37	4	553230	4686750	Tpais	BA	54.74	0.99	18.13	2.33	5.59	0.15	3.97	7.26	4.22	0.96	0.24	1.09	99.67	8.54	11.8	647	22.9	82	195	35	29	4.7	22.2	53	74	24	417	12	29	1.1	4.6	19.4	6	--	--
60	99-19	--	SW	NW	21	37	4	552470	4687640	Tpais	BA	54.80	1.01	18.10	2.98	5.20	0.15	4.21	7.24	4.17	0.95	0.24	1.00	100.05	8.76	12.1	644	26.2	84	201	39	39	4.9	22.0	112	73	23	374	15	22	1.6	4.7	19	4	--	--
61	00-11	--	NE	NE	22	37	4	555430	4687730	Tpais	BA	55.01	1.02	17.88	5.20	3.26	0.14	3.96	7.07	4.22	1.07	0.26	1.04	100.13	8.82	13.8	643	29.4	92	199	45	24	6.1	18.0	97	79	26	420	13	26	0.7	1.0	22	4	--	--
62	00-13	--	SW	SE	23	37	4	556490	4686600	Tpais	BA	55.04	1.03	18.04	4.15	4.31	0.14	3.97	7.20	4.21	1.01	0.24	1.15	100.49	8.94	12.3	669	40	91	186	44	19	5.7	19.0	124	74	25	412	5.7	18.9	<0.5	1.0	22	--	--	--
63	99-20	--	SW	NW	22	37	4	554190	4687560	Tpais	BA	55.08	0.98	18.52	2.95	4.71	0.14	3.82	7.22	4.25	0.97	0.23	1.14	100.01	8.18	12.7	650	27.4	85	186	30	48	4.5	22.2	63	70	22	393	18	25	1.1	4.7	19	5	--	--
64	91-72	--	SE	NE	23	37	4	556820	4687590	Tpais	BA	55.19	1.02	17.68	3.72	4.47	0.14	4.20	7.27	4.14	1.01	0.23	0.57	99.64	8.69	17.4	641	27.4	80	194	31	74	3.2	19.6	55	76	24	401	12	26	0.7	0.6	20		--	--
65	91-64	--	NE	NW	28	37	4	553110	4686270	Tpais	BA	55.23	1.00	17.84	3.43	4.62	0.13	4.17	7.72	3.78	1.07	0.21	0.80	100.00	8.56	19.1	628	33.4	80	198	21	64	4.0	19.1	67	76	24	409	14	28	--	1.7	22	--	--	--
66	84-17	--	SW	SW	14	37	4	555800	4688460	Tpais	BA	55.66	1.00	17.76	3.86	4.21	0.15	4.11	7.03	3.97	1.02	0.26	0.61	99.64	8.54	16.3	632	20	91	186	35	28	4.3	18.7	47	74	24	420	9	21	1.2	1.2	22	4	--	--
67	91-70	--	SE	NE	16	37	4	553880	4689220	Tpais	BA	56.02	0.93	17.43	4.45	3.00	0.13	4.09	7.05	4.12	1.44	0.25	0.61	99.52	7.78	22.8	585	25.5	140	162	46	121	6.8	19.1	82	70	21	443	11	31	2.4	4.3	20	6	--	--
68	00-24	--	NE	NW	32	37	5	560970	4684850	Tpais	BA	56.03	0.75	17.04	2.69	4.06	0.12	6.32	7.42	3.61	1.03	0.24	0.76	100.07	7.20	9.8	903	20.9	118	131	160	281	6.0	18.6	63	66	28	474	17	36	1.4	1.2	18	4	--	--
69	91-74	--	SW	SW	19	37	5	559090	4686790	Tpais	BA	56.31	0.79	18.74	2.28	4.51	0.13	3.53	6.87	4.18	1.16	0.18	0.85	99.53	7.29	21.2	654	25.2	104	149	35	76	5.1	20.1	219	129	18	421	9	29	1.5	3.4	19	9	--	--
70	99-3	--	SW	SW	16	37	4	552580	4688300	Tpais	BA	56.48	1.00	17.10	3.12	4.42	0.13	4.15	6.45	4.00	1.50	0.26	1.74	100.35	8.03	22.9	551	24.2	140	160	41	75	6.3	21.9	110	72	23	500	15	33	2.4	5.1	18	10	--	--
71	00-34	--	SE	SE	16	37	4	553690	4688500	Tpais	BA	56.55	1.01	17.06	2.85	4.76	0.13	4.14	6.89	4.00	1.53	0.26	0.87	100.05	8.14	26.0	605	32.4	145	169	47	71	6.6	18.8	83	74	24	563	18	37	<0.5	1.6	22	--	--	--
72	91-62	--	NW	NE	21	37	4	553220	4688090	Tpais	BA	56.67	1.03	16.67	3.70	3.77	0.12	4.40	7.04	3.98	1.51	0.20	0.59	99.68	7.89	25.4	596	29.2	137	185	37	83	4.3	18.8	95	78	25	482	15	37	1.2	2.6	21	--	--	--
73	HC91-53	--	NE	NW	10	37	4	554620	4689640	Tpais	BA	56.83	1.03	17.06	4.15	3.50	0.13	3.81	6.81	3.85	1.57	0.26	1.04	100.04	8.04	21	495	39	138	182	29	72	--	--	--	--	27	518	24	37	--	--	21	--	--	--
74	91-71	--	SE	NE	16	37	4	553880	4689220	Tpais	BA	56.87	1.03	17.18	4.60	3.36	0.12	3.88	6.70	3.88	1.54	0.24	1.18	100.58	8.33	25	602	27	145	182	50	80	--	--	--	--	27	488	17	34	--	--	21	--	2.1	1.7
