

Mica Deposits of the Southeastern Piedmont

Part 3. Ridgeway-Sandy Ridge District,
Virginia and North Carolina

Part 4. Outlying Deposits in Virginia

GEOLOGICAL SURVEY PROFESSIONAL PAPER 248-C



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By WALLACE R. GRIFFITTS, RICHARD H. JAHNS, *and* RICHARD W. LEMKE

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*Distribution and structure of pegmatite
bodies in the area, their mineralogical
characteristics, and the economic possibilities
of the mica and other pegmatite minerals*



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MICA DEPOSITS OF THE SOUTHEASTERN PIEDMONT

PART 3. RIDGEWAY-SANDY RIDGE DISTRICT, VIRGINIA AND NORTH CAROLINA

By WALLACE R. GRIFFITTS, RICHARD H. JAHNS, and RICHARD W. LEMKE

ABSTRACT

Between January 1943 and January 1945 thirty-one mica mines and prospects were examined in the Ridgeway-Sandy Ridge district of Virginia and North Carolina. Thirteen of these were mapped. The district is a crescentic belt, the center of which is near the State line. The largest concentration of deposits is in the eastern half of the district. The relief is low, and the rocks, like most of those in the Piedmont, are deeply weathered.

Most of the district is underlain by mica schist and gneiss. Hornblendic rocks, considered to be metamorphosed mafic igneous rocks, are common in the Virginia part of the district but are not common in the North Carolina part. Sills and dikelets of granite are exposed near Sandy Ridge. Some of the granite is strongly foliated. The sills apparently are outlying satellites of a large body of granite that occurs to the north. Diabase dikes, presumably of Triassic age, cut the other rocks. The sills and the foliation of the metamorphic rocks trend northeast and dip northwest in the Virginia part of the district. They bend sharply to the west at the State line and continue westward at least to Sandy Ridge. The few linear structures that were observed plunge to the north or northeast.

Most of the pegmatite bodies are concordant, and the trend of the pegmatite belt is parallel to the country-rock structure. Zoning in the pegmatite bodies is more distinct in the western part of the district. The essential minerals of the pegmatite are plagioclase, perthite, quartz, and muscovite. Few deposits contain uncommon accessory minerals.

The commonest and richest mica deposits are those in which the books are scattered through the plagioclase-quartz pegmatite of wall zones and unzoned pegmatites. In several deposits the mica in shoots constitutes 10 percent of the rock, whereas that outside the shoots amounts to only 2 percent. Green mica occurs in the northeastern two-thirds of the district and brown mica near the west end and at the bend in the district near the State line. Stained mica occurs in pegmatites along the inside of the bend. Most books from intermediate zones yield no more than 3 percent sheet; those from plagioclase-quartz pegmatite may yield 12 percent.

Mica mining probably began about 1890 and, as in most districts in the southeastern Piedmont, has continued intermittently until the present time. Activity reached a peak between 1942 and 1945, when 31 deposits were mined and at least 40 were prospected. Only one mine was in operation after the summer of 1945. During the World War II boom, 44,735 lb of clear sheet mica and 32,000 lb of stained sheet were produced. Several of the mica deposits appear not to have been exhausted; others have not been adequately explored. Further production is therefore possible.

A small production of feldspar is credited to the district, but resources of that mineral appear to be small. Kaolin is present in many deposits too small to mine profitably.

