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Walter A. Anderson, State Geologist

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Title: Mesozoic Plutonic - Volcanic Rocks of the Newfield Quadrangle, Maine

Author: Richard A. Gilman

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Contents: 16 page report

INTRODUCTION

A series of five small, discordant plutons trend north-south through the center of the Newfield quadrangle (Figure 1). The composition of the stock varies from diorite to alkaline syenite and granite with two stocks having associated volcanic breccias. The country rock consists of sillimanite zone schists and migmatites of the Rindgemere Formation (Devonian), and syn-tectonic Devonian intrusives of granodiorite and binary granite. The stocks are post-tectonic and have had little or no effect on the attitude of the regional structural trends of the metasediments at their contacts. The stocks have been mapped as part of a regional study of the Newfield and adjacent quadrangles for the Maine Geological Survey. No previous work on these stocks has been published.

DESCRIPTION OF THE STOCKS

The five intrusives have been given appropriate geographic names, thus from north to south they are referred to as the Randall Mountain, Symmes Pond, Picket Mountain, Abbott Mountain, and Acton stocks.

RANDALL MOUNTAIN STOCK (Figure 2)

Randall Mountain is located in the north-central part of the Newfield quadrangle between the villages of South Parsonsfield and East Parsonsfield (Figure 2). The area occupies about one square mile and is easily accessible on all sides by blacktop and gravel roads. There is approximately six hundred feet of relief, the summit of Randall Mountain being 1118 feet above sea level.

The area is completely forested except for bald ledges at the summit of Randall Mountain. Even so, there are good exposures on the steep south and southeast slopes and on the ridge crests. The north facing slopes are more gentle and outcrops are scarce. A man-made pond now occupies the former marshland on the southwest side of the mountain.

Rock Units

General: In the field the rocks are easily divided into either fine- to medium-grained, grey to brown syenites, and grey fragmental trachyte porphyry.

Syenite: Brown to greenish grey syenite is the most abundant rock type. Hornblende and/or biotite are visible in hand specimen while pyroxene was recognized in thin section study only. The rocks vary from a porphyritic phase carrying up to 30 percent phenocrysts (dominantly feldspar) of 2.0 to 4.0 mm. length set in a fine-grained groundmass, to an equigranular, medium-grained phase with feldspar individuals averaging 3.0 to 5.0 mm. with a maximum length of 10.0 mm. This textural variation is not systematic and the change from one type to another is gradual. Mafic minerals are conspicuous but never more than five percent of the rock.

Igneous lamination or other primary flow structures were not found in place, however, float on the ridge northeast of the summit of Randall Mountain showed a well developed parallel arrangement of feldspar crystals.