75	00-30	--	NE	SW	36	37	4	557950	4683980	Tpais	A	57.30	0.87	17.48	3.51	3.05	0.11	3.75	6.80	4.01	1.42	0.25	1.09	99.64	6.90	19.5	1216	24.7	130	144	53	63	6.4	19.2	59	68	23	573	20	45	1.0	2.5	16	5	--	--
76	00-10	--	SE	NE	15	37	4	555200	4689050	Tpais	A	58.08	0.85	17.19	3.53	3.09	0.11	3.49	6.09	4.27	1.61	0.20	1.75	100.26	6.96	26.9	676	23.6	127	144	45	46	6.3	20.0	68	77	21	536	17	31	1.2	3.1	18	10	--	--
77	91-81	--	SE	SE	35	37	4	557050	4683690	Tpais	A	58.56	0.89	16.97	3.58	2.98	0.11	3.49	6.61	3.86	1.47	0.24	1.23	99.99	6.89	21.4	1152	29.1	111	147	36	74	4.2	19.8	91	70	20	504	30	50	1.6	2.1	16		--	--
78	00-14	--	NE	NW	25	37	4	557620	4686180	Tpais	A	58.94	0.72	17.90	3.69	2.53	0.10	3.14	6.04	4.10	1.20	0.20	1.70	100.26	6.50	11.5	809	16.3	101	127	32	31	5.6	21.3	31	59	18	388	13	26	<0.5	1.1	16	6	--	--
79	00-8	--	NE	NE	30	37	5	560150	4686490	Tpais	A	58.94	0.71	17.94	5.11	1.25	0.10	3.36	6.45	4.16	1.19	0.19	0.88	100.28	6.50	11.5	816	21.2	100	136	34	29	6.0	21.6	30	61	19	430	15	30	0.6	2.4	15	6	--	--
80	84-18	--	NE	NW	26	37	4	556330	4686490	Tpais	A	59.16	0.69	17.95	2.94	2.68	0.10	3.49	6.14	3.82	1.12	0.20	1.24	99.53	5.92	13.0	840	14.1	100	133	30	33	4.1	19.2	22	55	14	403	11	25	2.7	0.6	14	2	--	--
81	00-9	--	NE	NE	25	37	4	558400	4686350	Tpais	A	59.39	0.71	17.94	3.32	2.62	0.10	3.34	6.51	4.18	1.22	0.20	0.81	100.34	6.23	12.8	855	16.7	101	130	36	32	5.4	21.5	32	62	17	411	10	21	0.6	1.5	16	5	--	--
82	91-88	--	SW	SW	32	37	5	560890	4683450	Tpais	A	59.39	0.72	17.97	2.76	3.14	0.10	3.34	6.54	3.92	1.11	0.18	0.97	100.14	6.25	12.4	820	18.7	82	150	23	49	3.3	20.0	40	62	17	388	13	26	0.5	0.8	16	--	--	--
83	91-66	--	NE	SE	26	37	4	556850	4685670	Tpais	A	59.42	0.72	17.87	3.30	2.77	0.10	3.29	6.11	3.89	1.23	0.18	1.21	100.09	6.38	14.5	797	26.4	88	143	24	50	3.2	19.6	37	63	18	452	16	28	--	0.6	15	--	--	--
84	00-7	--	SE	SW	29	37	5	561040	4685230	Tpais	A	59.89	0.59	18.28	2.36	3.15	0.09	2.88	6.14	4.12	1.06	0.15	1.40	100.11	5.86	8.8	780	16.9	81	110	18	16	4.5	22.0	53	53	15	353	12	22	0.5	1.1	12	3	--	--
85	91-39	2.92 +/- 0.07	NE	NE	6	38	5	560440	4683260	Tpbdp	B	50.01	0.99	16.07	2.64	6.07	0.15	9.38	9.88	2.95	0.58	0.31	0.39	99.42	9.39	5.1	737	23.8	80	198	151	356	3.4	18.5	48	69	42	277	15	33	1.8	2.1	30	3.8	1.9	1.4
86	91-76[1]	2.77 +/- 0.05	SE	SE	30	37	5	560490	4685330	Tpbdp	B	50.04	0.95	14.97	3.63	5.01	0.15	10.63	9.82	2.67	0.77	0.33	0.72	99.69	9.20	8.3	981	21.1	74	201	184	529	4.4	18.2	59	70	42	369	16	34	0.8	3.5	29	5.4	1.7	1.3
87	94-21A	2.96 +/- 0.11	NW	NE	10	38	4	554840	4681640	Tpbdp	B	50.09	0.88	16.70	4.08	4.97	0.15	8.21	10.02	3.23	0.71	0.33	1.18	100.55	9.60	8.5	875	18.3	64	233	76	341	6.9	21.4	78	80	27	305	17	40	1.7	6.0	28	3.5	2.0	1.4
88	94-20	3.16 +/- 0.12	NW	SW	11	38	4	555670	4680730	Tpbdp	B	51.86	1.04	16.76	5.30	3.08	0.13	6.85	9.16	3.92	1.11	0.44	0.49	100.14	8.72	11.9	1283	17	104	225	54	192	8.3	23.6	80	94	23	476	25.6	50.3	1.8	6.5	19	4.1	1.7	1.7
89	99-16	3.19 +/- 0.01	SW	SW	3	38	4	554340	4681850	Tpbdp	BA	52.45	0.96	17.14	3.47	4.36	0.13	6.50	9.01	3.79	0.89	0.32	0.51	99.53	8.32	7.6	1018	15.6	96	205	40	167	6.5	22.3	89	67	23	348	18	32	2.1	6.4	20	4	--	--
90	94-21B	--	NW	NE	10	38	4	554840	4681640	Tpbdp	B	48.77	1.07	18.20	2.91	6.36	0.15	7.87	10.56	2.86	0.21	0.10	1.84	100.90	9.98	2.6	517	24.9	52	216	93	204	1.3	17.0	79	66	31	124	--	12	0.6	<.5	40	--	2.8	0.9
