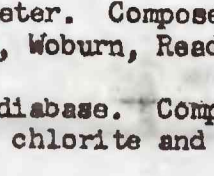


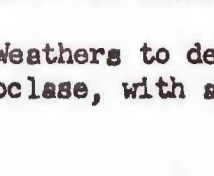
PLATE I
GEOLOGIC MAP
OF THE
ANDOVER GRANITE AND SURROUNDING ROCKS
EXPLANATION



Diabasic intrusives

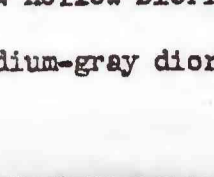
rd - Fine- to medium-grained, massive, dark-gray to black, diabase. Commonly porphyritic with tabular plagioclase phenocrysts up to 1 inch in diameter. Composed chiefly of plagioclase and pyroxene with accessory magnetite. Confined to Wilmington, Woburn, Reading, Lynnfield, and Peabody areas

rg - Fine-grained, massive, dark-gray to black diabase. Composed chiefly of plagioclase and pyroxene. Pyroxene almost completely altered to actinolite and magnetite. Confined to South Lawrence area



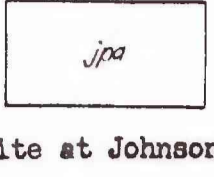
Trachyte south of Middleton center

Fine-grained, vaguely porphyritic, massive, light-gray trachyte or keratophyre. Composed chiefly of sodic plagioclase, potash(?) feldspar, and pyroxene. Highly altered



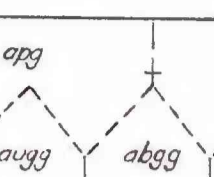
Peabody Granite and associated rocks

Coarse-grained, massive, light-gray, granite. Weathers to deep resinous brown. Composed chiefly of microperthite, quartz, hornblende, and plagioclase, with accessory amounts of pyroxene and zircon. Biotite occurs mainly in peripheral rocks



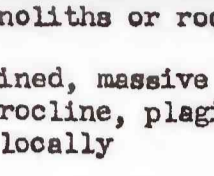
Straw Hollow Diorite

Chiefly medium-grained, massive to foliated, medium-gray diorite. Composed mainly of plagioclase, hornblende and biotite



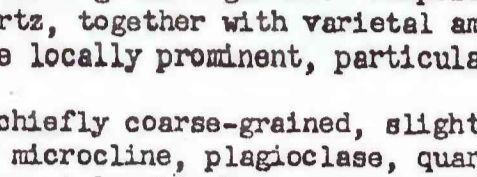
Adameellite near Middleton Pond

Medium- to fine-grained, massive, pink to red adameellite. Composed chiefly of microcline, plagioclase, and quartz with variable amounts of biotite almost completely altered to chlorite. Contains abundant xenoliths



Adameellite at Johnsons Pond

Chiefly coarse-grained, vaguely foliated light- to medium-gray adameellite. Composed mainly of microcline, plagioclase, and smoky quartz. Moderately deformed and altered



Andover Granite

spg - Pegmatitic granite facies, chiefly medium- to extremely coarse-grained, massive, pearly-white to light-bluish-gray granite and pegmatite. Composed mainly of microcline, plagioclase, quartz, and muscovite. Biotite occurs locally and garnet is a common accessory. Broad areas underlain entirely by pegmatite. Contains numerous xenoliths or roof pendants of older metasediments

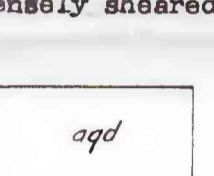
abg - Binary granite facies, chiefly medium-grained, massive to faintly foliated, pearly-white to light-gray, granite. Composed mainly of microcline, plagioclase, quartz, muscovite, and biotite with accessory garnet. Pegmatite prominent locally

afg - Fine-grained granite-gneiss facies, fine to medium-grained, generally prominently foliated, light-gray to pearly-white granite-gneiss

aug - Undifferentiated granite-gneiss facies, chiefly coarse- to medium-grained, slightly to prominently foliated, generally pearly-white granite-gneiss. Composed mainly of roughly equal amounts of microcline, plagioclase, and quartz, together with variable amounts of mica. Ratio of muscovite to biotite ranges widely. Pegmatite locally prominent, particularly in Marlboro quadrangle