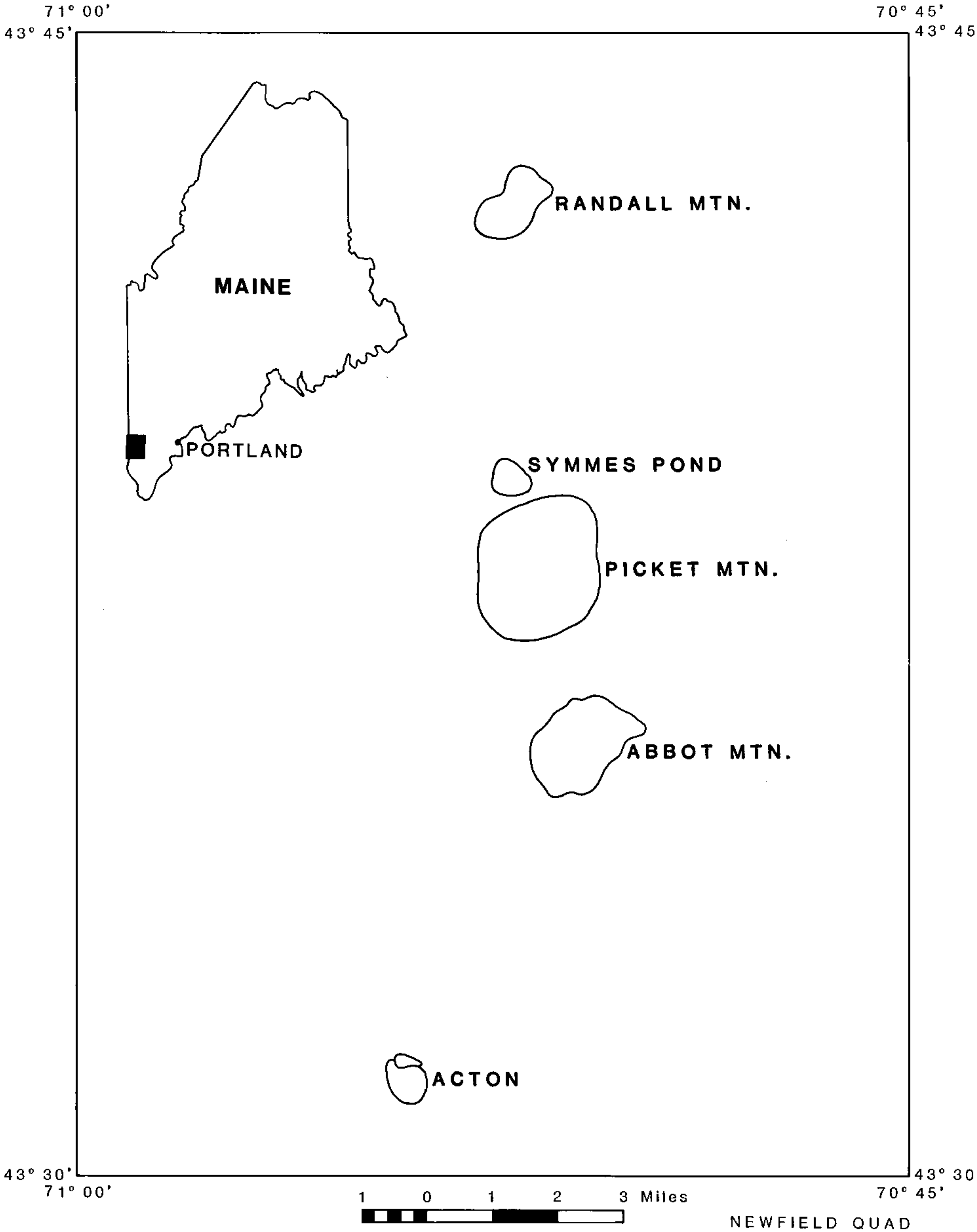
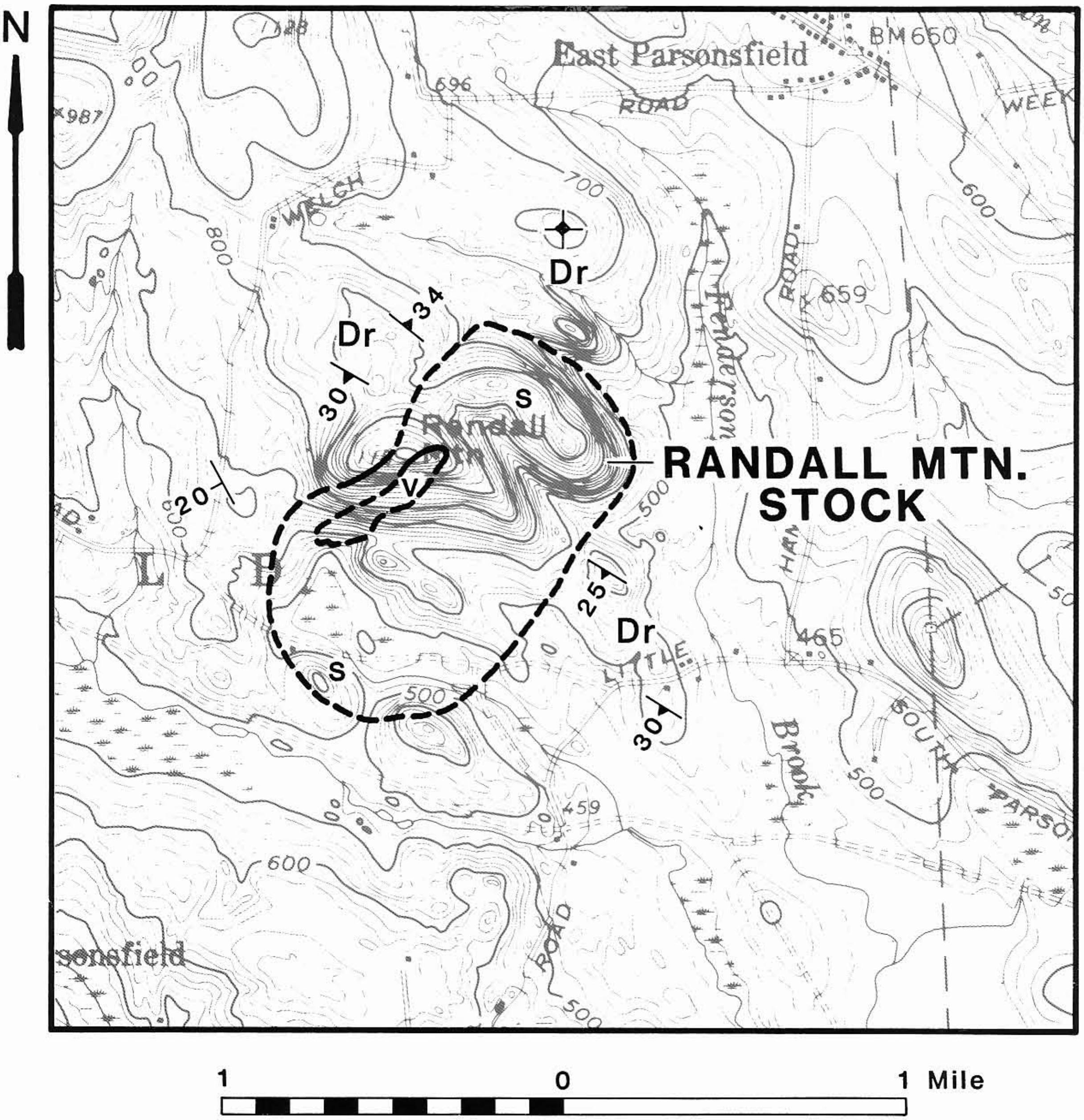

71° 00'
70° 45'
43° 45'
43° 45'
MAINE
PORTLAND
RANDALL MTN.
SYMMES POND
PICKET MTN.
ABBOT MTN.
ACTON
43° 30'
71° 00'
43° 30'
70° 45'
1 0 1 2 3 Miles
NEWFIELD QUAD

FIGURE 1

Figure 2



Dr - Rindgemere Formation

s - syenite

v - fragmental porphyry

schistosity

bedding

exposed contacts

covered contacts

Several varieties of the syenite may be seen in a traverse up the south side of the mountain, the syenite at the summit being the equigranular, medium-grained type.

In thin section, the syenites can easily be subdivided into porphyritic and equigranular types. The *equigranular* type is characterized by 2.0 to 5.0 mm., subhedral, interlocking orthoclase laths with minor fine-grained interstitial feldspar. Orthoclase usually constitutes more than 95 percent of the rock. It is always dusted by alteration products, commonly shows Carlsbad twinning, and consists of either homogeneous orthoclase or irregular micro-perthite. Interstitial nepheline and albite were found in one specimen each. Mafic minerals consist of biotite, clusters of fine-grained green hornblende, and pyroxene. The pyroxene occurs as euhedral to subhedral, 0.5 to 1.0 mm. grains which in some cases show deep green colors indicating an aegerine-augite[1] type and is commonly partially altered to hornblende. Of the accessory minerals, sphene is particularly noticeable due to its large, subhedral grains.

