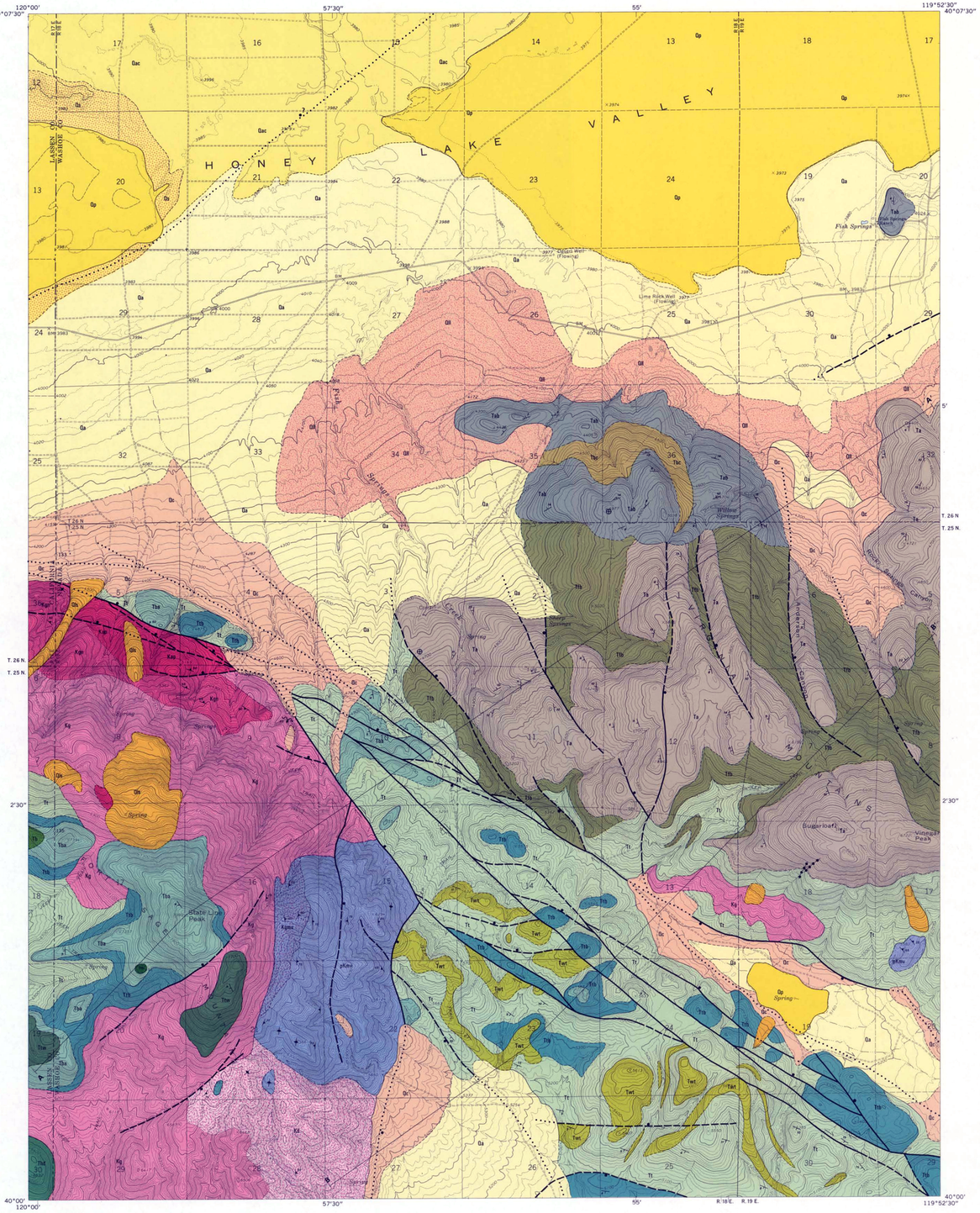

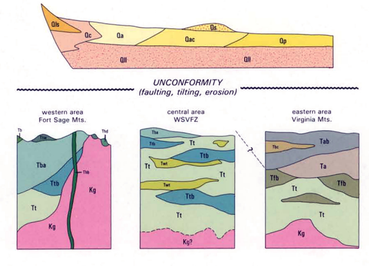

FIGURE 1. Index map showing the location of the State Line Peak quadrangle in the northern part of the Walker Lane fault system. HLF, Honey Lake fault; PLF, Pyramid Lake fault; SLP, State Line Peak quadrangle; WSVF, Warm Springs Valley fault. Dashed line indicates the boundary between the Basin and Range and Sierra Nevada physiographic provinces.