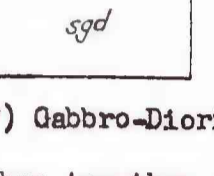
abgg - Biotite granite-gneiss facies, chiefly coarse-grained, slightly foliated very light-gray granite-gneiss. Composed mainly of microcline, plagioclase, quartz, biotite and muscovite. Garnet commonly occurs as accessory. Cross-cut locally by pegmatite dikes and quartz veins

amg - Muscovite granite-gneiss facies, chiefly coarse-grained, faintly to prominently foliated pearly-white granite-gneiss. Composed chiefly of microcline, plagioclase, and quartz. Muscovite is the major varietal mineral and biotite occurs in lesser amounts; garnet is accessory. Cross-cut locally by pegmatite and diabase dikes



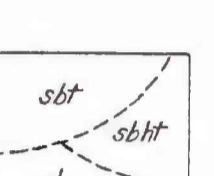
Newburyport(?) Quartz Diorite

Chiefly medium-grained, massive and locally foliated medium- to dark-greenish-gray quartz diorite. Composed mainly of plagioclase and quartz together with minor amounts of microcline. Abundant secondary chlorite and epidote. Locally intensely sheared and brecciated



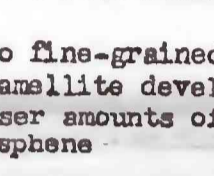
Assabet Quartz-Diorite

Chiefly medium-grained, faintly to moderately foliated, medium- to dark-gray quartz diorite. Composed mainly of plagioclase, quartz, hornblende and biotite



Salem(?) Gabbro-Diorite

Chiefly medium- to coarse-grained hornblende gabbro together with lesser amounts of fine-grained hornblende diorite

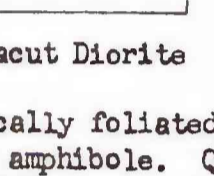


Sharpers Pond Tonalite

sbt - Biotite tonalite facies, chiefly medium- to fine-grained, massive to distinctly foliated light- to medium-gray tonalite. Gneodiorite and adameellite developed locally. Composed mainly of plagioclase, quartz, and biotite, together with lesser amounts of microcline and hornblende. Contains accessory amounts of magnetite, sphene, and apatite

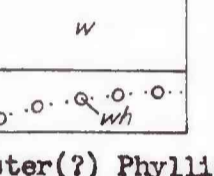
sbt - Biotite-hornblende tonalite facies, chiefly medium-grained, massive to vaguely foliated, medium- to dark-gray tonalite. Composed mainly of plagioclase, hornblende, quartz, and biotite, together with accessory amounts of sphene, apatite and magnetite

sd - Hornblende diorite facies, chiefly medium- to coarse-grained, massive, medium-gray to black diorite to tonalite. Composed mainly of plagioclase and hornblende together with variable but generally small amounts of quartz. Biotite locally composes up to 10 percent of the rock. Main accessories include magnetite, sphene, and apatite



Dracut Diorite

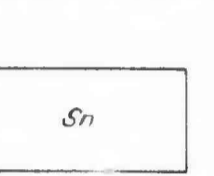
Chiefly medium- to coarse-grained, massive to locally foliated, light-gray to black gabbro to tonalite. Composed mainly of plagioclase, pyroxene, and amphibole. Quartz present in marginal parts of stock. Sulfides scattered throughout stock and locally concentrated at Nickel Mine Hill. Intensely sheared and altered in places. Contains abundant xenoliths



Worcester(?) Phyllite

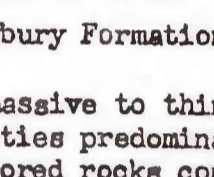
w - Undifferentiated Worcester(?) Phyllite, chiefly ultra-fine- to fine-grained, distinctly schistose and locally contorted medium-gray phyllite and schist. Composed mainly of muscovite, chlorite, and quartz

wh - Harvard Conglomerate Lentic, chiefly small quartzitic pebbles in dull, greenish-gray to buff phyllite-schist matrix. Identified in 3 exposures by Johns, but now hidden