The *porphyritic syenite* in thin sections shows 3.0 to 5.0 mm. phenocrysts of primarily K-feldspar with lesser amounts of plagioclase, pyroxene, hornblende and biotite, set in a groundmass of feldspar, mafics, and accessory minerals ranging from 0.2 to 0.8 mm. diameter. Phenocrysts constitute from 5 percent to 30 percent of the rock. K-feldspar phenocrysts are usually subhedral and display an irregular, micro-perthitic intergrowth over the entire grain. Clinopyroxene phenocrysts are pale green and show faint pleochroism. The groundmass is predominantly feldspar laths, frequently displaying a weak trachytic texture. Grains of hornblende, augite, biotite and accessories complete the groundmass. Sphene is again the most noticeable accessory. Two of the specimens studied carry nepheline as either phenocrysts or in the interstitial spaces between feldspar laths. In addition, three specimens carry small amounts of sodalite in interstitial spaces and as subhedral, dodecahedral phenocrysts.

Trachyte porphyry: Light grey porphyries, some of which carry rock fragments, are found both as dikes cutting the syenite, and as inclusions within the syenite. These show only minor differences in thin sections and are indistinguishable in had specimen. Where exposures are limited it is not always possible to determine which of the two types is present.

The geologic map shows two areas of trachyte porphyry both of which are interpreted as large blocks engulfed within the syenite. Other instances of smaller inclusions of porphyry within the syenite strengthen this interpretation. In hand specimen these rocks consist of feldspar penocrysts (2.0 to 4.0 mm.) and rock fragments enclosed in a grey, aphanitic groundmass. Primary flow structures were not observed. The rock fragments, though not always present, are usually subangular and range in size from a fraction of an inch to five inches, the smaller being the most common. Fragments and/or phenocrysts constitute from 20 percent to 40 percent of the rock.

In thin section the phenocrysts are seen to be predominantly euhedral-subhedral orthoclase with minor perthitic intergrowths. Plagioclase phenocrysts were observed in a few samples, but always subordinate to orthoclase. Other

1 *mineral identifications are based on flat-stage examination of thin sections.*

phenocrysts include clinopyroxene and biotite. Clusters of subhedral, interlocking orthoclase grains could represent either phenocrysts or fragments of an early phase of the syenite. Rock fragments consist of trachytes commonly showing well developed flow structure. The groundmass consists of subparallel laths of feldspar that are sometimes deflected around rock fragments and phenocrysts. Augite, hornblende, biotite and accessories are also present.

Dikes of fragmental trachyte porphyry are similar to the rocks just described, the major microscopic difference being the tendency for the groundmass to be allotriomorphic-granular rather than trachytic. Rock fragments include trachyte and syenite.

A small dike cutting the syenite on the summit of Randall Mountain consists of 0.2 to 0.4 mm laths of subhedral orthoclase with a homogeneous felted texture. A pink felsite dike (?) found in the valley east of the summit is distinctly different from other types in the area. It consists of 0.2 mm laths of plagioclase with minor interstitial quartz arranged in a well developed trachytic texture.

Field Relationships

The contact of the syenite with the country rock is exposed on the west side of Randall Mountain in a zone approximately one hundred feet wide consisting of angular blocks of schist enclosed in pinkish, quartz-bearing syenite. The contact dips steeply to the northwest. At other locations, the contact is not exposed but the limits of the body are fairly well known due to mapped exposures of the surrounding country rocks. The contact is discordant to the surrounding rock structure which shows no defection from regional patterns as the margin of the stock is approached.

Discussion

The Randall Mountain stock represents the intrusion of a nearly homogeneous syenite magma that crystallized to produce a suite of rocks with textural variation but mineralogical homogeneity. The textural variation--from medium-grained, equigranular syenite to porphyritic, fine-grained syenite--seems to follow no systematic pattern. This would suggest that their distribution was governed by local conditions which varied from place to place during crystallization. Widespread trachytic texture suggests that flow of a partially crystallized melt took place but was restricted to local domains rather than involving stock-wide convection. The latter would be expected to produce mineralogical and/or textural variations that show a systematic pattern with respect to the entire body, rather than the localized variations as observed. Any differentiation that took place during the syenite crystallization was insufficient to produce mineralogical changes detectable by microscopic examination.

The excess of silica in the matrix of the breccia zone at the contact with the country rock suggests that the marginal phase was contaminated by the country rocks, the latter consisting of quartz-feldspar-mica schist and migmatite.

The two areas of fragmental trachyte porphyry (Figure 2) are interpreted as blocks of an early phase of activity engulfed in the younger syenite.

Smaller blocks of porphyry enclosed in syenite support this interpretation. The nature of this early phase, whether intrusive or extrusive, is not evident.

The last phase of intrusive activity was the emplacement of porphyry dikes, some of which cut the syenite and contain fragments of the syenite as well as porphyritic trachyte. Dikes of porphyry also have been found cutting the country rock but it is not evident which phase of porphyry emplacement these represent.

ABBOTT MOUNTAIN STOCK (Figure 3)

Abbott Mountain lies just east of the village of North Shapleigh (Figure 3). The summit is 1077 feet above sea level, approximately six hundred feet above the surrounding land surface. Exposures are excellent along the tops of ridges and remain good on the steeper slopes. The lower slopes and surrounding areas are generally covered by thick glacial deposits. Fresh samples are frequently difficult to obtain due to the rounded, weathered nature of the exposures. Frequently the bald outcrops are covered with thin sheets of crumbled rock. The entire area is forested but trees are sparse along the ridge tops. The area is accessible by dirt road on the north side, and by discontinued roads on the south and west sides and through the center. Abbott Mountain is shown erroneously as part of a single pluton on the Preliminary Geologic Map of Maine (1967); it is in fact the southernmost of three separate stocks. It is oval-shaped with dimensions of approximately 1 1/4 x 2 miles.