INTRODUCTION

The State Line Peak quadrangle is located in a sparsely mapped region of the western part of the Basin and Range province several miles east of the Sierra Nevada front and 35 miles north of Reno along the California-Nevada state line. Within the quadrangle are parts of four physiographic features, the eastern part of the Fort Sage Mountains, the southern margin of the Honey Lake Basin, the western part of the Virginia Mountains, and the northern end of Dry Valley. Elevation varies from about 4000 feet in the Honey Lake Basin to about 8050 feet at the summit of State Line Peak. A major fault within the northwestern part of the Walker Lane fault system, the Warm Springs Valley fault zone (WSVFZ; figs. 1, 2), passes diagonally through the quadrangle. The following three major groups of geologic formations crop out in the quadrangle: a variety of Quaternary surficial deposits, late Oligocene to early Miocene silicic tuffs and Miocene to Pliocene(?) andesitic and basaltic flows, and Cretaceous granodioritic plutonic rocks intruded into older metamorphosed andesite flows and tuffs.

Previously published geologic maps that encompass some of the area of the State Line Peak quadrangle include Bonham (1969) and Lydon and others (1960).

LITHOLOGY

QUATERNARY DEPOSITS

Playa clay. Hard, smooth, light-gray clay covers about 7 square miles in two separate areas in the southeastern part of Honey Lake Valley in the northern part of the quadrangle. After heavy rains, lakes form on the clay playas and may persist for days or, rarely, for weeks. More extensive areas of playa clay occur to the northwest, north, and northeast of the State Line Peak quadrangle.

Fine sand. Low mounds, less than 20 feet high, of windblown sand and clayey sand arrested by sparse vegetation and ground water occur on the north, east, and south sides of a small playa in the northwest part of the quadrangle. A northeast-trending linear sand deposit on the south side of the playa may be controlled by upward ground water seepage from an underlying buried Holocene fault zone.

Sand and clay alluvium. Eolian and fluviatile sand, silt, and clay form a finely hummocky blanket on the surface of Honey Lake Valley between areas of sand and playa in the northwestern part of the quadrangle and in extensive areas to the north of the quadrangle.

Fine gravel and sand alluvium. Coalescing alluvial fans form bajadas that merge with sand and clay deposits of the floor of Honey Lake Valley. The alluvium is composed of gravel- and sand-sized clasts of quartz, feldspar, and volcanic rocks derived from the Fort Sage and Virginia Mountains to the south. A small area in the south central part of the map is also underlain by locally derived alluvium.

Boulder and sand colluvium. Coarse detritus, with boulders up to 10 feet in diameter, occurs against the north flank and locally against the east flank of the Fort Sage Mountains. Somewhat finer colluvium made up entirely of volcanic clasts occurs discontinuously along the base of the north and south sides of the Virginia Mountains. In S9,10 on the northeast flank of the Fort Sage Mountains relatively deeply incised arroyos expose colluvium, up to about 100 feet thick, resting on a high-relief surface cut in tuffs, breccias, and flows.

Landslide and slump deposits. Granitic and volcanic debris form four distinct slump masses amidst several less distinct slump masses on the steep fault-bounded northern slope of the Fort Sage Mountains block. One long debris flow (S5) that reached the base of the mountain is eroded by wave action of pluvial Lake Lahontan at its highstand of about 4375 feet. That particular slide must predate the age of the last major highstand of Lahontan, placed at 11,100–13,600 years by Benson (1978) and at about 18,000 years by Morrison and Frye (1965). Another area of considerable slope instability in which two slump masses are mapped is on the steep south flank of the Virginia Mountains (S17,18) where 500 feet of andesite flows overlie several hundred feet of incompetent tuff. Faulting may have triggered these slides, for the base of the slope is marked by a late Pleistocene fault scarp. All significant landslide and slump deposits in the mapped area occur on abnormally steep and high slopes controlled by late Quaternary faults.