91	00-27	--	SW	SW	35	37	4	555760	4683490	Tpbdp	B	49.60	1.00	14.96	4.02	4.69	0.15	11.10	8.87	2.80	1.00	0.38	1.07	99.64	9.23	6.2	997	27.7	128	187	389	636	6.1	16.0	83	76	45	572	30	59	0.7	2.2	29	6	--	--
92	00-15	--	NE	NE	35	37	4	557110	4684620	Tpbdp	B	49.96	1.02	16.81	4.18	4.41	0.15	7.66	10.50	2.78	0.82	0.35	1.36	100.00	9.08	4.3	1119	20.2	97	202	101	294	6.9	17.3	54	69	35	483	18	39	<0.5	0.6	31	6	--	--
93	91-40	--	NE	NE	1	38	4	557230	4683250	Tpbdp	B	50.04	1.00	17.32	5.07	3.89	0.15	8.01	9.82	2.93	0.60	0.29	1.34	100.46	9.39	6.5	708	43	80	205	124	352	3.5	17.1	54	71	32	378	--	35	<.5	1.3	35	--	--	--
94	91-80	--	SE	SE	35	37	4	557080	4683640	Tpbdp	B	50.14	1.06	15.79	2.98	5.94	0.15	9.14	8.95	3.07	0.86	0.36	0.86	99.30	9.58	8.5	857	24.1	100	211	226	525	3.8	16.5	72	72	41	408	17	39	0.7	2.8	9	--	--	--
95	91-65	--	NE	SE	26	37	4	556940	4685360	Tpbdp	B	50.42	1.03	16.26	2.60	5.62	0.14	8.06	10.41	2.77	0.85	0.37	0.92	99.45	8.85	7.8	1093	24.2	78	225	101	347	3.4	17.6	70	70	37	500	20	43	0.5	0.6	32	--	--	--
96	91-77	--	SE	NW	30	37	5	559350	4685990	Tpbdp	B	50.48	0.95	15.56	1.95	6.45	0.15	9.66	10.16	2.59	0.69	0.30	0.60	99.54	9.12	6.2	993	21.3	70	213	162	494	3.2	16.1	106	69	42	370	18	38	--	2.1	33	--	--	--
97	HP94-1Q	--	NW	NE	10	38	4	554860	4681580	Tpbdp	B	50.69	0.87	16.58	3.61	4.85	0.15	7.84	10.40	3.51	0.74	0.36	0.56	100.16	9.00	8.8	879	13.8	86	185	71	231	6.4	19.1	78	69	25	284	20.1	47.6	1.3	6.3	21.9	6.5	--	--
98	94-11	--	SE	NE	1	38	4	558690	4682630	Tpbdp	B	50.72	0.97	16.93	2.07	6.17	0.16	8.05	9.82	2.79	0.60	0.32	0.99	99.59	8.93	5.2	731	19.7	94	212	125	318	3.7	16.3	70	70	35	299	12	28	<0.5	1.0	30	3	--	--
99	91-78	--	NW	SE	31	37	5	560010	4683910	Tpbdp	B	50.73	0.99	15.77	4.44	4.02	0.15	8.37	10.22	2.57	0.73	0.29	1.18	99.46	8.91	7.1	1049	21.3	71	207	126	394	3.0	17.5	56	71	39	394	20	40	1.2	--	33	--	--	--
100	HP94-29	--	SE	NE	10	38	4	555250	4681010	Tpbdp	B	50.77	0.87	16.62	4.29	4.21	0.15	7.81	10.26	3.54	0.78	0.38	0.56	100.24	8.97	8.5	872	13.7	89	203	86	312	6.7	18.6	76	79	28	307	19.1	43.8	1.1	5.3	24	5.9	--	--
101	00-26	--	SE	NE	3	38	4	555470	4682500	Tpbdp	B	51.87	0.99	17.00	4.10	4.13	0.14	7.13	9.00	3.63	0.94	0.34	0.52	99.79	8.69	8.2	1029	18.4	107	213	74	190	6.5	19.2	91	81	36	417	18	40	0.9	2.5	23	5	--	--
102	91-82	--	NW	NE	3	38	4	555420	4683230	Tpbdp	BA	52.04	1.03	17.06	3.45	4.46	0.13	6.56	9.06	3.78	0.96	0.33	0.55	99.41	8.41	11	1053	19.2	87	219	43	174	4.8	19.5	76	74	29	406	19	39	1.0	3.1	24	--	--	--
103	HP94-23	--	NW	SW	11	38	4	555700	4680690	Tpbdp	BA	52.05	1.05	17.01	4.45	3.58	0.13	6.57	8.90	3.94	1.15	0.47	0.93	100.23	8.43	12.3	1163	14.6	131	202	46	180	7.1	21.3	35	85	24	462	26.5	57	2.6	6.0	22.6	5.5	--	--
104	HP94-31	--	NW	SE	10	38	4	554910	4680790	Tpbdp	BA	52.42	1.13	17.54	4.68	4.21	0.16	5.95	8.34	3.56	0.80	0.38	0.50	99.67	9.36	9.9	634	19.7	101	182	80	203	6.1	19.4	70	75	26	389	11.6	34.3	0.7	2.6	22.4	8.1	--	--
105	00-29	--	NW	SW	35	37	4	555950	4683960	Tpbdp	BA	53.37	0.75	17.18	2.83	4.86	0.13	6.44	9.31	3.25	0.64	0.17	0.96	99.89	8.23	1.9	893	14.7	51	187	35	200	3.9	17.1	68	60	30	279	4	14	<0.5	1.1	24	4	--	--