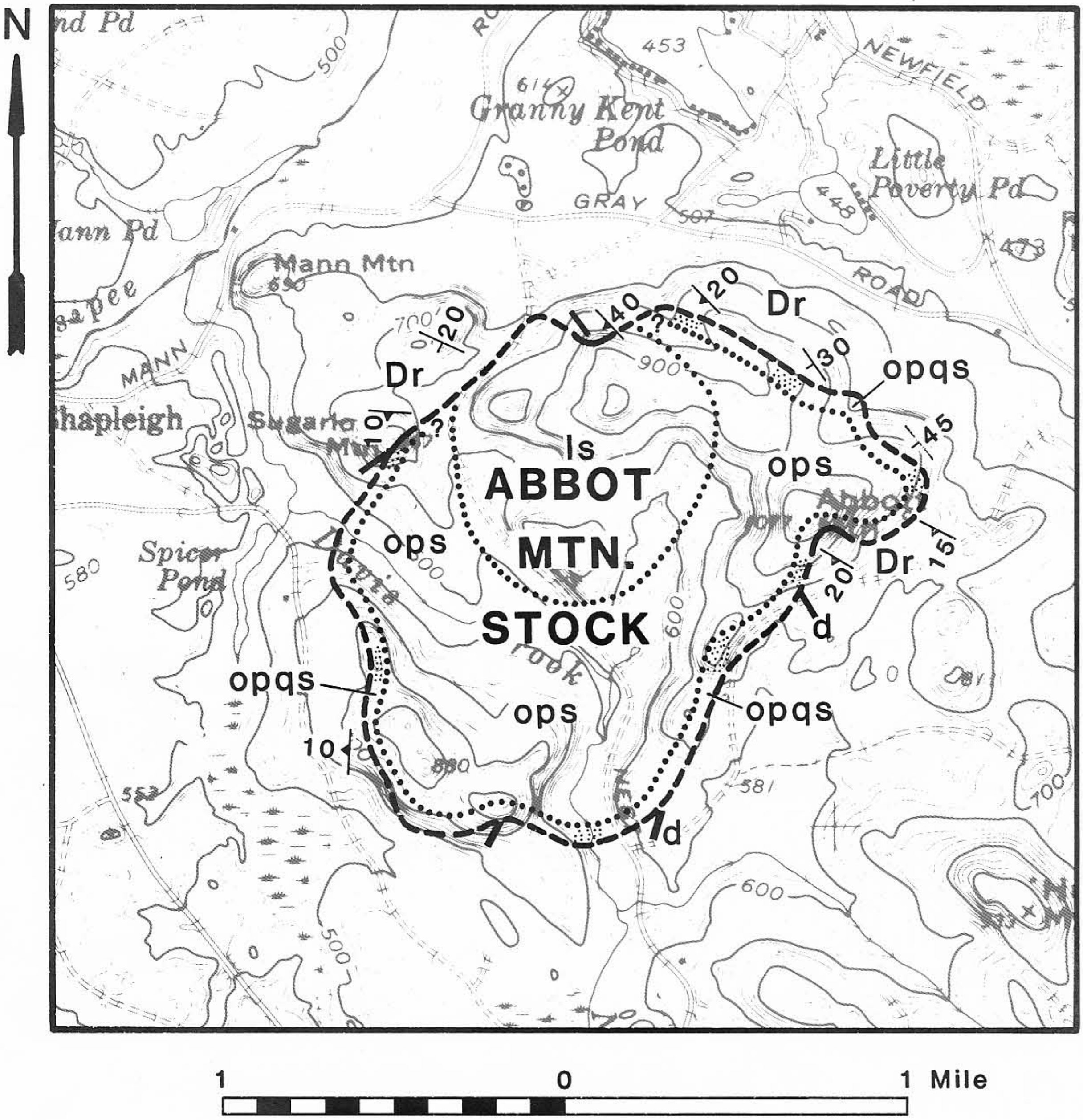
Rock Units

General: The Abbott Mountain stock consists predominantly of a brown to grey, coarse-grained syenite in the interior with fine-grained diorite dikes at the margins. Subdivisions of the coarse syenite are possible in thin section study, but were not recognized in the field. The coarse syenites are cut by late stage aplitic dikes.

Syenite: The coarse syenite has been subdivided into three types on the basis of microscopic study. The most widespread type is syenite containing fayalite and aegirine-augite as the characteristic minor constituents. A second variety is similar to this but in addition contains minor amounts of quartz. The third variety is virtually devoid of mafic minerals.

Olivine-pyroxene syenite carries from 90 to 95 percent euhedral-to-subhedral randomly arranged feldspar laths averaging 5.0 mm in length with maximums of 10.0 mm. The feldspar is dominantly orthoclase or microcline micro-perthite with patches and veins of albite distributed either uniformly throughout the grain or in some cases restricted to grain margins. Pyroxene constitutes from 2 to 7 percent of the rock and usually occurs in 0.5 to 2.0 mm, euhedral-to-subhedral grains commonly with hornblende alteration. The pyroxene is a darker green than common augite, suggesting aegirine-augite, but pleochroism is faint or nonexistent. Fayalite (2V = approx. 40^{o}, sign(-)) constitutes up to 3 percent of the rock and is found as 0.5 to 2.0 mm equant, anhedral grains that are partially altered along fractures to red iddingsite and a yellowish serpentine. In some grains the original olivine has been completely replaced. Biotite, apatite, zircon and opaques complete the assemblage.