Newbury Formation

Fine-grained to aphanitic, locally porphyritic, massive to thinly layered metavolcanic rocks. Dark greenish-gray and flesh colored to white varieties predominate. Dark rocks composed chiefly of plagioclase, quartz, and epidote; lighter colored rocks composed chiefly of feldspar and quartz. Extensively altered locally. (Interbedded sediments unexposed in this area)



Merrimack Group

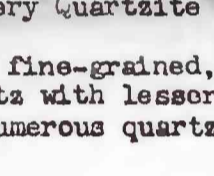
Ellet Formation

me - Chiefly fine-grained, distinctly schistose and locally layered, gray to silvery-gray phyllite and schist. Composed mainly of quartz, sericite, biotite, and chlorite. Progressively more phyllitic and less quartzitic toward the east. Poorly exposed

Kittery Quartzite

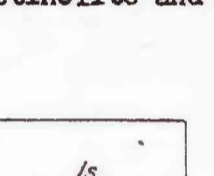
mk - Undifferentiated Kittery Quartzite, chiefly fine-grained, massive to foliated and bedded, gray to silvery-gray quartzite. Composed mainly of quartz with lesser amounts of biotite. Secondary epidote or clinzoisite and calcite occur locally. Numerous quartz-mica schist beds interbedded with massive quartzite near top of formation

mka - Actinolitic quartzite, chiefly fine-grained, massive to slightly foliated light-gray quartzite. Composed of quartz with variable amounts of actinolite and biotite. Actinolite commonly weathers out leaving finely pitted surface



Serpentinite at Lynnfield center

Chiefly ultra-fine-grained, massive and slickensided, very dark bluish- to greenish-gray serpentinite. Composed chiefly of antigorite. Tremolite(?), olivine, magnetite, and chlorite present locally. Poorly exposed

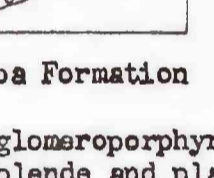


Nashoba Formation

hg - Hornblende gneiss, fine- to coarse-grained glaucophanoblastic, massive to slightly foliated, black to dark-gray. Composed chiefly of hornblende and plagioclase. Sphene and magnetite occur as prominent accessories. Fracture surfaces heavily coated with iron oxides

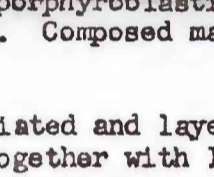
na - Amphibolite, chiefly fine-grained, locally porphyroblastic, distinctly foliated, dark-gray to black amphibolite and plagioclase amphibolite. Composed mainly of hornblende and plagioclase. Epidote, magnetite, and pyrite occur locally

nb - Biotite gneiss, chiefly medium-grained, foliated and layered, light-gray gneiss. Composed mainly of quartz, plagioclase, and biotite, together with locally conspicuous muscovite. Commonly contains accessory garnet. Less prominent accessories include sillimanite, magnetite, ilmenite, and apatite. Thin mica schist layers crop out locally, particularly in northern belt. Comfortable lenses or discordant sheets of pegmatite occur in many exposures



Brinfield-type schist

Chiefly fine- to medium-grained, prominently foliated and locally contorted, gray to silvery-white quartz-mica schist and sericite schist. Composed mainly of quartz, muscovite, plagioclase, and biotite. Commonly weathers to rusty-brown color. Locally interlayered with amphibolite. Poorly exposed



Boxford Formation

ba - Undifferentiated upper member, chiefly fine-grained, distinctly foliated, very thinly layered, light-gray to black schist and gneiss. Composed of rocks of widely differing mineralogical composition, including amphibolite, calc-silicate rock, andalusite-sillimanite-sericite schist, quartz-feldspar gneiss, and others transitional between these extremes. Contains a few thin beds of white quartzite near the top of formation

bas - Amphibolite, chiefly fine-grained, foliated and locally layered, gray to black amphibolite. Composed mainly of hornblende and plagioclase. Weathers to brown color. Differentiated where amphibolite is the predominant rock type

bg - Quartz-plagioclase gneiss member, fine-grained and foliated but generally unlayered, white to light-gray gneiss. Composed of plagioclase and quartz with minor amounts of chlorite

bb - Lower member, chiefly fine- to medium-grained schist, gneiss, and amphibolite. Schist commonly bluish-gray and composed mainly of muscovite, biotite, and quartz with minor amounts of andalusite and fibrolitic sillimanite. Gneissic rocks composed of quartz and plagioclase with variable amounts of actinolite. Amphibolites in part coarser-grained than those of upper member of Boxford Formation. Poorly exposed



