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PRELIMINARY GEOLOGIC MAP OF THE LAKE OF THE WOODS SOUTH 7.5' QUADRANGLE, KLAMATH COUNTY, OREGON

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Introduction

Much of the northeast segment of the Lake of the Woods South quadrangle (LOWSQ) falls within the confines of the Mountain Lakes Wilderness Area, an area of 108 km^2 that was designated as wilderness by the U. S. Congress in 1984. 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 LOWSQ is situated. The dominant two access points are the Mountain Lakes Trailhead on the northwest side and the Clover Creek Trailhead on the southwest side of the Wilderness Area. Topographically the elevation ranges from 1434m where Spencer Creek exits the quadrangle on its southeast extremity to 2398m, the summit of Crater Mountain. 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.” Topographic features that result from alpine glacial activity are plentiful in the Mountain Lakes Wilderness including horns, arêtes, moraines, cirques, and cirque lakes.

When viewed from a distance the Mountain Lakes region topographically forms a broad rather flat-topped elevated area that covers nearly 100 km^2. At first blush it reminds one of the Crater Lake region when viewed from a distance, particularly on the south side from the Upper Klamath valley. That similar topographic profile has led some people to believe that an individual composite volcano like Mount Mazama existed in the Mountain Lakes region that also “blew its top” sometime in the geologic past. That is not the case, however. With violent explosive andesite volcanic activity, which is often followed by collapse and caldera formation, fragmental volcanic rocks known as welded tuffs or ignimbrites are invariably erupted. Driving into Crater Lake NP from the south along Annie Creek provides a splendid view of the welded tuff blanket that was deposited as part of the violent demise of Mount Mazama and the formation of Crater Lake approximately 7,000 years ago. When traversing the Mountain Lakes region from any and all directions, no welded tuffs or ignimbrites are encountered. This observation convincingly argues no such violent geologic event occurred in this region. To be sure there were dozens of volcanic eruptions that led to the extrusion of both basaltic andesite and andesite lava flows from a number of individual volcanoes in the region but none led to an event like the climactic final caldera-forming events that took place at Mount Mazama.

Greylock Mountain (2387m), Whiteface Peak (2375m), and Burton Butte (1878m) are prominent topographic high points within the Lake of the Woods South Quadrangle. The first two high points are glacially eroded remnants of Pleistocene andesitic composite volcanoes and the latter is a cinder cone / scoria cone complex from which copious amounts of basaltic lava poured. Extrusive rocks that are Pleistocene in age (1.806 Ma to 11,500 years old) cover approximately 75 percent of LOWSQ. Volcanic material that is Middle (3.600 to 2.588 Ma) to Upper (2.588 to 1.806 Ma) Pliocene in age (see Gradstein and others, 2004 for details) covers the remaining 25 percent of the quadrangle.

There are two lakes of consequence within the confines of the LOWSQ. One is Lake of the Woods, located in a linear valley oriented in a N-S direction, and is a weekend destination for residents of the Rogue River Valley to the west and the Klamath Falls area to the southeast who enjoy boating, fishing, and other forms of outdoor activity (see Figures 2 and 3). A number of summer homes and cabins together with several camps and a U. S. Forest Service campground ring the margins of this natural perennial lake. Located 7 to 8 miles south of Lake of the Woods, is Buck “Lake” (see Figure 4), situated in an intermountain circular-shaped basin that has been largely drained and perhaps has standing water in it during the early Spring after a period of rapid snow melt. The land has been modified with some dikes and levees and is used for cattle grazing and hay growing purposes. Water drains to the east forming the headwaters of Spencer Creek, which is one of the few perennial streams in the region. Spencer Creek flows generally to the southeast and eventually empties into the Klamath River near the John C. Boyle Reservoir.

One prominent fault with several splays cuts across the Lake of the Woods South quadrangle in a N10 to 20ºW orientation. It is a normal fault that is down to the east (hangingwall side) and up on the west (footwall side). The steep east-facing mountain front block can most easily be seen at Lake of the Woods. The western margin of the lake is a fault scarp developed by the latest movements along the fault, the trace of which probably parallels the base of the slope. From evidence preserved within the Lake of the Woods South quadrangle, the faulting is Lower Pleistocene or younger in age. Interestingly, on September 20, 1993 at 8:28 and 10:45 PM PDT earthquakes of magnitude 5.9 and 6.0 respectively, occurred to the east in the adjoining Aspen Lake quadrangle, near the northwest tip of Aspen “Lake” (see Figure 1). Both Braunmiller and others (1995) and Dreger and others (1995) reported the depth to the focus of these earthquakes at nearly 10 km and that the earthquake mechanism was that of a normal fault with mostly dip slip movement. These clues strongly suggested to both research groups and to me as well that the Lake of the Woods fault zone is most likely at the heart of this latest episode of seismic activity.

There are two prominent hard rock stone quarries in the LOWSQ. One is the Ichabod quarry located in the northwestern part of the quadrangle exactly whence sample 91-79 originated. An immense quantity of crushed stone has been generated from thick ($\geq$20 meters) very light gray platy two-pyroxene andesite lava flows whose primary physical characteristic is ubiquitous platy flow jointing. The thickness of each tabular plate is typically 3 to 6 cm, a size that most crushing apparatus can easily handle. The second is an un-named quarry to the NE of the paved Clover Creek road that connects the Dead Indian Memorial highway to Oregon Route 66 near Keno, Oregon and is the site whence sample 94-5 originated. This hard rock quarry is also located in somewhat less platy two-pyroxene andesite. This quarry is very interesting for a geologist to visit because of the physical evidence it contains for the incomplete mixing of two somewhat different magma compositions, one basaltic andesite and the other andesitic. Most if not all of the aggregate for the Clover Creek road originated from this quarry.

Known absolute ages for samples from the LOWSQ range from 5.77 Ma to less than 100,000 years old. The next quadrangle to the east is Aspen Lake and its age range is more limited than that of LOWSQ, nothing older than Mid- to Upper Pliocene. However, to the west in the Brown Mountain quadrangle, at its western edge, the first vestiges of pre-Pliocene volcanic rocks make their appearance. The age pattern seems to suggest that at least in this region volcanic activity migrated to the east during the time period Lower Miocene to the Mid- to Late Pleistocene.

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, a non-iron magnesium bearing silicate mineral, plus a few percent of chromium, iron, and 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 LOWSQ, 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 LOWSQ as well as immediately adjacent to it. These adjacent ages are depicted because they are from extensions of the volcanic rock units found within the LOWSQ. The goal was to show all the ages for each volcanic unit discussed in the Explanation of Map Units. Figure 5 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 LOWSQ. In addition the chemical data are displayed for each stratigraphic unit that is defined below using an individualized symbol that is summarized in the legend that accompanies Figure 5. Lastly, Mertzman (2000) and Mertzman (unpublished data, 2007) provide many new age dates, derived from both a whole rock K-Ar method as well as $^{40}Ar/^{39}Ar$ technology, that have been measured through October, 2007.

Explanation of Map Units

Surficial Units

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

Qg **Undifferentiated colluvium and alluvium (Holocene and Pleistocene)** Unconsolidated sediment whose origin is related to glacial activity.

Qs **Lacustrine deposits (Holocene and Pleistocene)** Unconsolidated sediment found in association with the Buck Lake enclosed basin.

Volcanic Rocks

Qbv **Basaltic to basaltic 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 (see Figure 5, 6, and 7). The outermost carapace of the blocky flow material is medium to dark gray in color and dominated by open vesicles that are 1 to 2 mm 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 universally characterized by platy flow jointing. Hand samples contain 10 to 20 percent microphenocrysts between 0.4 and 1 mm, plagioclase most abundant, 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 southwest corner of the map, immediately juxtaposed to the Brown Mountain – LOWS boundary. 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. Chromite, present within early-formed olivine crystals, and titanomagnetite and ilmenite are the opaque minerals that constitute 8 to 10 percent of the minerals present in these basaltic lavas. One whole rock K-Ar age is available for this unit (see sample 91-3). Also, one $^{40}Ar/^{39}Ar$ age has recently been determined and is preferable due to the very small amount of radiogenic Ar present in this basaltic lava. Burton Butte volcanic activity is 0.33 ± 0.12 Ma old.

Qbaa **Basaltic Andesite of Aspen Butte (Lower to Middle Pleistocene)** Nearly one-half of the Aspen lake quadrangle, the quadrangle immediately to the east of LOWSQ, is covered by medium gray, aphanitic, platy basaltic andesite that originates from both Aspen and Little Aspen Buttes. The lavas from these two volcanoes are indistinguishable in hand specimen and have very similar major and trace element geochemistry. They have 2 to 5 percent small 1 to 2 mm phenocrysts of fresh green olivine, plagioclase, and orthopyroxene, both in clumps and as separate crystals, immersed in a fine-grained aggregate of the same minerals together with titanomagnetite and clinopyroxene. In thin section two textural characteristics are quickly noticeable: the olivine phenocrysts invariably have a rim of pyroxene around them and the larger orthopyoxene phenocrysts on their elongate crystal faces have small acicular clinopyroxene crystals. Plagioclase is the most abundant mineral, present as 1 to 2 mm in diameter phenocrysts, smaller sized microphenocrsts, and the dominant constituent of the matrix. Two whole rock K/Ar age dates are available suggesting this pulse of basaltic andesite volcanism spanned from 0.86 ± 0.02 to 0.47 ± 0.04 Ma. Both samples are located within the adjacent Aspen Lake quadrangle. Late Pleistocene glaciations have substantially modified the summit region of Aspen Butte and have clearly exposed numerous interbedded layers of lava and pyroclastics; thus, Aspen Butte is a composite volcano. The glacial erosion has been sufficiently intense that the conduit has been uncovered and can be easily recognized by the much more granular texture of the constituent rock, clearly marking the slower rate of cooling for this intrusive mass.

Qbah **Basaltic Andesite of High Knob (Lower Pleistocene)** High Knob, situated on the southwest flank of Crater Mountain, is the residual vent structure for a number of basaltic andesite lava flows. The High Knob lavas have been segmented into several discontinuous areas because of younger lavas flowing down from vents located further uphill and to the north leaving in their wake islands of older material surrounded by younger volcanic rock. These “islands” of older rock are referred to as kipukas. Hand samples from the High Knob unit are light to medium gray in color with 10 to 15 percent small phenocrysts (< 2 mm in diameter) with plagioclase decidedly more abundant than pyroxene that in turn is more abundant than olivine. Both orthopyroxene and clinopyroxene are present in hand-sample but the identification is made more difficult than usual because the olivine phenocrysts are strongly altered to iddingsite and therefore take on a surface color that is similar to pyroxene. Some of the altered olivine produces an iridescent array of purple color on fracture surfaces that helps distinguish it from pristine pyroxene phenocrysts. Pyroxene and plagioclase are the most abundant minerals in the matrix of this unit followed by the Fe-Ti oxide mineral titanomagnetite. Two whole rock K/Ar age dates are available for this unit, 1.08 ± 0.05 and 0.90 ± 0.05 Ma.