Figure 3



ls - leucocratic syenite
ops - olivine-pyroxene syenite
opqs - olivine-pyroxe-quartz syenite : stippled is known exposure.
d - diorite dikes showing average strike.
Dr - Rindgemere Formation (Dev.)

exposed contact

covered contact

contact based on microscopic study

bedding

schistosity

This variety occurs on the east, south, and west part of the area including Abott Mountain where there are abundant exposures.

Quartz syenite is characterized by minor interstitial quartz; otherwise it is similar to the olivine-pyroxene syenite. Orthoclase and microcline microperthite constitute 85 to 95 percent of the rock occurring as subhedral grains averaging 4.0 to 8.0 mm. in length. Grains of medium green, non-pleochroic aegirine-augite are usually subhedral and average 1.0 mm. in deameter. Some grains have been totally altered to red and yellow secondary minerals. Quartz varies in amounts from a trace to 8 percent and occurs as anhedral grains (less than 0.5 mm. in the interstices between feldspar laths. Relatively large (up to 0.5 mm.) grains of rounded or euhedral zircon are also characteristic of this variety. Biotite, apatite and opaques complete the assemblage.

This variety has been found only in the contact zones of the stock, and, while it has only been observed from several isolated localities, it appears that this may form a continuous shell between the country rock and the syenite of the interior.

The *leucocratic syenite* contains feldspar as the only essential mineral. Mafic and accessory minerals never constitute more than one or two percent of the rock. The feldspar consists of euhedral to subhedral grains averaging 4.0 to 8.0 mm. long. Both orthoclase microperthite and plagioclase (antiperthite) are present in various rations but plagioclase is frequently more abundant than orthoclase. The orthoclase is commonly clear in the center of the grains and perthitic at the margins. Microcline twinning is sometimes present. The antiperthite consists of albite showing extremely thin twin lamellae and patches of orthoclase. The albite twin lamellae are usually tapered producing an unusual "splintery" appearance. Accessory minerals are hornblende, zircon, and opaques.

This type is found in the north-central part of the stock, but its boundaries and contact relations are not well known. One sample of the margin carries small amounts of aegirine-augite and fayalite suggesting that this is gradational into the olivene-pyroxene syenite.

Micro-diorite: Fine-grained (0.1 to 1.0 mm.) micro-diorite consists of approximately equal amounts of weakly zoned, intermediate plagioclase (An_{30-40}) and mafic grains arranged in an intergranular texture. Augite (nearly colorless as compared to the pyroxene in the syenite) constitutes about 35 percent of the rock and usually occurs as subhedral interstitial grains but occasionally is found in larger, poikilitic grains. Biotite occurs in small, red-brown irregular plates and amounts to 5 to 10 percent of the rock. Brown hornblende is sometimes associated with augite. Accessories are apatite and opaques.

This rock type has been found in several localities at the margin of the stock where it occurs as small dikes which cut the country rock. Inclusions of the micro-diorite have been found enclosed in the border phase of the coarse-grained syenite, thus establishing the relative age relationships.

Aplite dikes: These consist of stubby, euhedral to subhedral phenocrysts of orthoclase (1.0 to 2.0 mm.) embedded in a fine-grained (0.2 mm.) groundmass of quartz and feldspar. Tiny grains of riebeckite are scattered throughout the rock. These show strong pleochroism in blue and green-brown and have nearly parallel extinction. Biotite is also present in small amounts.

Field Relationships

Field observations, strengthened with petrographic study, shows that there is a consistent pattern in the distribution of the major rock types within the stock. The micro-diorite is always found at the margin of the stock as dikes which cut the country rock. It appears that these are isolated intrusions along the outermost zone that was later to become the site of the stock, rather than a continuous body circling the stock's outer margin. Fracturing and dike emplacement may have been extensive in the area now occupied by the syenite. They may also extend farther out into the country rock, but exposures are limited and they have not been found more than a few tens of feet from the stock margin.

The quartz-bearing phase of the syenite has been found at several locations, but only at the margin of the stock. The rock was not recognized as a separate type during the field mapping, thus no attempts were made to establish the continuity of this type around the entire stock margin. However, since it occurs as massive, coarse-grained rock, it would appear that it forms a marginal phase around the entire body except where it may have been cut out by younger phases of the syenite. Judging from the distribution of the quartz-bearing syenite and the olivene-pyroxene syenite, the quartz-rich type is restricted to a few hundred feet at the contact.

The main body of olivine-pyroxene syenite is believed to occur in the majority of the stock on the west, south, and east sides. Only in the north does it appear to be absent. Additional sampling needs to be done in the interior of the stock to further define the limits of this rock type.

The leucocratic syenite is found in the north-central part of the stock. The distinctive microfeatures of this unit were not recognized in the field, thus sampling was not specifically planned to delineate its extent. The one sample that appears to be near the margin of this unit is from the ridge northwest of Abbott Mountain. This sample has a mineral assemblage intermediate between the leuococratic syenite and the olivene-pyroxene syenite, thus the contact has been drawn through this location: elsewhere it has been drawn separating known exposures of the two rock types.

The riebeckite - bearing aplite dike occurs near the southwest margin. Other such dikes were not recorded, but it is unlikely that this is the sole occurrence of this rock type.

The relative ages of the rock units are defined on the basis of cross-cutting features, inclusions and inferred petrogenetic trends. The micro-diorite dikes are clearly the oldest phase of intrusive activity. These cut the schist and pegmatite country rock and are in turn cut, brecciated, and included in the syenite. No indications of the relative ages of the quartz-bearing syenite and the olivine-pyroxene syenite were observed. Both rocks are medium to coarse-grained and it is possible that they grade one into the other by a gradual decrease in quartz content. This is what would be expected if the quartz-bearing syenite represents a silica enriched, contaminated phase at the margin of the stock. Likewise, there is evidence of a transitional contact between the olivine-pyroxene syenite and the leucocratic syenite. The decrease in mafic constituents perhaps reflects a later stage of differentiation, thus suggesting its younger age relative to the olivine-pyroxene syenite. The riebeckite - bearing aplite is clearly younger than the olivine-pyroxene syenite but of unknown relationship to the leucocratic syenite.