Lahontan lake beds. Exposed near-shore deposits of the late Pleistocene pluvial Lake Lahontan include sand, silt, clay, ash (west-central S35), and tufa (south-central S25). They occur lapping up on volcanic bedrock of the north side of the Virginia Mountains and as windows in a blanket of more recent alluvium in Honey Lake Valley. Probably a significant fraction of the Quaternary deposits of Honey Lake Valley are composed of primary and reworked Lake Lahontan sediments.

TERTIARY VOLCANIC ROCKS

Hypersthene basalt. Black, vitrophyric, with euhedral, <3 mm long phenocrysts of augite, hypersthene, sodic labradorite, and rare olivine set in cryptocrystalline groundmass with crystallites of feldspar; dense, uniform. This is the only hypersthene-bearing basalt and the only intrusive plug recognized within the quadrangle. It occurs in a fan-jointed, crudely circular (about 200 feet in diameter), topographically prominent mass about ½ mile southwest of State Line Peak. Extrusive equivalents are absent within the mapped area. An unrelated(?) dacitic(?) circular intrusive center, ten times larger, occurs 1½ miles to the west (just off the map).

Hornblende dacite. Light gray, finely porphyritic with phenocrysts of potash feldspar, plagioclase, hornblende, and sparse quartz set in a felsitic matrix; dense. This unit occurs only in the southwest corner of the map. Lying directly on Cretaceous granodiorite, it consists of over 200 feet of flows, each 5–10 feet thick, with more plagioclase-rich nonporphyritic flows in the upper part. No rocks overlie this unit within the quadrangle area.

Rhyolite tuff. Red, pink, tan, dark gray; coarse grained with varying amounts of crystals of sanidine, quartz, plagioclase, and rare biotite and of fragments of dense devitrified glass and pumice set in a stony vitroclastic matrix; dense, moderately welded, relatively resistant ledge-former. Over 300 feet of this unit are locally preserved at two localities, high in the Fort Sage Mountains in the southwestern part of the map area. In one area it lies directly on granodiorite; in the other it lies on finely porphyritic andesite. No rocks overlie this unit in the mapped area.

Basalt. Black, microporphyritic, hyalo-ophitic with microphenocrysts of sodic labradorite, olivine, and pyroxene in groundmass of dusty glass and feldspar microlites; dense, uniform. This unit is confined to one small area in S18 along the western margin of the map where a less than 100-foot-thick flow sequence is preserved. Associated with the dense flow rock is scoria, pahoehoe, and aa. The basalt overlies the finely porphyritic basalt sequence, but no rocks overlie the basalt in the mapped area.

Andesite and basalt. Medium to dark gray; coarsely porphyritic with euhedral phenocrysts of sodic labradorite and calcic andesine, 1–10 mm, 10%–45% by volume, set in intergranular and pilotaxitic matrix of feldspar and pyroxene; rare 1-mm-long phenocrysts of pyroxene and olivine (largely iddingsite); dense to moderately vesicular. An estimated minimum thickness of 500 feet of flow-on-flow andesite and basalt occurs low on the northwest part of the Virginia Mountains. A distinctive lens of volcanic breccia and conglomerate (Tbc) occurs within the section. The andesite and basalt unit is lithologically similar to underlying units (Ta and Tfb), but it forms a well-defined and younger sequence that strikes generally east-west and dips north and that is structurally discordant with the underlying units. No rocks overlie the andesite and basalt in the mapped area.

Volcanic breccia and conglomerate. Light to dark gray; clasts of gray uniform felsite, rounded to angular, ½–50 cm in sparse volcanic sand matrix. Flow breccia and rubble of porphyritic and nonporphyritic andesite and basalt; crudely bedded. A large lens of this unit occurs within the andesite and basalt unit (Tab). This lithology is representative of many thin lenticular beds, difficult if not impossible to map, within the andesite and basalt sequence. Furthermore, it somewhat resembles the older flow breccia unit (Tfb) occurring widely in the Virginia Mountains.