Qbbp **Basalt of Buck Peak (Lower Pleistocene)** The volcanic source point for the lavas of this unit is located along the southeast boundary between the LOWSQ and the Aspen Lake quadrangle. On freshly broken surfaces the lava has 10 to 15 percent small, 1 to 3 mm, phenocrysts of plagioclase and green olivine, some of the latter is iridescent due to oxidation and partial alteration to iddingsite, with plagioclase consistently more abundant than olivine. Pyroxene is confined to the matrix of the sample. Buck Peak basalts are higher silica basalts (50 to 53 weight percent) and as a result are found as thicker lava flows less extensive in nature that may be vesicular in texture but never diktytaxitic. An $^{40}Ar/^{39}Ar$ age date is available for a Buck Peak lava flow sample from the southeast corner of the Lake of the Woods quadrangle and it indicates these lavas were extruded in the Lower Pleistocene, 1.45 ± 0.01 Ma ago.

Qbbl **Basalt of Buck Lake (Lower Pleistocene)** Lavas that belong to this unit were erupted from fissures aligned in a similar direction to the conspicuous NNW-SSE normal fault that cuts through the LOWSQ. Typical hand samples are medium gray to bluish gray in color, predominantly aphanitic with only several percent of 1 to 3 mm in diameter phenocrysts that are primarily olivine, partially converted to iddingsite, and plagioclase. In order of decreasing abundance plagioclase, pyroxene, and opaque minerals dominate the matrix that is often finely vesicular and spongy - almost but not quite diktytaxitic. Near the flow surfaces larger nearly spherical vesicles are encountered that are up to 1 cm in diameter and are thinly lined by cryptocrystalline material but are completely devoid of any secondary mineralization. Even though the radiometric ages for the Basalt of Buck Lake and the Basalt of Buck Peak are identical when the analytical error is taken into account, the Basalt of Buck Lake is older based on field data. Lava flows from Buck Peak flowed to the west and southwest and came in contact with earlier formed flows of the Buck Lake unit and were deflected in a southeast direction. Three $^{40}Ar/^{39}Ar$ age dates and one whole rock K/Ar age date are available to document the timing of the Buck Lake volcanic activity. Only one of the age-dated samples is actually from the LOWSQ (see sample 99-62). The three additional samples are from the Spencer Creek quadrangle, which is located adjacent to the LOWSQ to the southeast (see Figure 1). The four age dates range from 1.48 ± 0.10 to 1.19 ± 0.11 Ma.

Qawp **Andesite of Whiteface Peak (Lower to Middle Pleistocene)** In the northeast corner of the LOWSQ are three topographic high points, Greylock Mountain, Crater Mountain, and Whiteface Peak. The modal mineralogy of these andesite lava flows varies from 3 to 20 percent phenocrysts that are nearly equal amounts of plagioclase, orthopyroxene and clinopyroxene, sporadically with minor amounts of olivine and hornblende. The andesite flow exposed at Crater Peak has nicely preserved examples of the dehydration breakdown reaction of hornblende to pyroxene + plagioclase + magnetite. Phenocrysts of hornblende have been partially resorbed from the outside in towards the center and rims (coronas) composed of the anhydrous mineral assemblage pyroxene + plagioclase + magnetite have been added to the corroded margins of the original phenocryst. The matrix is dominated by a granular aggregate of 0.5 to 1 mm plagioclase crystals with interstitial pyroxene and titanomagnetite crystals. Many outcrops of this unit are characterized by widespread flow jointing that has been strongly enhanced by the freezing and thawing and the abundance of water given the glacial activity in this region over the past 0.5 to 1 m.y. The individual plates are 2 to 5 cm thick and the size of loose-leaf paper. Six whole rock K-Ar age dates are available for this unit and range between 1.55 ± 0.04 to 0.57 ± 0.10 Ma. Five of the six samples are located in the LOWSQ; however, sample 92-81 that produced the youngest age is from the adjacent Aspen Lake quadrangle.

Qbams **Basaltic Andesite of Muddy Spring (Upper Pliocene to Lower Pleistocene)** Lava flows that constitute this unit are medium gray in color and contain 12 to 15 percent 1 to 4 mm in diameter phenocrysts which, in order of abundance, are plagioclase, pyroxene, and olivine. Rare glomeroporphyritic clots nearly 1 cm across that contain plagioclase, two pyroxenes, and olivine, are present.

Both the abundance of plagioclase and the nearly equal amounts of pyroxene and olivine phenocrysts are clues that these extrusive rocks are basaltic andesites and not simply basalts. One very interesting aspect of this unit is exemplified in sample 92-53, the sample that was used for geochronology. In thin section complex petrographic relationships become noticeable pretty quickly. For example, there are several large orthoproxene phenocrysts (3 to 4 mm across) that have discontinuous coronas of smaller olivine crystals. Are these larger orthopyroxene grains xenocrysts? There are also discrete smaller olivine phenocrysts (1 to 2 mm across) scattered through the hand sample and virtually all of them have thin reaction rims of predominantly orthopyroxene. One interpretation is that the larger population of pyroxene phenocrysts crystallized from this basaltic andesite magma at a depth likely within the lower crust and, as the magma batch moved into an environment much closer to the Earth's surface, the mineral olivine began to crystallize replacing pyroxene as a liquidus phase. Subsequently after an interval of time in which olivine and plagioclase co-precipitated, pyroxene replaced olivine as a crystallizing mineral thus producing the textural relationships one sees in thin section: flow aligned small crystals of plagioclase and pyroxene with several percent of nearly equi-dimensional olivine dominating the matrix of these lavas. One whole rock K/Ar age, 1.79 ± 0.04 Ma, is available for this unit. It straddles the arbitrary boundary established between the Upper Pliocene and the Lower Pleistocene, which is 1.806 Ma (see Gradstein and others, 2004).

Tpbas **Basaltic Andesite of Surveyor Mountain (Upper Pliocene to Lower Pleistocene)** This voluminous basaltic andesite unit is widespread in both the Spencer Creek and Surveyor Mountain quadrangles but barely trickles into the southwest corner of the LOWSQ. Lavas of this unit are typically medium gray in color, darker as one approaches the more vesicular tops and bottoms of lava flows, and have 5 to 7 percent 1 to 2 mm in diameter phenocrysts of plagioclase and olivine. The matrix is characteristically quite aphanitic with scattered pinhead sized vesicles. Plagioclase dominates the matrix together with both orthopyroxene and clinopyroxene and scattered opaque granules. The elongate plagioclase crystals in the matrix are often flow aligned producing what is termed a trachytic texture. One $^{40}Ar/^{39}Ar$ age and one whole rock K/Ar age are available for the Basaltic Andesite of Surveyor Mountain; however, neither sample is actually within the LOWSQ. The two ages are 1.98 ± 0.05 Ma (Little Chinquapin Mountain quadrangle) and 1.88 ± 0.22 Ma (Surveyor Mountain quadrangle), respectively.

Tpbtc **Basalt of Tunnel Creek (Upper Pliocene)** Light gray in color with 10 to 15 percent olivine phenocrysts, 1 to 2 mm in diameter, this basaltic lava is reminiscent of the olivine-phyric lavas of Daley Prairie located in the central portion of the adjacent Brown Mountain quadrangle. Many of the olivine phenocrysts are partially to nearly completely altered to iddingsite that converts the normally green crystals to ones that range from iridescent purple to a dull dark brown. All the other usually encountered basaltic minerals including plagioclase, pyroxene, and several opaque oxide minerals are confined to the matrix. Once again, the early-formed olivine phenocrysts have numerous small spinel crystals included within them, strongly suggesting the spinel crystallized first from the basaltic magma followed some time later by the olivine. One whole rock K/Ar age is available for the Basalt of Tunnel

Creek and its age is 2.32 ± 0.11 Ma old. However, the sample from which the age was derived (91-15) is located in the Surveyor Mountain quadrangle.

Tparc **Andesite of Rainbow Creek (Middle to Upper Pliocene)** As is often the case with andesite plagioclase feldspar is the dominant mineral present in this andesite unit. Plagioclase forms 15 to 20 percent phenocrysts that range up to 5mm in diameter, present both as singular crystals and in glomeroporphyritic clumps. The second most abundant mineral present is pyroxene, with orthopyroxene dominating over clinopyroxene. As phenocrysts pyroxene is clearly less abundant than plagioclase. Traces of olivine can be seen, too, often with thick mantles of orthopyroxene. Two very interesting but volumetrically minor constituents of this unit are dacite, a silica-rich volcanic rock with between 63 and 69 percent SiO_2, and low K_2O basalt to basaltic andesite. To the best of my knowledge this dacite occurrence marks the most siliceous rock south of Crater Lake and north of the Oregon-California state line that is part of the Cascade Mountain volcanic activity. This Cascade activity encompasses the time period from 7.5 Ma ago until the modern day. The dacite has two very different physical appearances: one is a light gray, very thin plated lava, plates 1 to 1.5 cm thick, with 15 to 20 percent plagioclase feldspar phenocrysts and several percent pyroxene, primarily orthopyroxene. The matrix is aphanitic (fine grained) due to its faster cooling at or very near the Earth’s surface. The second manifestation of this dacite has fewer total phenocrysts, approximately 5 percent, plagioclase > pyroxene, situated in a black, glassy matrtix. The rock looks like obsidian. Chemically, the two varieties of dacite are identical. The low K_2O basalt / basaltic andesite is also unusual in that, like the andesite lavas, plagioclase forms 15 to 20 percent phenocrysts that are 1 to 3 mm in diameter and that pyroxene, olivine, and opaque minerals fill in the open spaces between the larger feldspar crystals. Three whole rock K-Ar ages are available for this unit, 2.68 ± 0.11 Ma, 2.47 ± 0.04 Ma, and 2.45 ± 0.08 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 Brown Mountain quadrangle from vents located on the western margin of the LOWSQ. Four whole rock K-Ar ages are available for this unit, 3.42 ± 0.06 Ma, 3.38 ± 0.06, 3.32 ± 0.27 Ma, and 3.25 ± 0.05 Ma old. Only the latter two ages are derived from samples (AH94-96 and 91-79 respectively) that are located in the LOWSQ.

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 mineral present in this andesite unit. Plagioclase is present as singular phenocrysts and in glomeroporphyritic clumps, too. The size of the plagioclase crystals varies between 1 and 3 mm in diameter and constitutes 10 to 12 percent of the lava. Plagioclase thoroughly dominates the matrix in terms of abundance, forming 60 to 70 percent of the fine-grained material. 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; however, the sample (91-84) is located in the Brown Mountain quadrangle.