The attitude of the contact with the country rock is well displayed on several of the ridges. On Abbott Mountain, the country rock can be followed up the southeast side nearly to the summit. The outcrop pattern indicates that the contact dips southeast at a somewhat greater angle than the topography. The same type of feature is found at several localities around the margin of the stock. On the north side the contact dips northward at as little as 30 degrees. On Sugarloaf Mountain, on the contrary, the contact appears to be nearly vertical. The overall shape of the contact is that of a dome with dips ranging from moderate (30^{o}) to nearly vertical, the former predominating.

The stock is clearly discordant with respect to the foliation in the surrounding schist. This is best shown along the northeastern margin where the schistosity strikes uniformly northwest with a westerly dip. There appears to have been no change in the geometry of the schistosity as a result of the intrusion of the stock.

Exposures of schist and pegmatite near the contact sometimes display brecciation and veining by the syenite. The rocks also are less schistose than usual, presumably the result of thermal metamorphism.

Discussion

The Abbott Mountain stock appears to represent the upper portions of an intrusion with a domal-shaped upper contact. The structural discordance between the contact and the surrounding schistosity indicate that the intrusive mechanism had little mechanical effect on the country rock outside the marginal zone of brecciation. This suggests that the mechanism of emplacement involved stoping of the country rock with fracturing of the roof and dike emplacement over the rising magma plug.

Chemical studies were not undertaken in this project but are needed for a better understanding of the petrogenesis of the stock. The quartz-bearing syenite found at the margins needs examination to determine the origin of the quartz. Since interior parts of the syenite are quartz-free, it appears that the contact itself played a significant role in the occurrence of quartz in the marginal zones. It seems unlikely that if the quartz-bearing syenite represented the initial magma, the internal parts of the stock, presumably cooling later, would become deficient in silica. The quartz-bearing syenite appears to be a hybridized rock rather than the parent magma from which the internal parts of the stock formed by differentiation.

The change in mineralogy of the suite suggests that differentiation took place either in situ, or at depth, or both. The initial magma phase was of a pyroxene diorite composition to be followed in turn by the main syenite, the leucocratic syenite, and finally the aplitic dikes.

Christopher (1969) used fission track methods to date the Abbott Mountain Stock at 119 million years. This, in addition to the structural and mineralogical character of the body, clearly indicates a correlation with the White Mountain Plutonic-Volcanic Series of New Hampshire (Billings, 1956, Foland, et. al. 1971).

SYMMES POND STOCK (Figure 4)

The Symmes Pond stock lies just east of Symmes Pond (Figure 4). Its margins are poorly defined, but neighboring outcrops of schist and granite limit the size to approximately that shown on the map. A breccia zone can be observed on the south side of Hall Road where it crosses the southwest side of the stock. The stock consists of green-brown, coarse-grained syenite containing fragments of the foliated granodiorite country rock. The syenite contains small amounts of sulfides including molybdenite and has been the site of minor prospecting in past years. In thin section the rock consists of 95 percent microperthite and about equal amounts of fayalite and clinopyroxene. The fayalite is partially altered to serpentine and occurs as 1.0 mm equant grains. The clinopyroxene is medium green and non-pleochroic, possibly an aegirine-augite. The petrographic and mineralogical character of this syenite are similar to the olivine-pyroxene syenite of the Abbott Mountain stock.

Dikes of tan trachyte are found cutting the country rock on the hill northeast of the stock.

PICKET MOUNTAIN STOCK (Figure 4)

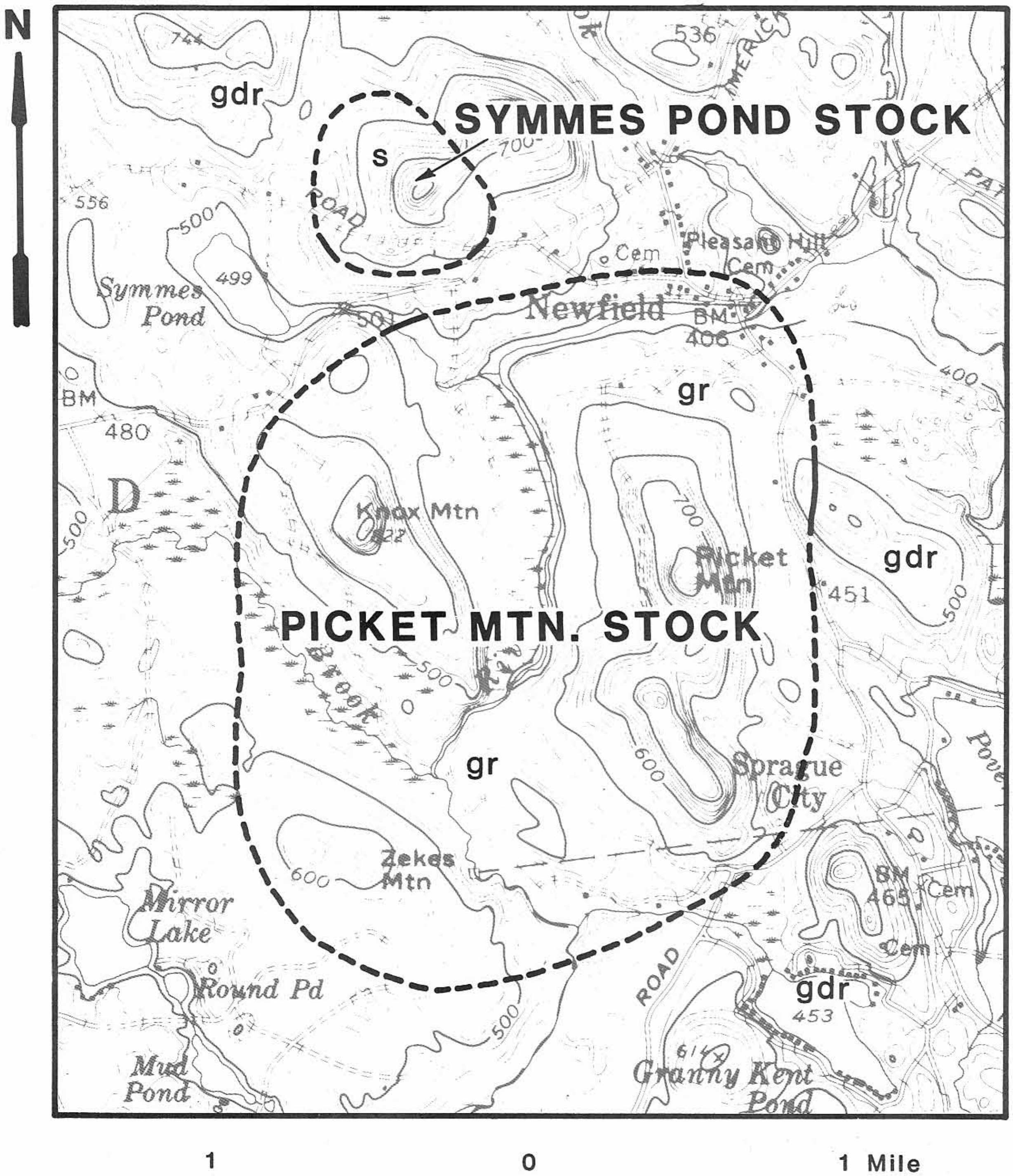
The Picket Mountain granite stock lies just south and west of the village of Newfield (Figure 4). Outcrops are limited to ridge tops on Picket, Knox, and Zekes Mountains, with the exception of exposures in the Little Ossipee River at Newfield. The contact can be found within a few tens of feet on the west slope of the small hill east of Picket Mountain where the granite is in contact with pegmatite and foliated granodiorite.