Porphyritic andesite. Medium to dark gray; euhedral phenocrysts, 2–15 mm long, 10%–40% by volume, of calcic andesine set in intergranular and locally pilotaxitic stony groundmass containing sparse 1-mm-long phenocrysts of pyroxene and rare olivine; dense to moderately vesicular. Porphyritic andesite flows are the most widespread rock in the Virginia Mountains within the State Line Peak quadrangle area. They rest disconformably on crystal vitric rhyolite tuff (Tt) on Sugarloaf in the southeastern part of the map area; in most other areas they generally rest conformably on flow breccia (Tfb). They are overlain unconformably in S1 by the andesite and basalt unit (Tab). The locally preserved thickness is about 500 feet. Lenses and interbeds of flow breccia of porphyritic andesite locally comprise up to about 50% of the formation, especially in S2,11. A detailed petrographic study of this widespread porphyritic andesite unit may reveal the presence of significant volumes of basaltic andesite and basalt.

Flow breccia. Dark gray; mostly gray porphyritic andesite and minor basalt fragments, 1 cm–1 m in diameter, with little matrix of tuff and volcanic mud. Toward the base of this unit the matrix becomes more tuffaceous and scoriaceous. Distinctive sections of flow breccia over 1000 feet thick locally contain flows of porphyritic andesite; likewise, the porphyritic andesite flow sequences locally include breccia beds. This flow breccia unit lies on a locally high-relief surface (NW/4 S13) on rhyolite tuff (Tt), and it is generally concordantly overlain by porphyritic andesite flows (Ta). The lower part of the flow breccia exposed near the Warm Springs Valley fault zone resembles the tuff breccia unit (Ttb), and the two units may be physically equivalent.

Porphyritic basalt. Light gray to black with locally tan to red areas; euhedral phenocrysts <2 mm long, <50% by volume of sodic labradorite, calcic andesine, and augite in pilotaxitic matrix of feldspar microlites, magnetite, and clinopyroxene; dense to vesicular flows; platy jointed to massive. Although most of the rock in this unit is petrographically basalt, a significant volume is also basaltic andesite and andesite with calcic andesine. Over 600 feet are preserved on top of State Line Peak and thinner sections occur on the west side of the Fort Sage Mountains and within the Warm Springs Valley fault zone. The unit unconformably overlies granodiorite (Kg), tuff breccia (Ttb), and rhyolite tuff (Tt), and it underlies both the lithic rhyolite tuff (Ttw) and the basalt (Tb).

Tuff breccia. Tan, white, gray, fine to coarse tuff matrix containing gray to black angular vitrophyric blocky fragments, 1 cm–½ m of pyroxene andesite and basalt with minor amounts of cinders, scoria, and rhyolite; highly variable amounts of tuff matrix and fragments; unsorted, massive, rarely bedded. This unit occurs on the summit and west side areas of the Fort Sage Mountains where it varies abruptly (within ½ mile) in thickness from 0 to 500 feet. It rests on a high-relief surface cut in granodiorite (Kg) and rhyolite tuff (Tt). It also occurs in the Virginia Hills where it largely overlies rhyolite tuff, except locally (S23) where it occurs within the tuff. Contacts with the underlying rhyolite tuff are gradational; breccia content increases upward in the upper 10–100 feet of the tuff. This tuff breccia may be equivalent to the lower part of the flow breccia (Ttb) occurring in the Virginia Mountains.

Crystal vitric rhyolite tuff. White, gray, pink, tan; fine to coarse vitroclastic matrix with broken crystals of sanidine, sodic oligoclase to sodic andesine, less quartz, and minor biotite; some bedded ash-fall sections with pumice lapilli and minor dark lithic felsite fragments; mostly nonbedded and nonwelded, uniform, and massive ash-flow deposit. This poorly exposed unit rests on a high-relief surface on granodiorite (Kg) and metavolcanic rocks (pKmv) on the north flank of the northwest Winnemucca Valley and on granodiorite (Kg) on the west flank of the Fort Sage Mountains. The most extensive occurrence is within and southwest of the Warm Springs Valley fault zone. The type of rock beneath the tuff there is not known. Thickness ranges up to 700 feet and changes abruptly because of uneven depositional surfaces at both the bottom and top of the unit. The tuff is overlain directly by tuff breccia (Ttb), porphyritic basalt (Tba), flow breccia (Tfb), and porphyritic andesite (Ta). Within the tuff unit are local lenses of tuff breccia (Ttb) and several prominent layers of moderately welded tuff (Twt).