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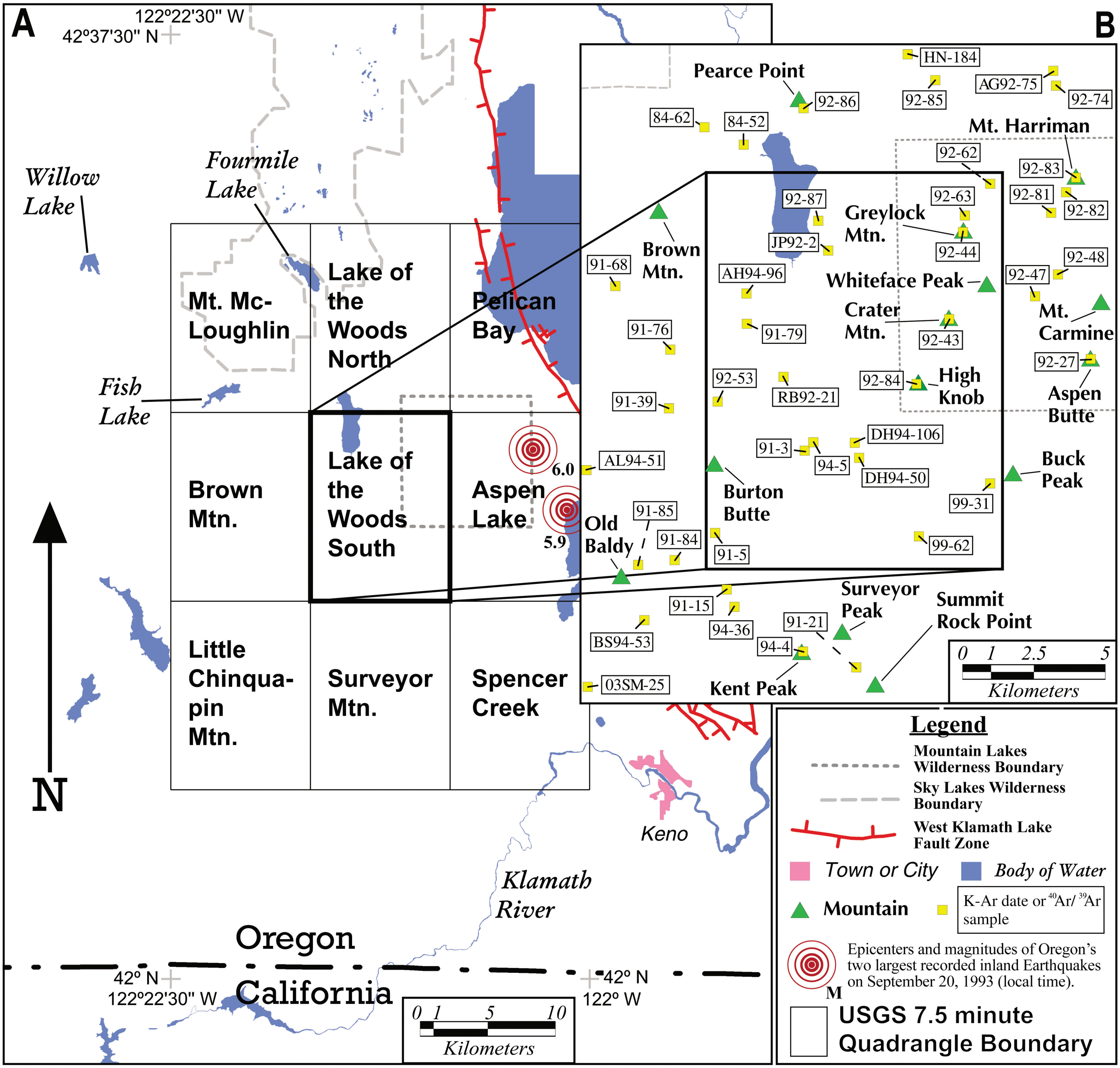

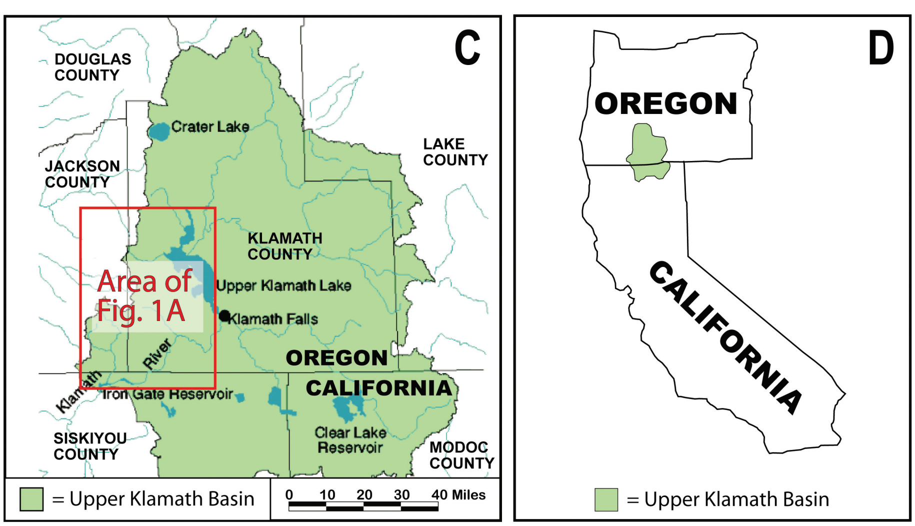

Figure 1. This series of location maps (A through D) provides a broad context in which to place the Preliminary Geologic Map of the Lake of the Woods South 7.5' Quadrangle, Klamath County, Oregon. Figures 1C and 1D were modified from U.S. Geological Survey (2006). Earthquake epicenter location and magnitude data are from The Pacific Northwest Seismic Network (2003).

Figure 2. Looking from east to west across the short dimension of Lake of the Woods, in the immediate foreground is a north-south oriented steeply sloped forest ridge that constitutes the up-thrown block of a normal fault that parallels the shoreline. The lake water occupies the structural valley formed by the block faulting. The valley is called a graben or a rift valley. Situated behind the fault scarp on the horizon is Brown Mountain, an Upper Pleistocene andesite stratovolcano.

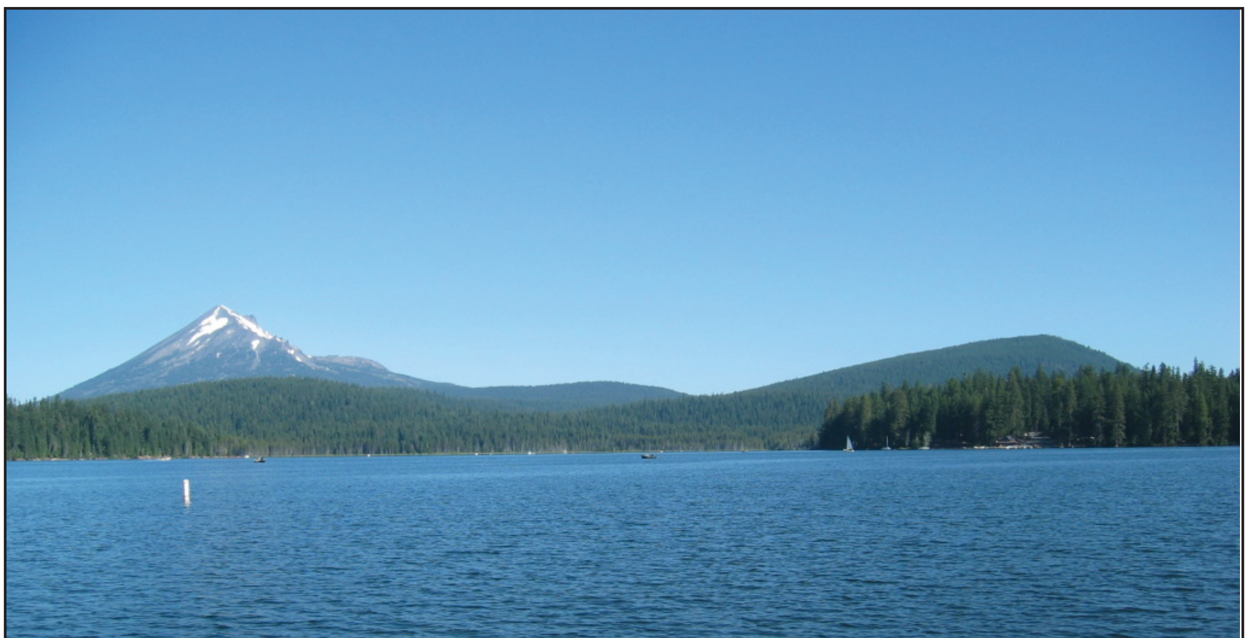

Figure 3. Looking from the southeast shoreline of Lake of the Woods towards the north-northwest, Mount McLoughlin, an Upper Pleistocene stratovolcano, dominates the left side of the image. To the right hand side is the Lower Pleistocene Rye Spur stratovolcano that is truncated by a N-S oriented normal fault, which has down-dropped the far right side of the structure to the east.

Figure 4. Buck "Lake" (the rather bare-looking area in the center of the image) as viewed from the southeast flank of Surveyor Mountain looking to the north. Crater Mountain within the Mountain Lakes Wilderness Area is the high point to the right. Spencer Creek flows from Buck "Lake" at the extreme right margin of the grassland, beginning its journey to the Klamath River located further to the south in the Spencer Creek quadrangle (see Figure 1).

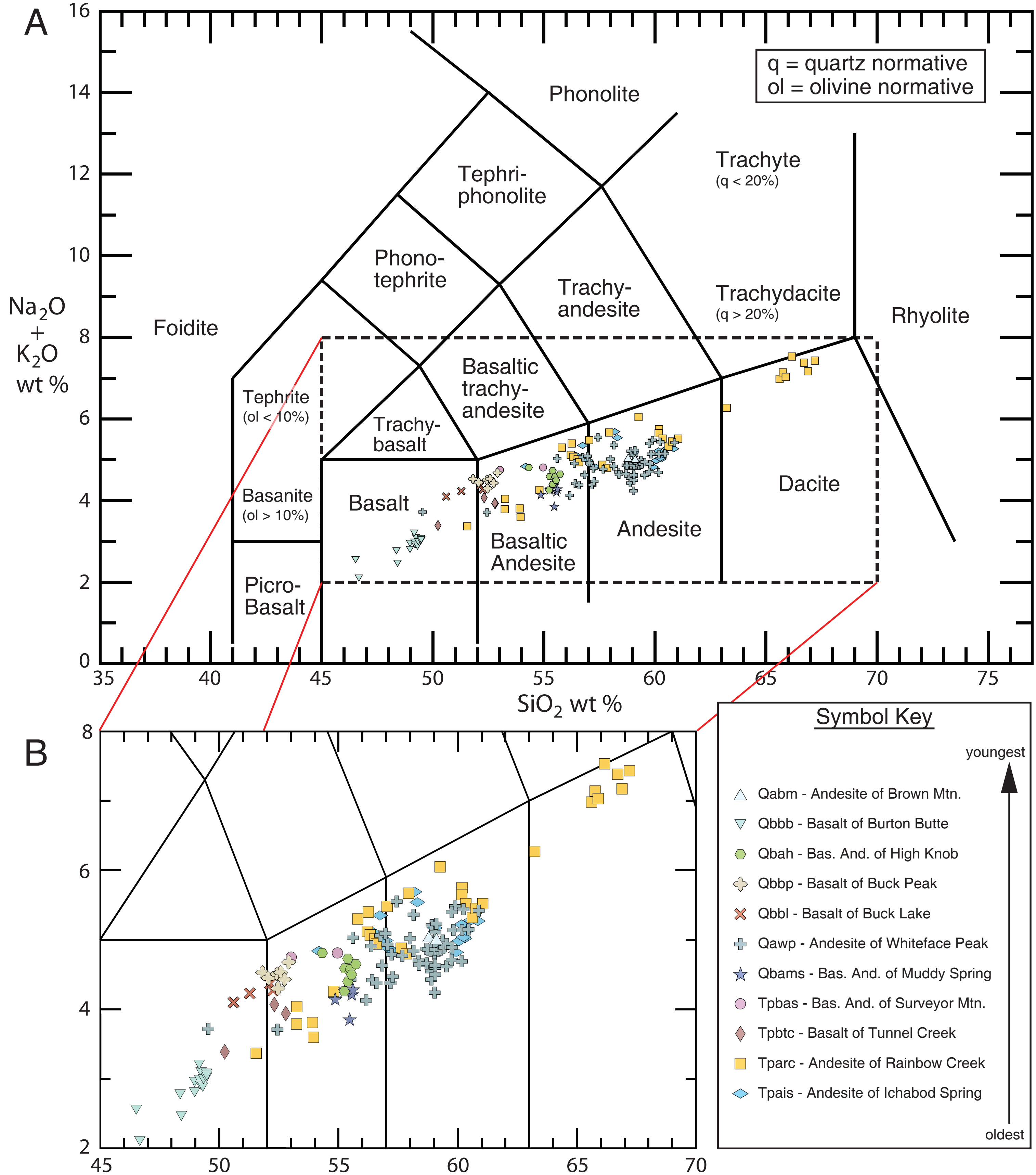

Figure 5. IUGS (International Union of Geological Sciences) classification system for volcanic rocks, which is based on total alkali ($Na_2O + K_2O$) vs. silica (SiO_2) content, with the data from analyzed Lake of the Woods South quadrangle samples (Table 1) superimposed (see Le Maitre, 2002).