The stock consists of homogeneous grey-brown, medium-grained, equigranular to subporphyritic granite. The mafic minerals are biotite and hornblende. The feldspar consists dominantly of K-feldspar, which is sometimes present as phenocrysts, and chalky-weathering plagioclase. Quartz is visible in all samples.

Thin section study shows that the rock is comprised of about 25 percent quartz, 50 percent micro-perthite, 20 percent plagioclase, and 5 percent mafics. Quartz ranges in size from tiny interstitial grains to those 3.0 mm in diameter. Microperthite phenocrysts up to 5.0 mm long show Carlsbad twins and a vein-type perthitic intergrowth over the entire grain. Plagioclase is restricted to small (0.5 mm) subhedral grains of the groundmass. Biotite and hornblende are ragged. Hornblende is less abundant than biotite and is ofter altered to matted biotite.

ACTON STOCK (Figure 5)

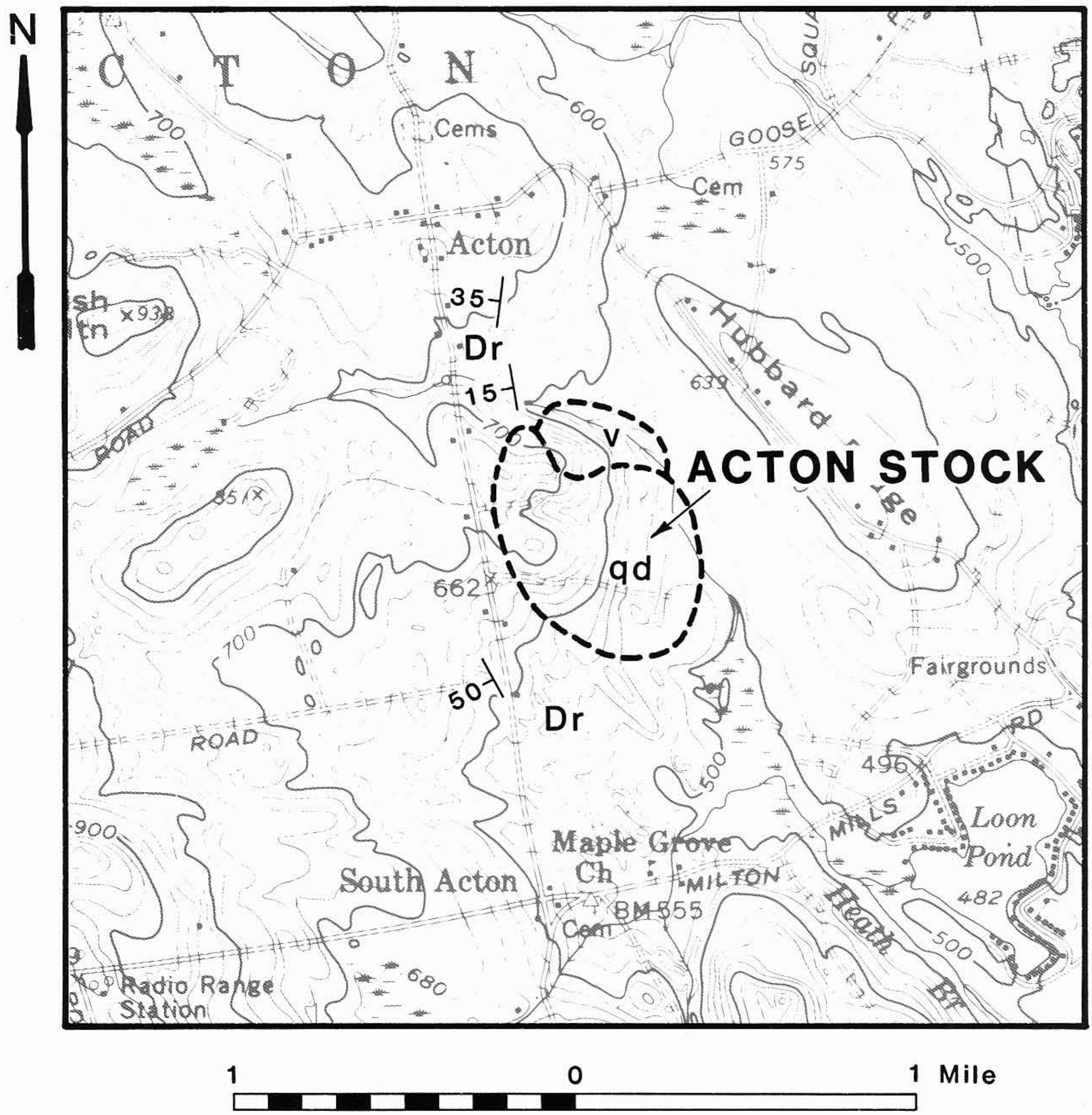
The Acton stock is a small body (1/2 x 3/4 mile) located on the east side of Grant Road approximately midway between Acton and South Acton (Figure 5). Part of the area is apple orchard and therefore is easily accessible. A few exposures are found in the orchard itself, but most large exposures are in the surrounding woods. The shape of the stock is not well known due to the lack of outcrops on the south and east sides.