106	91-63	2.96 +/- 0.06	SW	SW	26	37	4	555760	4685200	Tpbcb	BA	53.83	0.73	17.36	3.10	4.22	0.12	6.41	9.41	3.38	0.66	0.16	0.55	99.93	7.79	7.4	905	14.6	35	210	28	216	3.0	20.9	91	65	30	224	9	21	0.7	3.7	23	4.3	1.0	1.3
107	91-45	--	NE	SE	33	37	4	553630	4684110	Tpbcb	BA	52.63	0.70	16.70	3.38	4.81	0.13	7.72	9.54	3.07	0.48	0.13	0.97	100.26	8.73	5.4	707	18	54	217	63	325	1.2	17.1	64	64	27	183	--	22	0.9	<.5	31	--	--	--
108	84-19	--	NE	SW	26	37	4	556300	4685480	Tpbcb	BA	52.97	0.69	16.72	2.91	4.93	0.15	7.29	9.52	2.90	0.47	0.15	0.84	99.54	8.39	5.0	712	11.7	51	208	63	283	2.5	17.0	71	64	31	178	6	15	<0.5	1.5	24	2	--	--
109	99-10	--	SE	SW	34	37	4	554460	4683550	Tpbcb	BA	53.47	0.70	17.31	1.57	6.10	0.14	6.86	9.64	3.27	0.53	0.14	0.74	100.47	8.35	3.4	775	10.9	45	212	42	249	4.0	20.8	81	62	28	215	8	15	0.6	5.1	25	3	--	--
110	00-32	--	NE	NW	27	37	4	554470	4686420	Tpbcb	BA	53.53	0.73	17.22	3.26	4.42	0.13	6.45	9.22	3.25	0.64	0.17	1.05	100.07	8.17	2.9	907	27.4	52	199	39	211	4.4	17.7	47	64	29	280	14	28	<0.5	0.8	24	5	--	--
111	00-33	--	SW	SE	22	37	4	555010	4686660	Tpbcb	BA	53.58	0.74	17.36	2.91	4.65	0.13	6.40	9.23	3.36	0.66	0.17	0.77	99.96	8.08	2.0	925	17.2	53	193	37	185	3.8	18.0	69	61	30	291	7	18	<0.5	0.8	23	3	--	--
112	00-12	--	SE	SW	23	37	4	556070	4686670	Tpbcb	BA	53.82	0.74	17.33	4.34	3.29	0.12	6.42	8.93	3.48	0.72	0.17	1.03	100.39	8.00	2.6	958	22.4	58	196	48	196	5.1	20.6	74	65	30	286	15	29	<0.5	1.3	23	4	--	--
113	00-44	--	SW	SW	28	37	4	552490	4685080	Tpbcb	BA	54.42	0.77	17.12	3.82	3.24	0.11	5.93	8.59	3.63	0.94	0.22	0.77	99.56	7.42	7.2	1147	14.6	96	169	45	157	4.9	19.2	93	68	28	404	16	34	<0.5	2.2	22	5	--	--
114	00-28	--	SW	NW	35	37	4	555900	4684210	Tpbcb	BA	54.44	0.77	17.31	4.45	2.77	0.12	5.82	8.53	3.63	0.89	0.21	0.98	99.92	7.53	5.4	1108	14.5	75	184	43	154	4.5	19.9	81	62	28	400	15	32	<0.5	2.5	19	7	--	--
115	99-9	--	SE	NW	33	37	4	552850	4684430	Tpbcb	BA	54.63	0.82	17.10	3.45	3.70	0.12	6.14	8.21	3.67	1.01	0.26	1.37	100.48	7.56	6.5	1092	12	92	196	39	151	5.6	22.4	72	64	24	369	17	34	2.8	6.4	19	4	--	--
116	99-12	--	NW	SE	34	37	4	555060	4683870	Tpbcb	BA	54.68	0.79	17.28	4.25	2.90	0.11	5.92	8.23	3.69	0.94	0.23	1.25	100.27	7.47	6.5	1026	12	78	196	37	162	5.3	22.0	48	63	25	318	15	34	1.9	5.9	19	4	--	--
117	99-21	--	SW	SE	28	37	4	553160	4685110	Tpbcb	BA	54.78	0.79	17.18	4.13	2.78	0.11	5.74	8.34	3.77	0.98	0.25	0.94	99.79	7.22	7.9	1092	20.4	85	191	35	153	4.9	22.3	61	57	23	361	18	34	1.8	6.3	18	4	--	--
118	99-8	--	SW	NE	28	37	4	553500	4685790	Tpbcb	BA	54.79	0.80	17.27	3.29	3.56	0.11	5.87	8.22	3.75	0.99	0.25	1.22	100.12	7.25	7.3	1100	11.8	85	193	41	160	5.4	22.0	75	61	25	317	19	33	1.5	6.5	20	6	--	--
119	AL94-51	2.63 +/- 0.32	SW	NW	12	38	4	557540	4681090	Tpbao	BA	52.75	0.93	18.08	2.30	5.81	0.14	5.37	8.13	3.68	0.41	0.25	1.60	99.45	8.76	3.8	683	19.2	78	175	73	153	5.5	20.5	69	73	25	401	13.7	31.9	0.9	2.1	23	8.9	1.8	1
120	91-85	2.78 +/- 0.10	SW	NW	19	38	5	559350	4677750	Tpbao	BA	54.08	0.91	17.16	3.06	5.09	0.14	6.28	8.41	3.39	0.65	0.21	0.41	99.79	8.72	11.4	557	21.4	67	194	82	178	4.1	20.8	75	69	32	316	10	24	0.8	4.5	23	4.6	1.7	1.4

[1] Sample 91-76 has elements that were not measured for the other samples (values in ppm) (Hf =2.5, Ta =0.3, Nd=18, Sm=3.6, Eu=1.15, Tb=0.5, Lu=0.26)

(continued on next page)

Table 1 (page 3).