Figure 6. A blocky lava flow from Brown Mountain volcano. Blocky flows are characteristic of andesite volcanoes. The SiO_2 content of andesite ranges between 57 and 63 weight percent. The SiO_2 content is an important parameter governing the viscosity of the flowing lava.

Figure 7. If the dark vesicular outer portion of a blocky flow depicted in Figure 6 is removed by weathering and erosion, the flow jointing pattern of the more slowly cooled interior of the andesite lava flow is exposed.

Figure 8. It is not too difficult to imagine that after tens of thousands of years of weathering and erosion, that the blocky lava flows of Brown Mountain (see Figure 6) will appear nearly identical to this hillside and its accumulation of 5 to 10 cm thick rectangular plates that originate from the cooling of the interiors of andesite lava flows.

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 Preliminary Geologic Map of the Lake of the Woods South 7.5' Quadrangle, Klamath County, 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) results 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) (Willamette meridian and base line). In the Lithology column (Lith.), B = Basalt (SiO_2 = 45-52%), BA = Basaltic Andesite (SiO_2 = 52-57%), A = Andesite (SiO_2 = 57-63%), and D = Dacite (SiO_2 = 63-77%). See Figure 5 and Le Maitre (2002) for details regarding lithological classification. Please consult the detailed descriptions above 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	AH94-96	3.32 +/- 0.27	SW	NE	21	37	5	563170	4687310	Tpais	A	57.10	0.87	18.47	2.86	3.88	0.10	4.19	7.08	3.87	1.01	0.22	0.96	100.61	7.17	11.3	1182	20	69	167	51	87	2.3	19.8	75	68	--	--	--	--	0.9	1	--	--	--	--
2	91-79	3.25 +/- 0.05	NW	NE	28	37	5	563180	4686240	Tpais	A	60.28	0.59	18.38	2.68	2.82	0.09	2.91	6.22	3.98	1.04	0.13	0.82	99.94	5.81	11.9	780	13.2	68	106	6	15	3.2	22.3	65	54	18	308	8	16	1.4	3.2	12	4.7	0.9	1.1
3	JR91-30	--	NW	NW	10	37	5	564080	4690930	Tpais	BA	54.18	0.95	19.03	2.54	5.34	0.14	3.95	7.90	4.02	0.82	0.21	0.62	99.70	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4	84-56	--	NE	NW	16	37	5	562550	4689480	Tpais	BA	56.45	0.90	17.99	7.92	--	0.13	3.75	7.23	3.97	1.14	0.17	0.36	100.01	7.92	20.2	675	17.4	90	187	25	38	3.3	20.2	42	70	20	421	8	19	<0.5	1.1	22	9	--	--
5	00-25	--	NW	NE	21	37	5	563140	4687720	Tpais	BA	56.74	0.84	17.78	3.43	3.54	0.12	3.43	6.85	4.13	1.22	0.18	1.11	99.37	7.36	19.6	683	26.6	118	156	26	59	6.2	19.9	76	67	21	519	12	27	1.3	1.7	21	6	--	--
6	CM04-15	--	SE	SW	28	37	5	562710	4685020	Tpais	BA	56.98	0.79	18.39	2.93	3.77	0.11	3.39	6.15	3.92	1.07	0.21	1.94	99.65	7.12	17.8	746	17.5	95	141	30	38	3.7	20.3	57	69	20	527	--	--	<0.5	1.6	17	6	--	--
7	CM04-13	--	NW	SW	27	37	5	563820	4685550	Tpais	A	57.33	0.74	18.64	2.40	4.02	0.12	3.82	6.92	3.82	1.00	0.15	1.19	100.15	6.87	16.4	726	22.4	86	153	44	35	3.5	20.2	67	64	23	431	--	--	<0.5	2.2	17	6	--	--
8	JR91-42	--	SE	NE	16	37	5	563460	4689240	Tpais	A	58.19	0.83	17.11	2.00	4.19	0.11	3.96	6.49	4.28	1.41	0.25	0.57	99.39	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9	JR91-36	--	SW	SE	16	37	5	563030	4688110	Tpais	A	58.31	0.85	17.59	2.00	4.19	0.11	3.73	6.70	4.11	1.43	0.24	0.80	100.06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10	86-63	--	SE	NW	27	37	5	564380	4685940	Tpais	A	59.04	0.68	17.95	2.30	3.52	0.10	3.41	6.59	4.04	1.13	0.18	1.17	100.11	6.21	12.8	861	17.3	108	131	34	57	6.0	20.0	110	61	19	422	14	29	<0.5	1.5	13	7	--	--
11	RB92-35	--	SE	NW	27	37	5	564460	4686120	Tpais	A	59.93	0.70	18.19	2.86	3.17	0.10	3.51	6.63	3.69	1.13	0.16	0.85	100.92	6.38	3	848	11	102	141	32	37	--	--	--	--	20	345	12	27	--	--	15	--	1.3	1.3
12	RB92-31A	--	NW	SW	27	37	5	563390	4685330	Tpais	A	60.05	0.69	17.47	3.12	3.07	0.10	3.52	6.69	3.82	1.16	0.15	0.54	100.38	6.53	5	847	12	110	144	38	32	--	--	--	--	20	351	12	29	--	--	15	--	1.4	1.3
13	92-72	--	SE	NE	29	37	5	562100	4685770	Tpais	A	60.16	0.59	18.33	2.74	3.00	0.10	3.25	6.18	4.19	1.03	0.15	0.80	100.52	6.07	10.8	754	11.8	86	105	17	12	2.9	19.7	44	61	14	268	11.8	21.4	0.6	1.6	12.7	6.6	1.9	1.1
14	CM04-12	--	SW	SW	22	37	5	564030	4686670	Tpais	A	60.24	0.57	18.38	2.08	3.25	0.10	2.75	6.10	3.99	1.05	0.15	0.98	99.64	5.69	13.6	770	12.1	87	101	14	9	2.5	20.4	51	57	16	329	--	--	<0.5	<0.5	13	11	--	--
15	84-57	--	NW	NE	28	37	5	563180	4686240	Tpais	A	60.35	0.58	18.05	5.81	--	0.10	2.88	6.35	4.08	1.05	0.15	0.34	99.74	5.81	12.5	781	11.1	83	114	15	13	2.5	20.1	14	56	14	340	6	16	<0.5	1.4	12	5	--	--
16	00-16	--	SW	SW	28	37	5	562140	4685250	Tpais	A	60.55	0.58	18.37	2.32	3.10	0.10	2.89	6.31	4.20	1.08	0.16	0.78	100.44	5.77	9.9	804	14.1	82	109	18	13	4.5	21.1	46	54	16	315	11	21	<0.5	1.1	13	5	--	--
17	JP92-129	--	SE	SW	22	37	5	564160	4686650	Tpais	A	60.84	0.59	18.60	2.02	3.74	0.09	2.85	5.44	4.17	1.10	0.15	1.35	100.94	6.18	12	748	12	96	93	13	9	2	20	--	56	--	315	14	18	1	1	--	--	--	--
18	94-5	2.45 +/- 0.08	SW	SW	2	38	5	565530	4682060	Tparc	A	60.18	0.64	17.72	3.18	2.41	0.09	2.74	5.71	4.29	1.46	0.16	1.08	99.66	5.86	23.2	598	16.4	109	119	24	51	4.6	21	36	53	12	553	15	31	2.1	5.7	14	6.6	2	1.4
19	DH94-106	2.68 +/- 0.11	SE	SE	2	38	5	566970	4682050	Tparc	A	60.61	0.60	18.47	3.28	2.00	0.08	2.73	6.02	4.29	1.03	0.14	1.40	100.65	5.50	9.7	885	8.6	73	108	25	46	2.9	18.9	29	56	14	272	13	30.1	0.5	1.5	13	9.5	1.2	0.9
20	RB92-21[1]	2.47 +/- 0.04	SE	NW	34	37	5	564470	4684370	Tparc	D	65.61	0.86	16.01	2.88	2.19	0.08	0.91	3.24	5.12	1.86	0.22	1.19	100.17	5.31	26	446	25	156	67	3	4	6.2	19.2	20	74	7.1	590	16	36	2.3	4.9	13	9	2.82	1.7
21	00-20	--	SW	SW	23	37	5	565350	4686800	Tparc	B	51.55	0.80	18.43	2.31	5.61	0.15	6.55	9.48	3.16	0.21	0.10	1.82	100.17	8.54	0.9	667	21.3	48	183	114	179	3.8	17.2	96	65	36	228	9	14	<0.5	1	28	3	--	--
22	00-18	--	SW	NW	35	37	5	565470	4684490	Tparc	BA	53.24	0.77	18.18	1.87	5.77	0.13	6.42	9.10	3.34	0.45	0.11	0.83	100.21	8.28	1.1	663	19.7	48	176	112	164	3.7	17.5	87	64	35	171	7	12	<0.5	1.9	26	3	--	--