INTRODUCTION: FIELD WORK AND ACKNOWLEDGMENTS

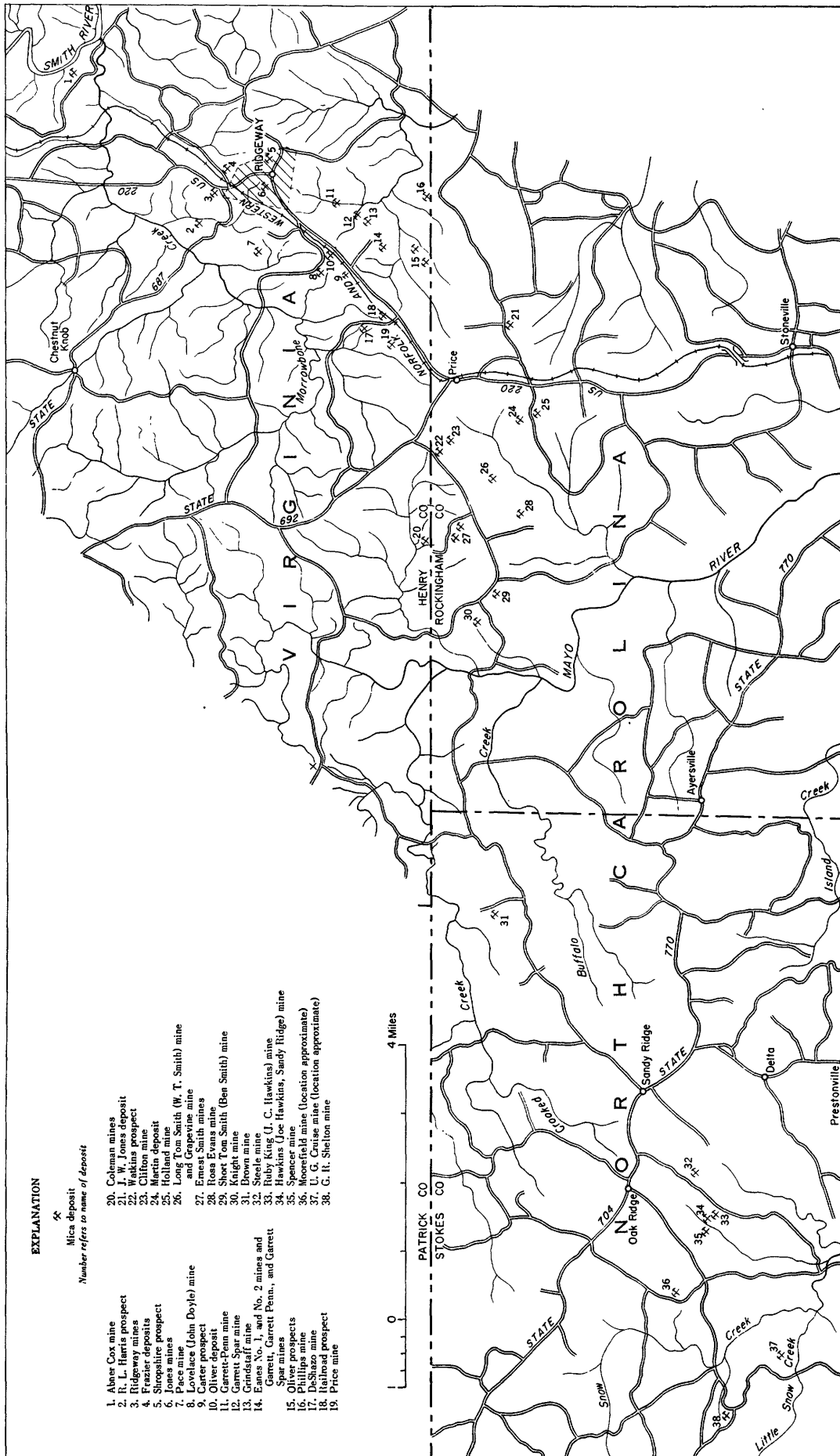
Recent investigations in the Ridgeway-Sandy Ridge district were started by the Geological Survey in January 1943, when W. C. Stoll and J. J. Norton mapped the Ridgeway mica mines. Further work was carried on intermittently during the period 1943-45 by R. W. Lemke, W. R. Griffiths, R. H. Jahns, Roswell Miller III, D. M. Larrabee, and J. C. Olson. Edward Ellingwood III served as field assistant during a part of 1944. A total of 13 mines were mapped, 18 others were examined and descriptions of 28 more were obtained from published reports (Sterrett, 1923, pp. 263-265, 322-326; Pegau, 1932, pp. 70-74) and from examination reports in the files of the Colonial Mica Corporation.

W. R. Brown studied parts of the district for the Virginia Geological Survey in 1944 and 1945, and the State and Federal investigations were integrated wherever possible. E. B. Ward and C. B. McFee, Jr., of the Colonial Mica Corporation, provided information about many mines and were helpful in numerous other ways. Mine owners and operators also cooperated wholeheartedly throughout the investigations.

GEOGRAPHY OF THE DISTRICT

The district occupies a crescentic belt that trends southwestward through south-central Henry County, Va., crosses the State line, and extends westward through northwestern Rockingham County and northeastern Stokes County, N. C. (fig. 59). It is about 25 miles long and 2 to 5 miles wide. The Abner Cox mine 3 miles northeast of Ridgeway, lies at one end of the district, and the G. R. Shelton and U. G. Cruise mines, 4.5 miles west-southwest of Sandy Ridge, are at the other. Outlying deposits include the Hole mine, 11 miles west of Sandy Ridge, and several deposits on Brown Mountain, farther west. For convenience, these are described with the mines that lie within the district.