Welded tuff. Moderately to strongly welded portions of the crystal vitric rhyolite tuff; rare layers of black or gray vitrophyre. Individual welded zones seldom exceed 100 feet in thickness and 3 miles in known preserved lateral extent. At least two prominent relatively continuous layers occur within the rhyolite tuff (Tt) in the Virginia Hills. Small, seemingly isolated masses also occur in the tuff.

MESOZOIC ROCKS

Biotite granodiorite. White to light gray; fine to medium grained, allotriomorphic-granular; contains calcic oligoclase, quartz, orthoclase, biotite, minor hornblende, and accessory zircon and magnetite; uniform, massive-directionless. This is the most prevalent crystalline basement rock within the State Line Peak quadrangle. It comprises most of the bulk of the Fort Sage Mountain block, and it also crops out in a small area (S13,18) on the south flank of the Virginia Mountains on the east side of the Warm Springs Valley fault zone. The granodiorite sharply intrudes pre-Cretaceous metavolcanic rocks (pKmv) in both areas and it has sharp to gradational contacts with the various other plutonic units mapped in the Fort Sage Mountains. Several different Tertiary volcanic formations locally lie directly on a high-relief surface cut on the granodiorite; these relationships are relatively well exposed high in the Fort Sage Mountains.

Aplitic and pegmatitic granite. White; fine to coarse grained with varying amounts of feldspar and quartz and minor biotite; aplitic phase is massive; grades into gneissic and massive-directionless biotite granodiorite. This unit occurs in less than a 1-square-mile area low on the north flank of the Fort Sage Mountains and in one small area higher up the mountain in S8. It parallels the gneissic biotite granodiorite (Kgn) and appears to represent a late stage and border phase of the biotite granodiorite pluton (Kg).

Gneissic biotite granodiorite. White to gray; fine to medium grained, fine to coarsely banded, gneissic grading to massive-directionless; contains andesine, oligoclase, quartz, orthoclase, and varying amounts (10%–60%) of biotite and hornblende mostly segregated in bands. This unit, occurring low on the north flank of the Fort Sage Mountains, grades into the aplitic and pegmatitic granite (Kap) and the biotite granodiorite (Kg). Petrographic resemblance to the biotite granodiorite and internal gneissic foliation generally parallel to the contact with the granodiorite pluton indicate that this unit is probably a flow-structured border phase.

Hornblende diorite. Medium to dark gray; fine to medium grained, allotriomorphic-granular; contains mainly sodic andesine and hornblende with minor potash feldspar, quartz, and biotite, and accessory sphene; slightly gneissic to massive-directionless; grades through tens to hundreds of feet into biotite granodiorite (Kg). This unit crops out over about 1 square mile on the east flank of the Fort Sage Mountains (S28). It sharply and discordantly intrudes metavolcanic rocks (pKmv) and grades gradually into granodiorite (Kg). Proximity to metavolcanic rocks suggests that the diorite represents contamination of the granodiorite by assimilation or reaction with the intruded metavolcanic rocks.

Metavolcanic and granitic rocks. Schistose metaandesite and metatuff invaded by concordant dikes of gneissic fine-grained aplitic granite and diorite. These rocks comprise a local contact zone (S16) up to 1000 feet wide between metavolcanic rocks (pKmv) and granodiorite (Kg) trending north-south on the east side of the Fort Sage Mountains. Schistosity and shearing of metavolcanics greatly increase within this unit as granitic dikes, largely unsheared, become more abundant in the direction of the main mass of granodiorite.