Map no.	Sample no.	K-Ar Age Ma	1/4 of 1/4	1/4	Sec.	T. (S.)	R. (E.)	UTM E m	UTM N m	Unit	Lith.	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI (%)	Total (%)	Fe_2O_3T	Rb	Sr	Y	Zr	V	Ni	Cr	Nb	Ga	Cu	Zn	Co	Ba	La	Ce	U	Th	Sc	Pb	Yb	Be
121	AL94-57	--	SE	NW	12	38	4	557700	4681220	Tpbao	B	50.86	1.05	17.72	3.55	5.85	0.15	6.89	8.94	3.48	0.55	0.21	1.07	100.32	10.05	7.9	563	21.4	78	254	133	213	4.7	18.0	33	75	34	239	9.3	22.3	0.8	1.1	25.8	6.9	1.5	1.2
122	HP94-58	--	NE	NE	11	38	4	557200	4681590	Tpbao	B	50.95	1.03	17.60	2.12	6.66	0.16	7.72	8.63	3.25	0.55	0.23	1.14	100.04	9.52	7	511	19	83	182	141	309	4.8	17.5	67	71	33	314	8.4	25.3	--	2.3	26.5	7.5	--	--
123	AL94-43	--	SE	NE	13	38	4	558680	4679300	Tpbao	B	50.97	1.05	17.59	1.30	7.76	0.15	6.97	9.45	3.35	0.56	0.25	0.83	100.23	9.92	7.5	546	18.9	75	228	109	204	4.9	17.8	11	80	33	248	7.8	20.1	1.0	1.3	28.1	5.1	1.5	1.2
124	AL94-48	--	SE	SE	12	38	4	558600	4680120	Tpbao	B	51.03	1.07	17.64	3.42	5.60	0.15	7.12	8.99	3.52	0.55	0.23	0.36	99.68	9.64	6.3	575	19	85	190	119	191	4.7	18.1	43	72	29	240	6.9	24.6	0.3	1.8	24.8	4.8	1.0	1.1
125	BS94-3	--	SW	NW	19	38	5	559110	4677640	Tpbao	BA	52.47	1.13	17.47	1.73	7.10	0.15	6.34	7.99	3.78	0.77	0.35	0.16	99.44	9.62	12	581	22.9	110	175	101	230	6.9	17.7	68	82	31	354	12.7	33	0.6	0.9	21.7	6.8	0.9	2
126	AL94-53	--	SW	SW	13	38	4	557640	4678530	Tpbao	BA	52.76	0.93	17.84	1.65	6.49	0.14	5.44	8.25	3.53	0.72	0.24	1.30	99.29	8.86	12.1	542	18.5	79	156	66	150	5.4	19.4	60	69	25	356	11.6	29.8	0.4	1.9	22.7	7.7	1.6	1.2
127	HP94-37B	--	NE	SW	11	38	4	556180	4680590	Tpbao	BA	52.81	1.03	17.85	2.48	5.70	0.15	5.66	8.21	3.70	0.72	0.34	0.65	99.30	8.81	9	634	20.2	96	174	80	155	6.1	19.5	66	74	42	409	14.7	36.8	1.2	1.2	23.8	8.5	--	--
128	HP94-37	--	NE	SW	11	38	4	556180	4680590	Tpbao	BA	52.85	1.03	17.83	2.62	5.69	0.15	5.66	8.21	3.68	0.73	0.34	0.70	99.49	8.94	7.5	644	23	96	--	89	--	4.9	19.6	70	74	--	--	--	--	1.2	1.2	--	--	--	--
129	AL94-36A	--	NE	SW	14	38	4	556380	4679100	Tpbao	BA	53.56	0.90	18.21	2.47	5.33	0.14	4.88	8.37	3.73	0.71	0.25	0.79	99.34	8.39	9.9	624	20.7	77	173	61	133	5.7	19.7	71	69	23	418	17	28.3	0.7	1.3	22.7	8.2	1.9	1.2
130	AL94-47	--	NW	NW	13	38	4	557540	4679830	Tpbao	BA	53.62	0.95	18.14	1.51	6.55	0.14	5.42	9.01	3.57	0.69	0.24	0.56	100.40	8.79	12.7	528	18.7	78	186	60	158	5.4	19.7	51	69	24	324	11.6	32.5	0.7	2.0	23	8.3	2.0	0.9
131	HP94-4	--	SE	NE	11	38	4	557000	4680880	Tpbao	BA	54.18	0.89	18.17	1.70	5.70	0.14	5.26	8.03	3.87	0.76	0.26	0.84	99.80	8.03	9.8	627	15.9	79	142	71	163	4.6	18.6	58	68	22	386	10.1	33.1	0.9	1.6	18.7	7.9	--	--
132	BS94-104	--	SW	NE	19	38	5	559940	4677800	Tpbao	BA	54.63	0.88	18.75	3.87	3.92	0.13	7.97	7.83	3.77	0.68	0.21	0.49	103.13	8.23	12	589	18.2	76	155	62	138	4.7	18.4	33	70	23	354	11.8	26.2	--	0.8	21	7.4	1.7	1