23	RB92-105	--	SW	SE	35	37	5	566310	4683550	Tparc	BA	53.25	0.73	17.64	3.84	4.40	0.13	5.90	8.71	3.37	0.67	0.10	1.12	99.86	8.73	6	729	10	57	180	93	93	--	--	--	--	37	283	6.1	19	--	--	19	--	1.1	1.2
24	RB92-55	--	NW	NW	35	37	5	565480	4684760	Tparc	BA	53.91	0.76	17.39	2.28	5.25	0.13	6.77	9.19	3.29	0.52	0.10	0.64	100.23	8.11	--	645	17	69	177	99	170	--	--	--	--	34	169	5.1	17	--	--	25	--	1.7	1
25	CM04-14	--	NE	SE	27	37	5	565320	4685370	Tparc	BA	53.95	0.74	18.11	1.93	5.34	0.14	5.96	8.68	3.13	0.47	0.11	1.12	99.68	7.86	4.7	667	21.2	60	162	89	142	2.2	18.5	76	65	33	230	--	--	0.7	2	24	4	--	--
26	RB92-68	--	SW	SE	35	37	5	566370	4683430	Tparc	BA	54.80	0.72	17.79	2.66	5.26	0.13	6.08	7.79	3.53	0.73	0.10	0.82	100.41	8.51	12	694	15	60	183	85	115	--	--	--	--	33	349	8.3	20	--	--	21	--	1.5	1.2
27	RB92-63	--	NE	SW	35	37	5	565780	4684010	Tparc	BA	55.81	1.00	17.33	3.63	4.49	0.15	3.99	7.02	4.33	0.97	0.19	0.62	99.53	8.62	11	657	19	100	183	43	52	--	--	--	--	26	398	9.3	24	--	--	20	--	1.8	1.4
28	86-64	--	NW	SW	34	37	5	564000	4683990	Tparc	BA	56.21	0.97	17.81	2.37	5.37	0.14	3.94	6.82	4.17	0.95	0.23	0.50	99.48	8.34	14.9	655	21.2	94	171	37	46	3.7	19.1	49	73	23	397	10	20	0.7	1.5	21	8	--	--
29	00-19	--	NE	SW	35	37	5	566120	4683950	Tparc	BA	56.25	1.01	17.75	3.56	4.57	0.15	3.84	6.94	4.41	0.99	0.22	0.62	100.31	8.64	9.9	654	25.5	95	191	39	42	5.7	18.0	72	74	25	421	13	27	<0.5	1.1	21	4	--	--
30	RB92-24	--	NW	SE	34	37	5	564880	4684080	Tparc	BA	56.33	1.01	17.70	3.21	4.81	0.14	3.98	6.95	4.09	0.98	0.20	0.58	99.98	8.56	6	679	21	98	182	34	46	--	--	--	--	25	401	11	26	--	--	20	--	1.8	1.4
31	CM04-03	--	NW	SE	34	37	5	564720	4683900	Tparc	BA	56.52	0.78	18.49	2.81	3.98	0.12	3.59	5.93	3.88	1.13	0.21	2.49	99.93	7.23	19.9	739	16.1	97	129	41	49	3.7	20.2	47	71	19	571	--	--	0.8	2.3	16	7	--	--
32	CM04-02	--	NE	SW	34	37	5	564230	4683810	Tparc	BA	56.59	0.75	18.91	2.54	3.88	0.11	3.70	6.56	3.90	1.04	0.22	1.57	99.77	6.85	15.3	754	21.2	95	132	35	43	3.7	20.1	62	68	20	511	--	--	<0.5	2.3	16	5	--	--
33	RB92-12	--	SE	SE	34	37	5	565280	4683510	Tparc	A	57.04	1.11	17.76	3.53	4.39	0.14	2.72	6.13	4.46	1.02	0.23	1.88	100.41	8.41	10	674	30	102	211	13	6	--	--	--	--	20	455	15	24	--	--	21	--	2.2	1.5
34	RB92-39B	--	NE	SE	27	37	5	565220	4685420	Tparc	A	57.63	0.75	18.04	3.37	3.26	0.11	3.93	7.08	3.87	1.01	0.13	0.85	100.03	6.99	12	758	17	149	166	49	46	--	--	--	--	23	380	14	23	--	--	18	--	1.6	1.3
35	RB92-42B	--	NW	NE	27	37	5	564820	4686480	Tparc	A	57.85	0.76	18.15	3.63	2.96	0.10	3.77	6.90	3.77	1.03	0.14	1.14	100.20	6.92	7	733	22	92	164	46	37	--	--	--	--	23	427	20	23	--	--	18	--	2	1.5
36	RB92-62	--	NW	SE	35	37	5	566200	4683800	Tparc	A	57.94	0.93	18.39	3.59	3.15	0.10	2.23	6.15	4.59	1.08	0.18	1.32	99.65	7.09	4	745	19	101	161	8	17	--	--	--	--	14	383	12	23	--	--	17	--	1.8	1.5
37	RB92-57B	--	NW	SW	35	37	5	565440	4684030	Tparc	A	59.26	0.81	17.14	3.30	3.23	0.10	3.25	5.96	4.50	1.55	0.24	0.83	100.17	6.89	14	842	21	138	137	39	44	--	--	--	--	20	550	20	35	--	--	15	--	2.2	1.5
38	91-30	--	NE	NE	11	38	5	566620	4681420	Tparc	A	60.17	0.63	17.28	2.42	3.27	0.10	3.14	5.80	4.22	1.43	0.16	1.04	99.66	6.05	21.7	588	17.6	121	108	36	80	6.0	18.3	51	58	14	492	10	32	1.6	4.7	15	8	--	--
39	91-37	--	SW	SE	35	37	5	566420	4683320	Tparc	A	60.34	0.66	16.92	3.12	2.87	0.11	3.41	5.31	4.03	1.49	0.17	1.35	99.78	6.31	22.7	565	19.3	125	106	34	83	6.3	18.3	62	58	15	521	14	33	2.3	3.9	14	9	--	--
40	91-2	--	SW	SW	2	38	5	565470	4682030	Tparc	A	60.77	0.67	16.94	3.05	2.67	0.10	2.94	5.68	3.97	1.48	0.16	1.23	99.66	6.02	23	590	20.2	111	130	28	52	4	18.2	48	60	18	528	15	29	2	2.7	15	--	1.5	1.6
41	CM04-05	--	NW	SW	2	38	5	565520	4682110	Tparc	A	61.05	0.64	17.16	2.07	3.55	0.10	3.31	5.93	4.04	1.48	0.17	0.65	100.15	6.02	24.1	595	14.2	117	115	38	44	4.4	18.7	44	57	18	523	--	--	0.8	3.7	13	14	--	--
42	CM04-01	--	SE	NE	34	37	5	565030	4684170	Tparc	D	63.23	0.89	17.01	4.03	1.28	0.09	0.61	2.47	4.42	1.85	0.24	3.64	99.76	5.45	27.1	363	19.2	159	80	4	1	5.0	20.3	35	67	8	812	--	--	1.8	1.8	14	12	--	--
43	CM04-04	--	NE	SW	35	37	5	566060	4683980	Tparc	D	65.76	0.83	15.91	2.83	2.03	0.10	0.98	3.24	5.29	1.85	0.25	1.10	100.17	5.09	29.0	447	41.1	150	78	3	1	5.5	19.1	41	74	7	774	--	--	1.6	1.8	14	10	--	--
44	RB92-20	--	SE	NW	34	37	5	564310	4684370	Tparc	D	65.89	0.87	16.02	3.48	1.62	0.07	0.68	3.06	5.15	1.88	0.22	1.41	100.35	5.28	19	424	18	162	77	8	2	--	--	--	--	6.7	718	16	34	--	--	14	--	2	1.5
45	99-47	--	SW	NE	35	37	5	566200	4684440	Tparc	D	66.16	0.82	15.67	1.35	3.15	0.11	1.24	3.33	5.67	1.86	0.25	0.41	100.02	4.85	24.7	426	25.3	159	63	2	24	6.2	19.2	20	74	7	588	16	38	2.3	4.9	13	9	--	--
46	RB92-60	--	NE	SW	35	37	5	566000	4684000	Tparc	D	66.71	0.85	15.37	2.53	2.30	0.11	1.03	3.24	5.46	1.92	0.23	0.65	100.40	5.09	19	412	26	167	74	5	--	--	--	--	--	8.3	685	16	39	--	--	14	--	2.6	1.6
47	RB92-59A	--	SE	SW	35	37	5	565970	4683490	Tparc	D	66.89	0.84	15.85	1.42	3.06	0.11	1.16	3.25	5.27	1.90	0.22	0.37	100.34	4.82	22	420	22	161	71	2	5	--	--	--	--	7.5	662	15	32	--	--	14	--	2.4	1.6
48	RB92-56B	--	SE	NW	35	37	5	565810	4684430	Tparc	D	67.20	0.84	15.26	1.56	2.90	0.11	1.08	3.18	5.50	1.93	0.22	0.32	100.10	4.78	25	410	23	183	68	2	1	--	--	--	--	6.7	665	15	39	--	--	13	--	2.6	1.6
49	MR94-13	--	NW	NE	22	38	5	564760	4678260	Tpbtc	B	50.23	1.20	18.18	2.69	6.40	0.16	6.86	10.44	3.08	0.31	0.12	0.01	99.68	9.80	4	542	25	64	239	78	167	1.6	18.7	96	62	41	131	7	12	0.3	--	38	--	2.5	0.8
50	91-13	--	SW	NW	22	38	5	563960	4677980	Tpbtc	BA	52.31	0.86	16.29	2.27	5.82	0.13	8.79	8.38	3.48	0.59	0.15	0.62	99.69	8.74	5.8	810	26.9	46	205	152	389	2.2	17	69	67	37	229	17	24	0.5	--	24	--	1.7	1.2
51	MR94-85	--	NW	NW	22	38	5	563970	4678330	Tpbtc	BA	52.79	0.86	17.83	3.45	4.24	0.14	7.31	8.40	3.38	0.56	0.17	0.01	99.14	8.16	5.8	817	29	61	191	125	302	1.8	18.2	64	61	34	251	18	24	2	<.5	24	--	2.4	1.3
52	99-66	--	SW	NE	23	38	5	566510	4677760	Tpbas	BA	53.02	1.21	18.11	2.80	5.93	0.14	5.19	7.34	4.03	0.72	0.25	1.05	99.79	9.39	9.6	629	28.3	111	170	80	120	4.9	18.4	73	79	29	311	17	20	2.2	1.8	21	5	--	--