Marlboro Formation

ma - Undifferentiated A member, chiefly fine-grained, fine-grained and locally porphyroblastic, foliated and locally layered, greenish-gray to black biotite-quartz-hornblende-plagioclase schists locally interlayered with ultra-fine-grained siliceous schists. The siliceous schists are commonly chloritic and epidotitic and crop out most conspicuously toward the probable top of the formation. Locally sheared. Interlayered quartzite and quartz-feldspar occur locally. Transitional with B member of Marlboro Formation

maq - Quartzite, chiefly fine-grained, massive to foliated, light-gray to white quartzite. Composed chiefly of quartz with minor amounts of chlorite and feldspar. Locally enriched with calc-silicate minerals. Mapped separately where quartzite is the predominant rock type

mas - Amphibolite, chiefly fine-grained, distinctly foliated and locally thinly layered, gray to black amphibolite and plagioclase amphibolite. Composed mainly of hornblende and plagioclase with lesser amounts of magnetite, chlorite, and calcite. Epidote conspicuous locally. Mapped separately where amphibolite or plagioclase amphibolite is the predominant rock type

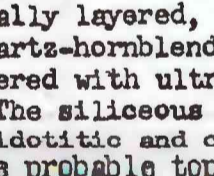
mp - Porphyroblastic gneiss member, composed chiefly of interlayered plagioclase amphibolite and porphyroblastic feldspar-quartz-biotite gneiss. Porphyroblasts are chiefly microcline and range from 3 to 10 millimeters in diameter. Poorly exposed in this area

mb - B member, chiefly medium- to coarse-grained, foliated and layered, very light- to dark-gray gneiss. Commonly possesses an augen- or feldspar-like texture. Composed mainly of varying amounts of quartz, plagioclase, microcline, and biotite. Hornblende, muscovite, epidote, and chlorite commonly present in small amounts. Contains some amphibolite and thin quartzite layers. Transitional with A member of Marlboro Formation



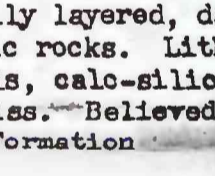
Westboro-type quartzite

Chiefly fine-grained, massive to faintly foliated, light-greenish-gray to white, quartzite. Composed mainly of quartz with minor amounts of feldspar, chlorite, and amphibole. Poorly exposed



Fish Brook Gneiss

Chiefly fine- to medium-grained, distinctly foliated, ug - Undifferentiated gneiss, chiefly medium-grained, contorted, light-gray gneiss. Composed mainly of quartz, plagioclase, and biotite. Contains minor amounts of epidote, apatite, and zircon. Biotite with accessory amounts of apatite, Potash feldspar rare, but present locally. Contains numerous amphibolite inclusions. Progressively less biotitic and less distinctly foliated toward the south



Unnamed gneiss in Reading quadrangle

ugs - Amphibolite, chiefly fine-grained, foliated and locally layered, dark-gray amphibolite. Composed mainly of hornblende, plagioclase, quartz, and biotite

Contact, dashed where approximately located

Indefinite contact

Concealed contact



Bearing and plunge of minor fold axis



Strike and dip of beds



Strike of vertical beds



Strike and dip of overturned beds



Strike and dip of foliation



Strike of vertical foliation

Generalized strike and dip of crumpled or contorted foliation

Generalized strike of vertical crumpled or contorted foliation



Strike and dip of cleavage

Strike and dip of axial plane of minor fold or crenulation



Strike of vertical axial plane of minor fold or crenulation



Bearing and plunge of linear element

Strike and dip of foliation showing plunge of linear element



Generalized strike and dip of crumpled or contorted foliation and bearing and plunge of linear element



Mine or quarry



Scratch contact

R. O. Castle
U.S. Geological Survey
OPEN FILE MAP

This map is preliminary and has not been edited or reviewed for conformity with Geological Survey standards or nomenclature.

Alkaline intrusive series

Subalkaline intrusive series

Upper Silurian

SILURIAN

PRE-SILURIAN

AGE UNDETERMINED

TRIASSIC (?)

LATE PALEOZOIC