133	HP94-57	--	SW	SW	11	38	4	555990	4680220	Tpbao	BA	54.68	0.86	17.94	1.64	5.69	0.14	5.16	8.01	3.77	0.75	0.26	0.66	99.56	7.96	11.9	649	19	89	145	67	153	5.1	19.5	74	71	24	377	11.3	23.7	1.2	2.2	20.4	6.9	--	--
134	HP94-34	--	NE	NE	10	38	4	555460	4681330	Tpbao	BA	54.94	0.88	17.86	1.71	5.69	0.14	5.23	7.88	3.72	0.75	0.26	0.74	99.80	8.03	11	650	15	79	105	64	153	4.6	18.9	67	61	19	37	6.9	33.6	0.5	2.1	18	8.8	--	--
135	94-16	1.97 +/- 0.08	SE	NW	23	38	4	556180	4677690	Tpbbm	B	49.71	1.20	18.09	1.39	7.79	0.16	6.74	10.25	3.20	0.47	0.20	1.26	100.46	10.05	6.8	469	30	68	229	57	166	3.1	20.4	66	69	31	246	12	27	2.5	3.8	32	3.8	2.7	1.2
136	AL94-34	--	NW	NW	23	38	4	555950	4678270	Tpbbm	B	49.42	1.29	17.77	2.21	7.75	0.17	6.81	10.50	3.21	0.43	0.18	0.87	100.61	10.82	6.8	458	24.2	65	217	62	163	4.6	19.4	73	64	30	199	8.1	21.1	0.7	--	29.8	6.3	1.7	1.2
137	HP94-62	--	SW	NE	15	38	4	555040	4679280	Tpbbm	B	49.76	1.23	17.74	2.00	7.35	0.17	6.56	10.38	3.30	0.47	0.21	0.91	100.08	10.17	6.1	487	26	78	183	57	133	4.6	19.2	86	61	27	232	7.7	16	1.5	2.0	28	6.6	--	--
138	HP94-13	--	NW	NW	22	38	4	554070	4678350	Tpbbm	B	50.18	1.08	17.45	1.54	7.36	0.17	7.52	10.14	3.04	0.65	0.24	1.11	100.48	9.72	6.3	640	17.3	69	150	68	308	4.3	16.8	73	60	23	281	8.5	25.6	1.4	1.8	20.9	6.7	--	--
139	HP94-42	--	NE	NW	15	38	4	554810	4679980	Tpbbm	B	50.36	1.05	17.63	1.57	7.73	0.16	6.94	9.78	3.21	0.52	0.24	0.91	100.10	10.16	4.9	609	19	83	194	76	324	4.9	18.0	79	66	28	315	12.9	33.4	0.8	2.0	26.2	7.7	--	--
140	HP94-46	--	NW	NW	21	38	4	552400	4678340	Tpbbm	B	50.36	1.06	17.49	1.27	7.35	0.16	7.14	9.91	3.17	0.56	0.23	0.86	99.56	9.44	5.7	605	19.2	76	17	77	317	4.6	18.7	75	63	28	308	12.9	27.4	1.0	3.1	27.4	7.5	--	--
141	99-24	--	NE	NE	20	38	4	552340	4678260	Tpbbm	B	50.48	1.07	17.38	1.00	7.94	0.16	7.23	9.61	3.16	0.59	0.23	1.09	99.94	9.82	4.6	597	22.6	82	219	77	310	5.3	20.7	82	67	31	269	12	23	1.7	4.6	25	5	--	--
142	HP94-49	--	NE	SE	16	38	4	553680	4679120	Tpbbm	B	50.49	1.04	17.54	1.12	7.35	0.16	7.01	9.70	3.17	0.58	0.24	0.83	99.23	9.29	5.2	614	21.3	89	192	67	316	4.7	18.5	74	66	28	283	16.1	23	2.2	2.2	25.2	5.7	--	--
143	94-17	--	SW	NW	23	38	4	556030	4677670	Tpbbm	B	51.00	1.05	17.50	3.02	6.13	0.15	7.87	8.37	3.35	0.53	0.26	0.98	100.21	9.83	4.9	562	25	91	192	137	366	3.3	17.6	33	76	30	320	--	30	<.5	2.2	28	--	2.8	1.2
144	AL94-31	--	NW	NE	23	38	4	556670	4678240	Tpbbm	B	51.34	0.90	17.14	2.46	6.38	0.15	7.97	8.02	3.64	0.66	0.31	0.74	99.71	9.55	9.9	638	20.7	107	162	177	364	5.9	17.0	42	76	31	286	16.6	36.9	0.8	2.5	23.3	5.1	1.5	1.2
145	AL94-36E	--	NE	SW	14	38	4	556250	4679050	Tpbbm	B	51.68	1.00	17.44	2.64	5.87	0.14	7.25	9.02	3.41	0.69	0.26	0.65	100.05	9.16	7.9	654	12	60	174	91	192	4.5	20.2	39	71	30	303	7.2	36.3	0.5	2.1	24.7	6.7	2.4	1.2
146	AL94-38	--	NW	SW	23	38	4	555760	4677560	Tpbbm	B	51.75	0.96	18.13	9.75	--	0.15	6.28	7.60	3.44	0.67	0.33	--	99.06	9.75	10	628	26	122	153	150	319	6.9	17.7	25	80	31	328	19.4	38.4	0.7	2.7	25	5.3	1.7	1.2