[1] Certain elements that were not measured in most other samples were measured in sample RB92-21 (values in ppm) (Hf = 3.9, Ta < 0.3, Nd = 25, Sm = 4.85, Eu = 1.45, Tb = 0.9, Lu = 0.42)

(continued on next page)

Table 1 (page 2).

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
53	MR94-11	--	SW	NE	22	38	5	564720	4677670	Tpbas	BA	54.96	1.04	18.48	1.54	5.72	0.13	4.33	7.52	3.96	0.85	0.28	0.01	98.82	7.90	12.3	571	20.3	104	178	46	82	3.4	19.6	35	66	27	449	15.4	24.3	0.6	0.2	23	--	2.4	1.2
54	92-53	1.79 +/- 0.04	SW	SW	33	37	5	562150	4683500	Qbams	BA	54.86	0.77	17.94	2.57	4.52	0.12	5.76	7.27	3.44	0.70	0.14	1.53	99.62	7.59	6.1	805	20.9	60	159	70	165	2.4	21.2	27	61	32	209	12	20	1.7	3.1	19	3.5	1.5	0.9
55	00-22	--	SE	SE	28	37	5	563640	4685140	Qbams	BA	55.26	0.76	18.10	2.69	4.41	0.12	5.38	8.02	3.57	0.69	0.14	0.84	99.98	7.59	3.1	833	16.5	73	150	87	128	4.5	18.1	26	60	32	228	8	16	<0.5	1	20	4	--	--
56	00-21	--	NW	SW	33	37	5	562260	4684080	Qbams	BA	55.29	0.76	18.11	2.65	4.40	0.12	5.26	7.90	3.59	0.69	0.14	1.09	100.00	7.54	3.0	821	18.1	73	160	78	118	4.8	18.2	99	63	29	250	8	14	<0.5	1.8	22	3	--	--
57	RB92-04	--	NW	SW	33	37	5	562150	4683810	Qbams	BA	55.47	0.77	18.13	2.98	4.32	0.12	5.63	7.82	3.16	0.69	0.11	1.02	100.22	7.78	--	809	17	80	157	77	133	--	--	--	--	30	228	9.6	20	--	--	20	--	1.6	1.1
58	00-23	--	NW	NE	33	37	5	563180	4684670	Qbams	BA	55.56	0.77	18.01	2.79	4.22	0.12	5.35	7.86	3.52	0.69	0.14	0.98	100.01	7.48	4.9	828	19.4	92	140	72	136	4.9	18.9	41	54	28	307	8	16	0.6	1.2	19	3	--	--
59	00-17	--	NE	SW	27	37	5	564410	4685700	Qbams	BA	55.61	0.76	18.31	2.58	4.45	0.12	5.34	8.12	3.60	0.68	0.14	0.60	100.31	7.53	3.1	838	16.3	72	162	88	133	4.2	17.7	39	61	31	212	6	14	<0.5	0.6	22	3	--	--
60	92-87	0.68 +/- 0.09	SW	SW	11	37	5	565690	4689870	Qawp	BA	56.41	0.89	17.34	2.92	4.30	0.11	4.81	6.31	3.33	1.09	0.27	2.35	100.13	7.70	17	748	20.1	105	157	65	106	2.9	21.6	83	66	26	508	16	34	2	3.8	15	5.4	1.4	1.5
61	JP92-2	1.55 +/- 0.04	NE	SW	14	37	5	566040	4688820	Qawp	A	57.23	0.78	18.59	2.25	4.19	0.10	4.18	7.58	3.87	0.92	0.26	0.24	100.19	6.91	12.3	1290	18.4	93	126	29	21	1.5	21.4	28	59	--	390	20	40	1.6	5.3	--	--	--	--
62	92-43	0.63 +/- 0.05	NW	NW	29	37	6	570310	4686410	Qawp	A	58.88	0.71	17.86	2.57	3.28	0.10	3.62	6.91	3.57	0.98	0.20	0.66	99.34	6.22	15.8	1161	13.7	71	140	18	31	3.7	22.9	28	59	21	376	15	34	1.6	1.5	12	6.9	1.2	1.4
63	92-63	0.71 +/- 0.06	SE	SW	8	37	6	570850	4690060	Qawp	A	58.91	0.67	17.34	1.64	3.77	0.09	3.90	6.69	4.10	1.11	0.14	1.36	99.72	5.83	14.1	1031	13.7	62	130	37	44	3.5	20.9	56	61	20	379	13	26	2.3	2.8	15	6.3	0.9	1.2
64	92-44	0.92 +/- 0.02	NE	NW	17	37	6	570790	4689470	Qawp	A	58.96	0.69	17.72	3.00	2.74	0.09	3.83	6.66	3.89	1.02	0.15	0.43	99.18	6.05	13.1	1038	14	66	134	41	54	4	22	50	58	22	377	14	25	2.6	5.3	14	8.2	1	1.2
65	92-62	0.80 +/- 0.03	NW	NW	9	37	6	571750	4691170	Qawp	A	59.89	0.66	18.17	3.07	2.70	0.09	3.19	6.37	4.27	1.21	0.16	0.62	100.40	6.07	16.7	980	14.8	65	125	17	35	3.8	21.1	47	52	18	439	13	27	1.5	5.3	13	6.5	0.9	1.1
66	LH92-185	--	SW	NW	11	37	5	565300	4690700	Qawp	B	49.54	1.14	16.58	3.69	5.95	0.16	8.71	9.04	3.10	0.62	0.38	1.53	100.44	10.30	10.3	612	20.8	85	249	173	422	7.5	17.1	50	99	37	263	19.6	43.5	0.4	0.5	29	6.3	--	--
67	CM04-08	--	SE	NW	11	37	5	565700	4690560	Qawp	BA	52.44	0.92	19.79	3.62	4.02	0.15	5.36	7.44	3.39	0.32	0.23	2.48	100.16	8.09	4.6	810	23.1	128	173	84	129	5.7	21.4	51	79	27	540	--	--	1	1.8	22	7	--	--
68	CM04-08A	--	NW	SW	11	37	5	565690	4690480	Qawp	BA	55.50	0.86	18.26	2.46	4.67	0.13	4.98	7.29	3.61	0.82	0.26	1.48	100.32	7.65	12.2	791	17.8	119	164	78	123	5.2	20.1	54	73	25	519	--	--	<0.5	2.5	20	7	--	--
69	92-64	--	NE	SE	8	37	6	571540	4690360	Qawp	BA	55.60	0.88	17.37	3.11	3.93	0.12	4.90	7.12	3.93	1.10	0.27	0.85	99.18	7.48	17.6	766	19	101	162	76	129	4.9	18.4	56	74	23	457	18	32	2.4	2.1	18	--	1.5	1.1
70	99-41	--	NW	SW	6	38	6	568780	4682090	Qawp	BA	56.16	0.67	19.71	2.69	3.36	0.11	3.52	5.70	3.54	0.59	0.15	3.95	100.15	6.42	0.4	909	13.7	69	127	24	44	2.4	21.7	48	57	16	303	11	31	2	3	14	5	--	--
71	91-33	--	NW	SW	36	37	5	567130	4684070	Qawp	BA	56.37	1.00	18.08	4.47	3.13	0.14	3.67	7.43	3.94	0.97	0.27	0.46	99.93	7.95	17.1	972	11.7	80	118	25	25	2.8	19.5	57	58	16	387	8	21	<0.5	<0.5	17	6	--	--
72	CM04-10	--	NE	SE	15	37	5	565290	4688560	Qawp	BA	56.59	0.84	17.43	2.46	4.44	0.12	4.83	7.20	3.46	0.92	0.26	1.25	99.80	7.39	13.4	808	18.6	117	155	80	113	5.5	19.3	51	72	25	488	--	--	<0.5	1.9	19	6	--	--
73	JP92-17	--	SE	SW	11	37	5	565850	4689890	Qawp	BA	56.75	0.88	17.53	2.47	4.58	0.12	4.84	7.14	4.02	1.04	0.26	--	99.63	7.56	15	794	13	128	127	81	118	6	18	--	71	--	466	19	28	1	2	--	--	--	--
74	JP92-16	--	NW	SW	14	37	5	565450	4688830	Qawp	BA	56.83	0.78	18.71	2.29	4.24	0.11	4.18	7.38	3.71	0.92	0.26	0.71	100.12	7.00	12	1216	13	125	129	32	29	3	22	--	59	--	415	24	39	1	2	--	--	--	--
75	JP92-81A	--	SW	SE	11	37	5	566440	4689740	Qawp	BA	56.97	0.82	17.58	2.45	2.54	0.12	4.84	7.12	4.03	1.06	0.26	--	97.79	5.27	17	786	16	128	129	81	117	6	19	--	70	--	463	14	30	1	2	--	--	--	--
76	LH92-188	--	SW	SW	11	37	5	565480	4689870	Qawp	A	57.05	0.86	17.79	2.99	4.02	0.12	4.84	7.27	3.87	1.06	0.24	0.54	100.65	7.46	15.4	775	16.8	119	147	85	129	5.9	18.2	61	74	20	452	16.3	39.1	1	2.1	18.8	6.9	--	--
77	98-74	--	SE	NE	12	38	5	568410	4681250	Qawp	A	57.18	0.64	19.13	4.73	1.37	0.10	3.48	6.41	3.67	0.71	0.15	2.69	100.26	6.25	3.1	1012	11.5	77	108	29	27	3.8	20.6	9	61	15	303	12	26	1.1	1	14	9	--	--
78	CM04-09	--	NW	NW	14	37	5	565570	4689620	Qawp	A	57.27	0.72	18.89	3.86	2.41	0.10	3.85	7.24	3.60	0.87	0.22	1.36	100.39	6.54	13.9	1180	12.4	100	134	30	26	2.2	21.5	37	58	19	397	--	--	1.4	1.9	15	10	--	--
79	JP92-132	--	SW	NE	22	37	5	564680	4687540	Qawp	A	57.44	0.82	18.08	2.45	4.56	0.12	3.51	7.00	4.31	1.24	0.18	0.01	99.72	7.52	23	680	20	107	143	27	30	4	19	--	70	--	466	12	20	1	2	--	--	--	--
80	RB92-80	--	SE	NE	36	37	5	568490	4684260	Qawp	A	57.67	0.71	18.15	3.22	2.86	0.10	4.32	6.78	3.82	0.95	0.17	1.45	100.20	6.40	5	1183	10	108	140	26	36	--	--	--	--	20	416	16	35	--	--	14	--	1.3	1.3
81	92-65	--	NE	SE	8	37	6	571670	4690270	Qawp	A	58.00	0.68	17.79	3.01	3.04	0.10	4.46	6.79	4.06	0.96	0.18	0.42	99.49	6.39	13.9	888	14.9	56	143	67	90	2.6	18.8	37	63	24	372	13	22	--	--	16	--	1.3	1.1