Metavolcanic rocks. Meta-andesite flows and minor flow breccias; light to dark gray, locally greenish; aphanitic, fine-grained granoblastic feldspar and amphibole with minor pyroxene in slightly saussuritized groundmass and less abundant blastoporphyritic flow rocks with plagioclase, <10 mm in length, slightly to moderately schistose. Metatuff: white to medium gray; finely granoblastic quartz and feldspar with rare biotite, hornblende, and muscovite and beds of lapilli and breccia locally variously epidotized; finely banded to massive to moderately schistose. These rocks occur as roof pendants in granodiorite on the east side of the Fort Sage Mountains, and they are exposed in a small area in the Virginia Mountains (S17,20). Contacts with granitic rocks are sharp. Hornfelsing and schistosity generally increase within a few hundred feet of the granitic intrusive rocks. Schistosity strikes generally northerly and dips steeply to both east and west, suggesting isoclinal folding at various scales. Original thickness, impossible to determine, is estimated to greatly exceed 4000 feet.

REGIONAL PETROGRAPHIC CORRELATIONS

TERTIARY VOLCANIC ROCKS

Lack of lateral continuity and disruption by faulting render the flow and pyroclastic sequences in the mapped area difficult to correlate beyond several miles. Rhyolitic tuffs are the oldest Tertiary rocks, and they lie directly on the plutonic basement. They are generally followed upward by tuff breccia and andesitic and basaltic flows and interbedded flow breccias. Basalt flows and a lone basalt plug appear to represent the youngest volcanic rocks in the area. Between eruptive periods general erosion and some faulting created hundreds of feet of local relief over which subsequent flows and breccias accumulated unevenly and discontinuously. These relationships are most evident in the Fort Sage Mountains, northwest and north of northwest Winnemucca Valley, and in the northwest part of the Virginia Mountains.

Within the State Line Peak Quadrangle, the crystal-vitric rhyolitic tuff unit, Tt, is correlated across the Warm Springs Valley fault zone (WSVFZ) from the southern part of the Virginia Mountains to the west side of the Fort Sage Mountains. Younger formations are not so continuous. The tuff breccia (Ttb) and porphyritic basalt (Tba) occur within the WSVFZ and on the west slope of the Fort Sage Mountains. Occurring only in the Fort Sage Mountains are the basalt (Tb), rhyolite tuff (Ttw), hornblende dacite (Thd), and hypersthene basalt (Thb). Occurring only in the Virginia Mountains are the flow breccia (Tfb), porphyritic andesite (Ta), volcanic breccia and conglomerate (Tbc), and andesite and basalt (Tab). The original extent of the volcanic formations is not known, but it seems likely that the basal rhyolite tuffs were deposited throughout the quadrangle and well beyond, whereas all of the younger volcanic units were deposited originally generally in only the areas in which they are now preserved.

Prior regional reconnaissance assigned the volcanic rocks in the State Line Peak area to an older Hartford Hill Rhyolite tuff (now abandoned name, Bingler, 1978) of essentially silicic tuffs of Oligocene-Miocene age, 34–17 m.y.b.p., and a younger Pyramid sequence of andesite, basalt, dacite, and minor tuffs of Miocene age, 17–6 m.y.b.p. (Bonham, 1969; Luedke and Smith, 1981; Stewart and Carlson, 1976). Recent detailed work by Deino (1983) in the Seven Lakes Mountain area, just a few miles south, strongly suggests correlation between the rhyolitic tuff units Tt and Twt and silicic pyroclastic flows that have been K-Ar dated between 30.5 and 23.0 m.y.b.p. Correlation is also possible with tuffs in Rainbow Canyon southwest of the Pyramid Lake about 12 miles east-southeast of the State Line Peak quadrangle (Wallace, 1975).

A regionally widespread change from calc-alkali to bimodal volcanism (fundamentally basaltic) accompanied by increase in normal block faulting (Christiansen and Lipman, 1972; McKee, 1971) appears to occur about 16–17 m.y.b.p. in regions north of the State Line Peak quadrangle and between 10 and 12 m.y.b.p. in regions to the east and southeast (Morton and others, 1980). In the State Line Peak area, this change may be reflected by the cessation of accumulation of andesitic and basaltic flows and tuffs followed by appearance of the basalt flows and plug.

MESOZOIC ROCKS

The two areas of Mesozoic crystalline rocks within the quadrangle correlate petrographically and structurally. The most abundant plutonic rock, the biotite granodiorite (Kg), appears petrographically indistinguishable from granitic intrusives in the Sierra Nevada several miles to the west. There they have been K-Ar dated at 88 m.y.b.p., a part of the Upper Cretaceous Cathedral Range intrusive epoch (Evernden and Kistler, 1970). Also, the biotite granodiorite strongly resembles granitic rocks of the same general age (85–105 m.y.b.p.) widely recognized in northwestern Nevada and assigned to the Lovelock intrusive epoch (Carlson and others, 1975; Smith and others, 1971).