147	84-16	0.40 +/- 0.30	SE	SE	8	37	4	552220	4689980	Qbrb	B	51.70	0.95	18.05	2.33	5.88	0.14	6.84	9.98	3.19	0.40	0.13	0.88	100.47	8.86	4.9	811	21.1	53	210	48	146	2.6	20.4	67	58	33	167	12	23	0.5	3.0	26	3.2	1.7	1
148	99-2	--	SE	SW	16	37	4	552930	4688440	Qbrb	B	51.08	0.85	16.41	1.28	6.51	0.14	9.37	9.81	2.66	0.39	0.16	1.51	100.17	8.51	1.8	897	16.6	75	210	172	427	4.3	19.0	75	68	37	193	14	31	1.2	4.3	28	3	--	--
149	99-1	--	NE	NW	21	37	4	553000	4688010	Qbrb	B	51.54	0.86	16.53	2.09	5.74	0.14	9.26	9.73	2.79	0.44	0.16	1.07	100.35	8.47	1.9	913	16.1	73	191	172	435	4.2	18.8	70	62	35	173	9	34	1.0	5.0	26	4	--	--
150	00-58	--	SE	SW	34	37	4	554690	4683320	Qbbb	B	48.39	1.16	17.56	3.25	6.96	0.17	7.75	10.04	2.99	0.32	0.21	1.03	99.83	10.98	2.9	463	22.5	84	223	149	223	2.9	17.7	87	74	46	169	5	12	<0.5	<0.5	26	4	--	--
151	91-42	--	NW	SW	4	38	4	552700	4682380	Qbbb	B	48.41	1.03	16.97	2.79	6.90	0.16	8.96	10.19	2.53	0.20	0.13	1.68	99.95	10.46	1.6	665	26.1	54	231	133	380	2.4	17.2	89	65	35	148	--	25	1.6	--	39	--	--	--
152	91-11	--	NE	SE	8	38	5	561800	4680450	Qbbb	B	48.56	1.00	17.51	4.41	4.91	0.16	8.29	10.85	2.76	0.18	0.08	0.80	99.51	9.87	1.0	468	23.5	66	169	108	302	2.8	16.7	67	60	34	109	3	14	0.8	1.5	30	4	--	--
153	HP94-67	--	NW	NW	10	38	4	554060	4681330	Qbbb	B	48.71	0.91	17.95	2.89	5.93	0.17	9.06	10.00	2.45	0.24	0.12	1.97	100.40	9.48	2.5	638	21.7	62	215	108	378	3.6	17.8	53	61	32	137	10.8	23.8	1.4	1.6	29.9	5	--	--
154	91-83	--	SW	SE	3	38	4	554920	4681940	Qbbb	B	48.96	0.97	16.89	4.30	4.79	0.16	9.00	10.64	2.68	0.23	0.10	1.40	100.12	9.62	2.3	673	23.5	48	235	130	406	1.4	16.9	84	61	41	134	7	16	0.8	--	39	0.32	--	--
155	99-15	--	SW	SW	4	38	4	552570	4681940	Qbbb	B	48.96	0.92	17.64	2.39	6.28	0.16	9.11	10.54	2.57	0.21	0.12	1.65	100.55	9.37	0.8	649	19.2	58	224	150	417	4.2	19.1	84	62	40	132	5	19	1.1	4.1	32	3	--	--
156	91-12	--	SE	NW	8	38	5	561390	4680820	Qbbb	B	48.98	0.98	17.95	2.42	6.42	0.16	7.77	10.96	2.84	0.17	0.09	0.94	99.68	9.55	1.2	501	23.6	66	167	93	262	3.3	17.1	74	59	34	120	4	15	<0.5	1.9	31	3	--	--
157	AL94-59	--	NE	SE	12	38	4	558760	4680510	Qbbb	B	49.02	0.97	17.94	1.84	7.15	0.16	8.38	10.54	2.68	0.22	0.09	0.78	99.77	9.79	2.3	501	22	57	193	105	282	3.5	17.3	69	63	38	134	3.5	15.9	--	1.0	31.2	4	1.9	0.9
158	91-73	--	NE	SW	19	37	5	559300	4687240	Qabm	A	57.86	0.64	18.97	1.81	3.97	0.11	3.32	6.85	4.02	1.11	0.15	1.02	99.83	6.22	17.6	709	15.2	85	119	35	71	5.2	18.9	56	66	16	367	9	27	1.7	3.0	17	7	--	--
159	84-60	--	NW	SW	14	37	4	555930	4688860	Qabm	A	57.87	0.70	18.93	2.50	3.86	0.12	3.34	6.81	4.17	0.86	0.17	1.10	100.43	6.79	11.5	722	14.8	80	128	30	32	4.7	20.5	51	71	18	431	11	24	0.1	0.9	16	8	--	--
160	04-2	--	NW	NE	11	37	4	556590	4691110	Qabm	A	58.19	0.68	18.46	1.36	4.58	0.11	3.28	6.84	3.92	1.04	0.15	0.99	99.60	6.45	20.0	709	12.8	82	127	32	28	3.0	18.9	52	66	19	464	--	--	0.8	2.0	14	7	--	--