s - syenite

gr - biotite-hornblende-granite

gdr - foliated granodiorite



Dr – Rindgemere Formation
v – fragmental volcanics
qd – quartz diorite

Rock Units

Two rock units are distinguished: medium-grained, grey weathering quartz diorite, and dark grey porphyritic and fragmental andesite. The contact between the two units is not exposed. On the basis of the absence of quartz diorite fragments in the fragmental andesite it is tentatively concluded that the quartz diorite is the younger.

Quartz Diorite: The medium to coarse-grained grey quartz diorite constitutes most of the body. Igneous lamination due to parallel feldspars is evident in some exposures. In thin section the rock consists of approximately 80 percent plagioclase, 15 percent pyroxene, and 5 percent opaques, apatite, and quartz. The plagioclase is in some instances strongly zoned but unzoned grains are abundant and are approximately An_{50}. The grains are subhedral with irregular, interpenetrating grain margins, and may be surrounded by finer-grained, anhedral plagioclase. Grains average about 4.0 mm but are as large as 8.0 mm. Both orthopyroxene and clinopyroxene are present. The orthopyroxene (hypersthene) is faintly pleochroic in pink to green and is optically negative. Otherwise it looks much the same as the optically positive clinopyroxene. Both are subhedral, average 1.0 mm diameter, and are partially altered to fibrous amphibole and biotite. Interstitial quartz is present in minor amounts.

Several exposures of a fine-grained border phase can be found along the west margin. In some cases this is the host of breccia containing fragments of hornfelsed schist.

Small dikes of aplitic textured, tan rock cut the medium-grained quartz diorite. These consist of about 80 percent subhedral feldspar, some of which is untwinned orthoclase (?), 10 percent biotite, and 10 percent interstitial quartz.

Andesite breccia: Dark grey, porphyritic and fragmental andesite constitutes the northern part of the body, but the contact with the country rock has not been found. The rock is massive and has abundant phenocrysts of light grey weathering plagioclase and small, angular fragments of dark, aphanitic rock types that show up best on a weathered surface. In thin section the rock consists of 20 percent plagioclase phenocrysts set in a microcrystalline groundmass of plagioclase, biotite, and opaques. In some cases the plagioclase phenocrysts appear to be fragments of phenocrysts having sharp but irregular edges.

At one location a three inch dike of lighter colored fragmental rock cuts the andesite. The fragments are usually less than an inch in diameter, subangular and consist of various aphanitic rocks and schist. The fragments are set in a matrix of microcrystalline biotite, feldspar, and quartz.

The andesite is cut by a dike of tan felsite that contains small, stubby crystals of untwinned feldspar set in a matrix of microcrystalline feldspar and opaques.

SUMMARY AND CONCLUSIONS

The group of small, post-tectonic stocks lies along a north-south line that continues to the north to include the Burnt Meadow, Boston Hills, and Pleasant Mountain stocks in the Kezar Falls and Fryeburg quadrangles. They form the eastern side of the cluster of Mesozoic stocks that trend NNW in central and northern New Hampshire and form the White Mountain Plutonic-Volcanic Series (Billings, 1956). The mineralogical, structural, and textural character of the stocks in addition to the single fission track date of 119 million years from the mountain stock clearly indicate that these are similar to the White Mountain Series. Briefly, these similarities consist of: (1) the alkaline character of the rocks composed of syenites with nepheline, sodalite, hastingsite, fayalite and aegirine-augite as minor constituents, (2) the lack of metamorphic foliation within the bodies, and the sharp discordance with the adjacent country rock, (3) the associated volcanic breccias which correspond in style to the Moat Volcanics of the White Mountain Series, and (4) the radiometric age determination which places the Abbott Mountain stock in the youngest group of the White Mountain Pluton-Volcanic Series (Foland, et.al., 1971; Armstrong and Stump, 1971) which extends from approximately 100 to 200 million years.

The stocks show little or no evidence of differentiation in place, the Abott Mountain body being a possible exception.

The alignment in a north-south direction across the structural grain of the surface rocks suggests a basement control as proposed by Chapman (1968-b).

The depth of intrusion of the White Mountain stocks in New Hampshire has been estimated to be about 4 miles at temperatures of about 700^{o}C based on stability ranges of biotite and amphiboles in the stocks plus the occurrence of andalusite in the contact aureoles (Wilson, 1969). Similar figures are likely appropriate for the stocks in the Newfield quadrangle.

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