82	92-35	--	NE	NE	20	37	6	571470	4688110	Qawp	A	58.14	0.72	18.53	2.63	3.35	0.09	3.68	7.08	4.04	0.80	0.19	0.56	99.81	6.35	10.9	1308	11	89	118	22	36	2.8	21.3	43	59	18	268	10.6	39.2	1.3	1.5	15.3	4.7	--	--
83	92-33	--	NW	SE	20	37	6	571090	4687090	Qawp	A	58.15	0.64	18.31	2.60	3.18	0.10	3.52	6.82	4.29	1.07	0.19	0.49	99.36	6.13	6.3	1026	11.4	91	111	23	38	3.5	19.9	36	58	17	379	14.2	35.3	1	2.7	13.7	7	--	--
84	CM04-07	--	NW	NW	11	37	5	565520	4691040	Qawp	A	58.36	0.70	18.47	5.11	0.99	0.11	3.54	6.30	3.77	0.93	0.17	1.70	100.15	6.21	14.5	1067	11.8	96	103	28	33	2.3	21.0	59	63	18	366	--	--	<0.5	2.4	13	6	--	--
85	RB92-82	--	NW	NE	31	37	6	569630	4684570	Qawp	A	58.38	0.66	17.98	5.00	1.35	0.10	4.19	6.62	3.79	0.85	0.11	1.11	100.14	6.50	5	1113	9	83	125	26	33	--	--	--	--	21	312	11	26	--	--	14	--	1.3	1.1
86	92-34	--	SE	SE	17	37	6	571480	4688390	Qawp	A	58.69	0.67	18.59	2.36	3.55	0.09	3.66	7.00	4.04	0.83	0.17	0.54	100.19	6.31	12.2	1173	11.3	81	108	24	43	2.4	19.7	55	52	16	298	13	31.1	2	1.2	14.7	4	--	--
87	LH92-73	--	NE	NW	11	37	5	565850	4691150	Qawp	A	58.70	0.71	18.29	1.42	4.42	0.09	3.42	6.16	3.61	1.05	0.17	1.96	100.00	6.33	17.2	1040	17.8	101	122	27	38	4	20	19	62	16	411	23.2	39.4	1.1	1.7	15.1	6	--	--
88	JP92-103	--	SE	SE	19	37	6	570020	4686670	Qawp	A	58.75	0.63	18.72	2.14	3.96	0.10	3.58	7.07	4.04	0.82	0.14	0.33	100.28	6.54	11	1067	10	79	98	27	20	2	20	--	57	--	292	11	24	1	1	--	--	--	--
89	RB92-74	--	NW	NE	6	38	6	569720	4683220	Qawp	A	58.89	0.66	18.21	3.09	2.91	0.10	3.58	6.84	3.58	0.85	0.12	1.07	99.90	6.32	10	1100	9	83	134	28	25	--	--	--	--	19	332	11	25	--	--	14	--	1.4	1.2
90	JP92-86	--	NE	NW	24	37	5	567680	4688040	Qawp	A	59.03	0.69	18.54	2.08	3.87	0.10	3.49	6.85	3.94	0.85	0.17	0.86	100.47	6.38	12	1251	10	130	110	23	24	2	22	--	59	--	315	9	31	1	2	--	--	--	--
91	JP92-99	--	NE	SW	19	37	6	569360	4687100	Qawp	A	59.03	0.63	18.58	2.12	3.94	0.09	3.33	6.77	4.03	0.95	0.15	0.24	99.86	6.50	15	927	11	83	90	23	17	2	20	--	49	--	356	11	22	1	2	--	--	--	--
92	LH92-193	--	NW	SE	11	37	5	566340	4690280	Qawp	A	59.03	0.69	18.21	2.29	3.40	0.09	3.66	5.81	3.71	1.10	0.16	1.94	100.09	6.07	15.4	920	12.4	93	129	52	65	3.8	18.3	34	59	16	383	17.4	30.4	1.2	2.2	14.4	8.3	--	--
93	RB92-46	--	NW	SE	26	37	5	566420	4685440	Qawp	A	59.03	0.64	18.03	3.19	2.86	0.10	3.58	6.43	3.38	0.86	0.11	1.90	100.11	6.37	3	1044	9	85	129	33	36	--	--	--	--	20	341	11	25	--	--	14	--	1.2	1.2
94	91-32	--	NW	SE	36	37	5	567810	4684010	Qawp	A	59.05	0.62	18.32	2.29	3.46	0.10	3.39	7.01	3.68	0.92	0.12	0.58	99.54	6.14	14.3	1036	14	53	124	20	41	2.6	19.1	31	57	18	344	11	25	1.2	2	14	--	1.1	1.2
95	JP92-108	--	SE	SE	19	37	6	569910	4686760	Qawp	A	59.05	0.64	18.90	2.09	3.88	0.10	3.47	7.02	4.02	0.84	0.15	0.36	100.52	6.40	12	1115	11	92	114	27	21	2	19	--	55	--	335	11	24	1	1	--	--	--	--
96	LH92-156	--	SW	SE	13	37	5	567780	4688240	Qawp	A	59.05	0.62	18.98	2.80	3.03	0.10	3.37	6.31	3.54	0.96	0.12	1.54	100.42	6.17	15.9	976	13.6	80	115	27	36	3.2	19.3	30	61	15	355	12.6	33.1	1	2.5	15.6	10	--	--
97	RB92-49	--	NW	NE	26	37	5	566210	4686220	Qawp	A	59.05	0.64	18.15	2.58	3.45	0.10	3.45	6.78	3.70	0.93	0.13	0.88	99.84	6.41	3	984	9	107	128	25	30	--	--	--	--	19	350	10	30	--	--	14	--	1.5	1.2
98	JP92-50	--	NW	NW	29	37	6	570550	4686440	Qawp	A	59.06	0.68	18.22	2.08	3.85	0.10	3.54	6.78	4.13	0.98	0.19	0.39	100.00	6.36	16	1143	11	111	113	28	33	3	20	--	62	--	398	15	31	1	2	--	--	--	--
99	JP92-120	--	SE	SE	30	37	6	570180	4685150	Qawp	A	59.10	0.67	18.61	2.10	3.90	0.10	3.48	6.57	4.16	1.07	0.20	0.87	100.83	6.43	12	1084	11	107	100	25	24	3	22	--	61	--	461	18	29	1	2	--	--	--	--
100	JP92-53	--	NE	SE	19	37	6	569170	4687280	Qawp	A	59.20	0.62	19.00	2.10	3.89	0.10	3.22	6.68	3.98	0.94	0.15	0.62	100.50	6.42	15	910	11	87	93	24	17	2	19	--	57	--	370	11	21	2	1	--	--	--	--
101	JP92-56	--	NE	SW	24	37	5	567400	4687110	Qawp	A	59.29	0.63	18.71	2.18	4.04	0.11	3.46	6.50	3.90	0.96	0.15	0.65	100.58	6.67	15	926	12	83	91	21	17	2	20	--	53	--	375	11	19	1	2	--	--	--	--
102	JP92-14	--	NE	NE	23	37	5	566560	4688030	Qawp	A	59.34	0.69	18.37	2.07	3.85	0.09	3.48	6.80	4.05	0.92	0.18	0.21	100.05	6.35	14	1165	11	107	111	27	26	2	20	--	55	--	360	17	31	2	2	--	--	--	--
103	JP92-95	--	NE	SW	25	37	5	567570	4685420	Qawp	A	59.37	0.62	18.78	2.10	3.91	0.10	3.41	6.84	4.06	0.93	0.14	0.04	100.30	6.45	14	1002	11	93	101	26	22	2	20	--	56	--	380	13	22	1	1	--	--	--	--
104	JP92-107	--	NE	SE	30	37	6	569870	4685470	Qawp	A	59.38	0.62	18.60	2.11	3.91	0.10	3.52	6.55	3.91	0.97	0.14	0.59	100.40	6.46	16	1026	11	97	102	25	28	3	20	--	59	--	391	11	23	2	1	--	--	--	--
105	LH92-197	--	NE	SE	7	37	6	569910	4690250	Qawp	A	59.43	0.68	17.81	2.78	2.90	0.09	3.59	6.56	3.82	1.07	0.15	0.81	99.69	6.00	12.8	1026	11.5	87	112	40	56	3.6	18.9	72	57	15	376	12.6	27.9	1.2	1	13.8	7.7	--	--
106	LH92-161	--	SE	SE	13	37	5	568470	4688510	Qawp	A	59.53	0.62	18.64	0.12	5.41	0.11	3.64	7.04	3.72	0.90	0.12	0.55	100.40	6.13	13.6	1009	10.3	77	114	29	35	3	19	22	61	16	303	9.4	27.3	0.6	1.5	14.5	4	--	--
107	JP92-47	--	NE	NW	19	37	6	569100	4687870	Qawp	A	59.54	0.60	18.43	2.05	3.81	0.09	3.46	6.70	4.00	0.94	0.14	0.21	99.97	6.28	15	994	10	96	102	26	28	3	18	--	57	--	368	9	20	1	1	--	--	--	--
108	92-32	--	SE	NE	20	37	6	571650	4687620	Qawp	A	59.75	0.59	18.28	2.51	2.88	0.09	3.08	6.21	4.09	1.31	0.15	1.11	100.05	5.71	23.6	747	12	91	111	25	45	3.2	18.3	36	58	15	460	12	30.3	2.9	2.6	14.7	8.7	--	--
109	RB92-85	--	NW	NW	31	37	6	568810	4684810	Qawp	A	59.75	0.70	17.78	2.83	3.12	0.10	3.56	6.91	3.72	0.99	0.16	0.67	100.29	6.30	9	1134	9	111	137	31	38	--	--	--	--	19	381	14	32	--	--	14	--	1.4	1.3
110	CM04-11	--	NW	NW	23	37	5	565730	4687840	Qawp	A	59.76	0.65	18.50	2.38	3.04	0.10	2.95	5.42	3.70	1.19	0.16	1.96	99.81	5.76	20.3	815	15.3	90	111	26	28	3.5	20.0	49	58	17	640	--	--	1.3	2.2	14	11	--	--
111	CM04-07A	--	NW	NW	11	37	5	565520	4691040	Qawp	A	59.82	0.60	18.43	2.22	3.10	0.10	2.93	5.54	3.82	1.32	0.15	1.91	99.94	5.67	23.9	721	11.9	89	103	25	31	3.3	19.7	44	63	16	507	--	--	0.8	1.4	13	19	--	--
112	LH92-6	--	NE	SW	12	37	5	567710	4690330	Qawp	A	60.17	0.60	18.53	1.91	3.76	0.09	3.42	6.64	3.64	1.05	0.11	0.76	100.68	6.09	18.1	949	12.1	85	117	31	51	3.6	18.2	27	63	16	371	11.5	30	1.1	1.5	14.9	5.3	--	--
113	LH92-90	--	NE	NW	17	37	6	570780	4689490	Qawp	A	60.18	0.69	18.22	1.23	4.26	0.09	3.68	6.68	4.08	1.06	0.16	0.52	100.85	5.96	14.1	1010	11	91	127	51	58	3.9	18.8	50	62	15	363	11.9	31	1.7	1.9	15.2	7.1	--	--