161	84-59	--	NW	NW	19	37	5	559110	4687790	Qabm	A	58.34	0.65	18.94	1.46	3.97	0.11	3.34	6.88	4.08	1.06	0.15	1.21	100.19	6.39	19.6	684	13.9	84	131	35	43	4.8	20.3	62	66	18	487	7	18	0.5	1.5	17	8	--	--
162	91-75	--	SE	SE	19	37	5	560200	4686920	Qabm	A	58.90	0.63	18.61	1.59	3.94	0.10	3.02	6.52	4.07	1.23	0.15	0.88	99.64	5.97	24.5	663	15.9	97	113	29	62	5.4	18.3	47	63	16	430	10	31	2.8	3.9	15	7	--	--
163	AT91-40	--	NW	SE	7	37	5	559750	4690070	Qabm	A	59.11	0.69	18.58	1.87	3.86	0.10	4.14	6.37	3.83	1.16	0.15	0.39	100.17	6.16	28.27	650.8	13.49	96.6	121.5	35.8	29	--	--	--	--	20	470	13	15	--	--	14	--	0.8	1.4
164	84-58	--	SW	NW	20	37	5	560890	4687630	Qabm	A	59.17	0.64	18.64	1.46	4.12	0.11	3.08	6.53	4.11	1.14	0.16	0.87	100.03	6.04	25.0	646	14.6	93	127	30	35	5.4	20.5	56	75	16	699	12	24	1.1	1.8	15	9		
165	AT91-47	--	NE	SE	7	37	5	560160	4690200	Qabm	A	59.26	0.67	18.37	1.77	3.73	0.10	3.01	6.40	3.87	1.20	0.13	0.93	99.44	5.92	31.6	643	13.8	91.5	120	37	30	--	--	--	--	20	482	13	23	--	--	13	--	0.9	1.5
166	AT91-23	--	SW	SE	5	37	5	561610	4691450	Qabm	A	59.46	0.66	18.36	1.65	3.89	0.10	3.07	6.50	3.89	1.22	0.14	0.95	99.89	5.97	31.9	643	13.3	110	124	30	37	--	--	--	--	19	499	14	19	--	--	13	--	0.8	1.4
167	AT91-52	--	SE	NW	17	37	5	561170	4688960	Qabm	A	59.53	0.68	18.43	0.65	4.75	0.10	3.02	6.52	3.91	1.17	0.14	0.55	99.45	5.93	29.6	657	14	87	122	31	30	--	--	--	--	20	444	13	21	--	--	13	--	0.8	1.4
168	AT91-32	--	SE	NW	8	37	5	560970	4690470	Qabm	A	59.54	0.67	18.22	1.87	3.70	0.10	3.00	6.46	3.81	1.21	0.14	0.83	99.55	5.98	32.8	647	14.3	90.5	122	35	39	--	--	--	--	19	504	14	22	--	--	13	--	0.8	1.5
169	HC91-32	--	SW	SW	12	37	4	557310	4689960	Qabm	A	59.55	0.67	18.20	1.70	4.09	0.10	3.08	6.49	4.08	1.28	0.15	0.63	100.02	6.25	26	660	12	85	122	27	31	--	--	--	--	18	471	13	25	--	--	13	--	--	--
170	AT91-41	--	SE	SE	18	37	5	560280	4688310	Qabm	A	59.57	0.67	18.52	1.53	4.06	0.10	3.07	6.52	3.95	1.18	0.14	0.65	99.96	6.04	31	664	13.7	89	123	30	35	--	--	--	--	20	473	12	21	--	--	13	--	0.9	1.4
171	AT91-33	--	NE	NW	7	37	5	559290	4690970	Qabm	A	59.80	0.67	18.33	1.65	3.99	0.10	3.07	6.33	4.00	1.25	0.15	0.65	99.99	6.08	34.8	642	13.5	89.7	124	32	32	--	--	--	--	19	504	13	22	--	--	13	--	1.0	1.4
172	AT91-49	--	SE	SW	7	37	5	559290	4689940	Qabm	A	59.89	0.67	18.59	1.22	4.03	0.10	3.09	6.69	3.85	1.19	0.13	0.59	100.04	5.70	29.8	662	13.8	107	122	29	32	--	--	--	--	20	466	13	20	--	--	13	--	0.9	1.5
173	AT91-39	--	SE	NW	18	37	5	559510	4688910	Qabm	A	60.06	0.67	18.78	0.83	4.62	0.10	3.05	6.42	3.93	1.18	0.12	0.56	100.32	5.96	28.4	659	13.5	86	124	26	31	--	--	--	--	20	480	14	26	--	--	14	--	0.7	1.4
174	AT91-51	--	NW	SE	12	37	4	558150	4690470	Qabm	A	60.13	0.67	18.34	1.78	3.70	0.10	3.01	5.53	4.14	1.19	0.15	0.56	99.30	5.89	31.2	645	13	88.6	19	28	29	--	--	--	--	20	458	13	19	--	--	13	--	0.8	1.4