Metavolcanic rocks exposed in two areas appear to be parts of the same general roof pendant mass in the Upper Cretaceous granitic rocks. The nearest known metavolcanic rocks generally resembling those encountered in the mapped area occur 20 miles south in Petersen Mountain and 15 miles southeast in Freds Mountain (Bonham, 1969). There they are included in the Jurassic(?) Peavine sequence.

STRUCTURAL GEOLOGY

Late Cenozoic structural units within the State Line Peak quadrangle include the Fort Sage Mountains uplifted fault block (fig. 3), the Virginia Mountains tilted and faulted terrane, the Honey Lake depression, and the Warm Springs Valley fault zone (WSVFZ).

The Fort Sage unit is a slightly southwest-dipping (average about 7°) block elevated along a north-south normal fault on the east flank of the uplift (S22,27) and along the northwest-southeast right normal-slip WSVFZ on the northeast flank of the uplift. Within the quadrangle these bounding faults are expressed by prominent Quaternary scarps older than Lake Lahontan highstand (11,100–18,000 yr b.p.). However, along the north-south Fort Sage fault on the west side of the Fort Sage block, 5 miles west of the map boundary, a M 5.6 earthquake in 1950 created an estimated 2-foot dip-slip displacement in bedrock (Gianella, 1951, 1957). At least 5000 feet of vertical offset have occurred along the east and northeast boundary faults subsequent to the latest volcanic activity in the area. The structural demarcation and uplift of the Fort Sage block probably coincided with Pliocene-Quaternary uplift of the Sierra Nevada just to the west.

The western end of the large Virginia Mountains fault block occurs in the State Line Peak quadrangle where it is characterized internally by several blocks gently tilted to the west bounded by north-south, east-dipping normal faults with several hundred feet of displacement. The terrane is structurally elevated most recently on the south where Cretaceous granodiorite is exposed along a late Quaternary normal or right-normal fault (part of the WSVFZ). The terrane physiographically and structurally declines northward into the large Honey Lake depression. The Virginia Mountains structural unit terminates along the WSVFZ and disappears beneath Quaternary sediments in the Honey Lake depression.

A small part of the southeastern margin of the Honey Lake depression falls within the mapped area. Quaternary fault scarps, believed to reflect both vertical and horizontal components of displacement along faults of the WSVFZ, mark the physiographic and structural margin of the depression against the Fort Sage Mountains. The margin against the Virginia Mountains is not fault controlled, for the horizontal Quaternary deposits there lap up on bedrock with a very sinuous pattern. Two late Quaternary (Holocene?) faults are expressed by local small scarps, linear sand dune arrest, and linear vegetation anomalies in Honey Lake Valley in the areas of S21,29. They trend northeasterly and may represent surficial expression of significant, deeply buried faults that basically define the boundary of the Honey Lake structural depression in this area.

The Warm Springs Valley fault zone (WSVFZ) dominates the deformational structure in the State Line Peak quadrangle (figs. 2, 3, 4). The 1-mile-wide zone of throughgoing, branching, high-angle faults trends N. 50° W. and is slightly convex to the southwest. It includes horizontal and gently southwest-dipping tuffs and breccias exposed in the Virginia Hills and in a narrow zone between the Fort Sage and Virginia Mountains that projects under the Quaternary sediments of the Honey Lake Valley. Determining displacement on individual faults is precluded by lack of specific geologic features on which measurements can be made. However, within the fault zone the offset volcanic sections suggest a component of dip-slip, usually down to the northeast. They also allow a significant strike-slip component on a geometric basis. Approximately 3½ miles of Cenozoic right-lateral displacement on the WSVFZ in this area is suggested by considering the mass of granodiorite and metavolcanics exposed north of northwest Winnemucca Valley, S13,17,18, as once a contiguous part of the northeast corner of the Fort Sage Mountains block, S9,10,15. Further speculation, depending upon what lies under the tuffs within the WSVFZ, allows for some right-oblique pull-apart across the WSVFZ in this area as well as for 30° of clockwise rotation of the Fort Sage Mountain block. Tectonic movement on the WSVFZ could have begun prior to deposition of the oldest volcanic units, the tuffs of probable late Oligocene age; certainly movement has occurred since then and into the Quaternary. However, evidence for late Quaternary strike-slip movement is absent, but evidence for a dip-slip component (which may include diagonal slip) during the last 100,000 years consists of relatively fresh, linear scarps (Bonham, 1969; Stewart and Carlson, 1977) along the north margin of the northwest Winnemucca Valley and along the base of the north flank of the Fort Sage Mountains.