(continued on next page)

Table 1 (page 3).

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
114	92-36	--	NW	SE	20	37	6	571320	4687260	Qawp	A	60.24	0.63	18.53	3.58	1.97	0.09	2.91	6.21	4.21	1.23	0.16	0.50	100.26	5.77	15.2	843	12.9	96	114	23	50	3.8	19.4	51	59	13	444	15.1	33	2	2.4	14.6	9.9	--	--
115	LH92-199	--	NW	NE	7	37	6	569540	4691250	Qawp	A	60.45	0.66	18.12	2.48	3.11	0.09	3.36	6.19	3.96	1.19	0.14	1.03	100.78	5.94	17	936	11.7	89	106	30	34	3.7	18.4	33	57	14	425	11.4	27.7	1.5	1.6	12.6	4.7	--	--
116	98-75	--	NW	SE	6	38	6	569750	4682420	Qawp	A	60.88	0.59	18.17	1.74	3.20	0.09	2.87	6.05	4.14	1.28	0.14	0.81	99.96	5.30	21.7	754	14.4	89	112	31	39	4.2	19.2	44	60	15	460	14	26	1.7	2.1	15	10	--	--
117	99-62	1.48 +/- 0.10[a]	SE	SW	18	38	6	569230	4678750	Qbbl	B	51.28	1.22	18.43	1.15	7.73	0.15	5.63	8.79	3.69	0.54	0.22	0.92	99.75	9.74	6.0	594	23.8	97	190	55	105	5.0	20.8	63	71	28	291	11	23	1.7	1.5	21	6	--	--
118	99-63	--	SE	NE	19	38	6	570050	4677900	Qbbl	B	50.60	1.17	18.44	5.76	3.82	0.62	5.97	8.61	3.63	0.47	0.21	0.52	99.82	10.01	2.8	592	22.7	89	153	86	169	4.9	19.6	48	71	32	292	10	19	0.6	0.9	20	4	--	--
119	98-73	--	SW	NW	18	38	6	568960	4679370	Qbbl	BA	52.13	1.21	17.80	3.14	5.19	0.14	5.68	8.91	3.55	0.82	0.26	1.07	99.90	8.91	8.1	705	21.2	113	185	53	119	8.6	20.3	48	73	25	329	15	29	0.8	0.5	24	9	--	--
120	99-40	--	SW	SW	7	38	6	568680	4680230	Qbbl	BA	52.25	1.01	18.63	1.95	5.97	0.14	5.77	9.39	3.65	0.62	0.21	0.81	100.40	8.58	3.4	730	20	83	200	65	116	3.9	20.5	74	72	27	312	12	24	1.2	3.1	25	4	--	--
121	99-31	1.45 +/- 0.01[a]	NE	SE	8	38	6	571750	4680610	Qbbp	BA	52.46	1.12	18.37	2.84	5.14	0.14	5.26	9.28	3.61	0.69	0.26	1.01	100.18	8.55	5.4	788	21	101	226	39	96	6.1	20.0	64	80	27	306	13	31	0.8	4	28	4	--	--
122	98-77	--	NW	SE	5	38	6	571200	4682400	Qbbp	B	51.81	1.05	18.26	2.78	5.38	0.14	5.07	8.52	3.75	0.78	0.22	0.96	98.72	8.76	9.1	660	19.9	93	182	51	77	5.6	20.8	52	72	24	330	11	24	1	0.5	24	9	--	--
123	98-76	--	SE	SE	6	38	6	570130	4682010	Qbbp	BA	52.06	1.06	18.61	1.45	6.44	0.14	5.35	8.95	3.71	0.74	0.22	0.80	99.53	8.61	8.9	672	20.9	93	201	56	82	6.0	20.6	65	72	24	333	11	26	<0.5	1.3	24	10	--	--
124	98-78	--	SW	SW	8	38	6	570330	4680400	Qbbp	BA	52.43	1.07	18.57	1.62	6.47	0.14	5.26	8.43	3.75	0.76	0.23	1.11	99.84	8.81	6.8	693	23.6	94	196	49	63	6.2	20.8	62	74	24	326	16	29	0.6	0.6	24	9	--	--
125	99-43	--	SE	SW	7	38	6	569440	4680430	Qbbp	BA	52.58	1.07	18.46	2.09	6.23	0.14	5.26	8.42	3.79	0.74	0.23	1.19	100.20	9.01	4.1	687	24.5	88	193	46	65	3.8	21.3	79	75	26	403	15	26	1.1	2.6	24	5	--	--
126	99-37	--	SE	SW	17	38	6	570950	4678500	Qbbp	BA	52.74	0.98	18.38	2.22	5.75	0.14	5.73	9.20	3.71	0.72	0.20	0.56	100.33	8.61	6.4	714	19.5	80	183	64	113	3.6	20.1	78	70	26	317	9	24	2	3.4	23	4	--	--
127	99-30	--	NE	NE	8	38	6	571490	4681440	Qbbp	BA	52.91	1.06	18.28	2.02	6.18	0.14	5.18	8.51	3.89	0.79	0.23	0.78	99.97	8.89	9.0	667	23.2	90	219	44	65	5.8	21.7	70	76	30	323	15	27	1.6	4	21	5	--	--
128	92-84	0.90 +/- 0.05	SE	NW	31	37	6	569160	4684120	Qbah	BA	55.26	0.87	18.75	4.17	2.77	0.11	4.31	8.32	3.93	0.66	0.20	0.59	99.94	7.25	6.6	1199	16.2	47	180	14	25	3.3	23.2	42	58	25	213	12	29	0.5	4.1	18	3.2	0.9	1.2
129	DH94-50	1.08 +/- 0.05	NW	NW	12	38	5	567130	4681520	Qbah	BA	55.39	0.86	17.48	2.47	4.25	0.11	5.87	8.00	3.87	0.86	0.21	0.70	100.07	7.19	10.2	1098	12	88	147	79	163	3.9	17.8	43	58	20	331	12.3	2.4	1	1.2	17	4	1.2	1
130	92-54	--	NE	NW	5	38	6	570920	4683130	Qbah	BA	54.32	0.89	18.76	2.26	5.06	0.12	4.60	7.76	3.97	0.84	0.15	0.63	99.36	7.88	11.8	828	17.3	49	197	41	59	1.4	20.1	81	66	31	312	11	18	0.7	1.4	20	--	1.3	1.1
131	CM04-06	--	NW	NW	12	38	5	567080	4681610	Qbah	BA	55.24	0.88	17.34	3.43	3.67	0.12	6.30	7.50	3.40	0.86	0.20	1.37	100.31	7.51	10.6	1074	13.9	91	154	105	138	3.1	20.1	46	66	28	407	--	--	<0.5	1.7	20	4	--	--
132	91-34	--	SW	NE	12	38	5	568180	4680950	Qbah	BA	55.39	0.87	16.97	2.52	4.26	0.11	5.75	7.89	3.61	0.79	0.20	1.11	99.47	7.25	8	1099	19.3	59	175	68	132	2.6	19	40	61	25	327	16	27	--	0.6	20	--	1.2	1.3
133	91-31	--	SW	NW	12	38	5	567180	4681250	Qbah	BA	55.48	0.89	17.23	2.16	4.52	0.11	6.04	8.07	3.71	0.83	0.19	0.57	99.80	7.18	9.3	1139	16.4	60	173	78	146	3	18.8	37	63	27	330	13	34	2.6	1.6	19	--	1.2	1.4
134	RB92-77	--	SE	NW	31	37	6	569230	4684330	Qbah	BA	55.50	0.88	18.59	4.55	2.59	0.11	4.21	7.99	3.89	0.69	0.18	1.04	100.22	7.43	--	1183	10	85	176	17	29	--	--	--	--	22	223	11	29	--	--	18	--	1.4	1.2
135	99-42	--	SW	NW	7	38	6	569030	4680960	Qbah	BA	55.55	0.82	17.38	2.92	3.86	0.12	6.00	8.02	3.73	0.77	0.19	0.89	100.25	7.21	5.2	1103	15.3	69	159	85	151	2.7	19.8	32	81	23	355	13	27	0.7	2.5	19	6	--	--
136	RB92-76	--	SE	NW	31	37	6	569210	4684180	Qbah	BA	55.73	0.85	18.22	4.32	2.72	0.11	4.50	8.32	3.98	0.67	0.14	0.76	100.32	7.34	4	1170	10	86	176	28	43	--	--	--	--	23	218	11	27	--	--	19	--	1.2	1.2
137	91-5	0.33 +/- 0.12[a]	NE	SE	17	38	5	562120	4678900	Qbbb	B	48.97	0.98	17.70	3.70	5.50	0.16	8.15	10.52	2.76	0.22	0.09	1.08	99.83	9.81	2.0	476	22.5	67	185	107	293	3.5	17.4	71	61	34	114	4	19	<0.5	2.6	30	2	--	--
138	91-3[2]	0.82 +/- 0.08	SE	SE	3	38	5	565210	4681770	Qbbb	B	49.24	1.05	17.46	3.14	5.89	0.15	7.58	10.59	2.86	0.26	0.10	1.25	99.57	9.69	3.2	492	27.1	55	214	91	239	1.1	17.6	83	62	41	113	4.3	13	1.3	3.7	34	5.1	2.31	1.1
139	91-9	--	NE	NE	8	38	5	562020	4681250	Qbbb	B	46.52	1.03	17.97	9.12	0.66	0.16	7.89	9.70	2.39	0.19	0.09	3.69	99.41	9.85	2.2	460	26	53	115	108	230	1.8	15.8	157	67	40	133	5	12	0.8	--	39	--	2.3	0.6
140	RB92-10	--	SW	SW	33	37	5	562280	4683360	Qbbb	B	46.67	1.08	18.00	2.37	7.24	0.16	9.09	10.04	2.03	0.10	0.08	3.59	100.45	10.42	--	519	23	68	237	112	261	--	--	--	--	45	163	3.4	15	--	--	38	--	2.5	1.1
141	91-1	--	SW	NW	4	38	5	562340	4682640	Qbbb	B	48.36	1.01	17.71	2.54	6.60	0.16	8.55	10.25	2.63	0.17	0.08	1.97	100.03	9.87	1.1	461	23.7	66	191	109	292	3.3	17.0	84	61	34	111	7	18	1.1	2.1	28	3	--	--
142	RB92-11	--	NW	NE	4	38	5	563110	4683130	Qbbb	B	48.41	0.98	18.26	2.84	6.28	0.15	8.74	10.86	2.36	0.13	0.07	1.31	100.39	9.82	1	555	20	62	219	113	242	--	--	--	--	44	129	3.7	12	--	--	35	--	2.3	1
143	91-86	--	SE	NE	20	38	5	562000	4677830	Qbbb	B	48.97	1.04	17.03	1.13	7.77	0.15	8.18	10.63	2.58	0.25	0.09	1.47	99.29	9.77	3.8	482	25.9	51	243	90	256	1.4	16.9	77	60	40	114	5	14	--	--	38	--	2.3	1.1
144	91-4	--	SE	NE	9	38	5	563710	4680880	Qbbb	B	49.16	1.08	18.08	3.12	5.83	0.16	7.07	10.44	2.96	0.27	0.10	1.55	99.82	9.60	2.7	530	24.2	69	162	68	198	3.2	18.2	72	58	30	138	6	19	<0.5	2	27	3	--	--
145	BS94-28	--	SE	NE	21	38	5	563670	4677990	Qbbb	B	49.17	0.95	18.10	3.38	5.58	0.15	7.84	10.69	2.75	0.26	0.10	0.89	99.86	9.58	4.2	530	22.2	57	220	88	227	3.6	15.3	80	64	33	137	5.6	13.8	0.3	--	36.4	4.6	1	1.8
146	91-6	--	SW	SE	16	38	5	563320	4678540	Qbbb	B	49.20	1.08	16.52	1.98	7.38	0.16	8.68	10.36	2.69	0.25	0.09	1.15	99.54	10.18	4.2	474	26.4	53.5	237	110	247	1.9	17.4	86	62	44	102	3.5	12	--	--	37	--	2.6	0.9
147	91-8	--	NE	NE	8	38	5	561940	4681330	Qbbb	B	49.31	0.99	17.09	7.70	1.71	0.15	7.79	11.11	2.65	0.26	0.09	0.56	99.41	9.60	2.4	545	25	47	54	82	242	2	16.4	54	65	39	142	7	14	--	--	39	--	2.3	0.9
148	91-10	--	SE	NE	8	38	5	562140	4680810	Qbbb	B	49.34	1.18	16.61	2.80	6.77	0.16	8.05	10.82	2.77	0.25	0.10	0.66	99.51	10.32	3.5	465	26.9	59	258	92	222	1.9	17	97	65	43	112	4	16	--	--	38	--	2.4	0.9
149	91-14	--	SW	NE	21	38	5	563380	4677910	Qbbb	B	49.46	0.97	17.52	1.99	6.79	0.16	8.00	11.02	2.76	0.28	0.09	0.56	99.60	9.54	2.8	549	25.3	48	235	77	222	2.3	16.2	79	62	38	135	5	14	--	--	39	--	2.5	1
150	BS94-42	--	NE	NE	21	38	5	563620	4678070	Qbbb	B	49.47	1.00	18.30	4.18	4.75	0.16	7.69	11.12	2.87	0.23	0.10	0.56	100.43	9.46	2.3	550	26	50	216	94	221	1	17	73	65	43	159	11	15	1	--	41	--	0.6	2.8
151	91-7	--	SE	SE	10	38	5	565390	4680050	Qbbb	B	49.48	1.05	17.63	1.52	7.17	0.15	7.63	11.02	2.86	0.21	0.09	0.90	99.71	9.49	2.4	544	25	49	228	83	201	1.6	17.1	77	65	40	120	5	11	--	0.5	36	--	2.1	1
152	84-55	--	NW	NE	9	37	5	563080	4691270	Qabm	A	58.79	0.67	18.29	6.39	--	0.11	3.30	6.74	3.90	1.12	0.15	0.50	99.96	6.39	22.0	693	13.2	83	133	32	31	3.3	18.6	45	65	19	431	8	19	0.6	0.8	15	7	--	--
153	AT91-40	--	SW	NW	9	37	5	562460	4690870	Qabm	A	59.11	0.69	18.58	1.87	3.86	0.10	3.14	6.37	3.83	1.16	0.15	0.82	99.68	6.16	28.3	651	13.5	97	121	36	29	--	--	--	--	20	470	13	15	--	--	14	--	0.8	1.4

[2] Certain elements that were not measured in most other samples were measured in sample 91-3 (values in ppm) (Hf = 1.5, Ta < 0.3, Nd = 9, Sm = 2.45, Eu = 0.98, Tb = 0.6, Lu = 0.32)