The WSVFZ appears to represent one of three major left-stepping right lateral faults that characterize the northern part of the Walker Lane (Bell, 1983; Bell and Slemmons, 1979, 1982). The WSVFZ appears to continue on strike at least 40 miles to the northwest, but in doing so it diffuses into several diagonal-slip faults mapped in the Susanville, California, area (Grose and others, 1983). To the southeast the WSVFZ continues about 20 miles through Warm Springs Valley until it encounters a series of northeast-trending faults (Bell, 1983; Bonham, 1969).

MINERAL DEPOSITS

Magnetite and hematite breccia dikes, products of replacement of meta-andesite, occur in contact with granitic rocks and in fault breccia zones within the metavolcanic rocks. The dikes are subvertical and are less than 15 feet thick and less than 100 feet in length. They discontinuously occur within the metavolcanic unit (pKmv) and within the metavolcanic and granitic rock unit (Kgmv) halfway up the east side of State Line Peak in the E/2 S21 and the SE/2 S16. Magnetite prospects occur in this area, at the Black Hawk prospect (Reeves and others, 1958), revealed a few elongate magnetite bodies aligned northeast-southwest. They are deemed of small volume and poor grade and are not economic.

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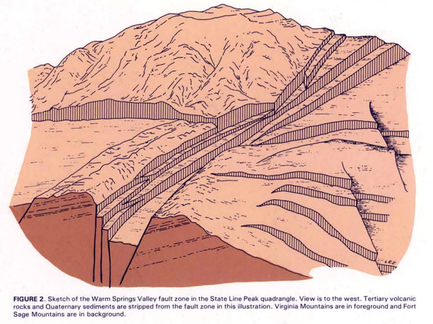

FIGURE 2. Sketch of the Warm Springs Valley fault zone in the State Line Peak quadrangle. View is to the west. Tertiary volcanic rocks and Quaternary sediments are stripped from the fault zone in this illustration. Virginia Mountains are in foreground and Fort Sage Mountains are in background.

FIGURE 3. Northeast flank of the Fort Sage Mountains. View southwest. State Line Peak is high volcanic plateau on left. Sierra Nevadan granitic rocks underlie middle and lower slopes. Warm Springs Valley fault zone produces fault scarps along base of mountain.

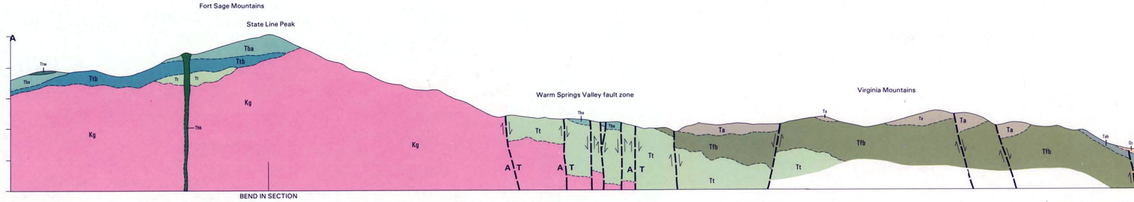

FIGURE 4. Warm Springs Valley fault zone (arrows). View east from State Line Peak. Granitic rocks of Fort Sage Mountains in foreground; silicic tuffs in middle ground along Warm Springs Valley fault zone; andesite and basalt flows of Virginia Mountains in background. White area in middle of photo is playa in northwest Winnemucca Valley, a sag graben within the Warm Springs Valley fault zone.