All parts of the district are readily accessible over a network of public roads. U. S. Highway 220 crosses the eastern part of the pegmatite belt from north to south, and a gravel road connects this highway with the deposits at the west end of the belt (fig. 59). Mines



EXPLANATION

- * Mica deposit
- Number refers to name of deposit
- 1. Abner Cox mine
- 2. R. L. Harris prospect
- 3. RidgeWAY mines
- 4. Frazier deposits
- 5. Shropshire prospect
- 6. Jones mines
- 7. Pace mine
- 8. Lovelace (John Doyle) mine
- 9. C. G. Smith (W. T. Smith) mine
- 10. Other deposit
- 11. Garrett-Penn mine
- 12. Garrett-Spar mine
- 13. Grandstaff mine
- 14. Fanes No. 1, and No. 2 mines and Spar mines
- 15. Other prospects
- 16. Phillips mine
- 17. DeShazo mine
- 18. Railroad prospect
- 19. Price mine
- 20. Coleman mines
- 21. J. W. Jones deposit
- 22. Watkins prospect
- 23. Clifton mine
- 24. Martin deposit
- 25. Rollam mine
- 26. F. G. Smith (W. T. Smith) mine and Gossett mine
- 27. Ernest Smith mines
- 28. Rosa Evans mine
- 29. Short Tom Smith (Ben Smith) mine
- 30. Knight mine
- 31. Brown mine
- 32. Steels mine
- 33. Ruby King (J. C. Hawkins) mine
- 34. Hawkins (Joe Hawkins, Sandy Ridge) mine
- 35. Spencer mine
- 36. Garrett-Penn mines (location approximate)
- 37. U. G. Cousins mines (location approximate)
- 38. G. R. Shelton mine

FIGURE 59.—Index map of the RidgeWAY-Sandy Ridge district, Virginia and North Carolina, showing the location of the mica deposits.

and prospects not on these roads are accessible over graveled or sand-clay access roads. The Roanoke and Winston-Salem line of the Norfolk and Western Railway extends southward from Martinsville to Ridgeway and continues southwestward through Price.

The area is in the Piedmont province of western Virginia and North Carolina and consists of rolling hills with local steep slopes. Altitudes range from about 550 ft along the large rivers to 1,300 ft on the highest hills, although the local relief probably is nowhere greater than 300 ft. The western part of the district is drained by the Dan River, which flows southeastward and eastward to join the Roanoke near Clarksville, Va. The eastern part is drained by the Smith River, which joins the Dan near Leaksville and Spray, N. C. Through most of the district the rocks are weathered to depths that range from a few feet at the Eanes No. 2 mine to at least 45 ft at the south end of the Hawkins mine. Hard rock is exposed in some stream valleys, on a few steep slopes, and in several road cuts, but the rest of the country is mantled with a thick accumulation of soil and thoroughly decomposed rock.

GEOLOGY OF THE DISTRICT

ROCK FORMATIONS

METAMORPHIC ROCKS

Most of the district is underlain by mica schists and gneisses that are assigned to the Wissahickon schist in Virginia and to the Carolina gneiss in the Carolinas and Georgia. Pegau (1932, pp. 15-19) divided the Wissahickon schist into three facies. The most abundant of these, a garnetiferous mica schist, is a well-laminated aggregate of muscovite, quartz, sodic plagi-

oclase, biotite, and garnet, named in approximate order of decreasing abundance. Epidote, magnetite, ilmenite, sphene, tourmaline, zircon, and rutile are accessory minerals.

Biotite gneiss, which forms concordant layers a few inches to 500 ft thick in the garnetiferous mica schist, is a rather massive rock with only local schistose phases. Its evenly distributed constituent minerals include oligoclase and orthoclase, quartz, biotite, muscovite, and epidote, with accessory apatite, garnet, zircon, sphene, magnetite, and pyrite. This gneiss forms the country rock at the Hawkins mine, where it is well exposed. Hornblende gneiss is present in layers only a few inches thick. It is sparsely interlayered with the mica schist and is composed of hornblende, plagioclase, magnetite, sphene, apatite, garnet, and pyrite. Some of the plagioclase has been altered to epidote. The hornblende rocks may be metamorphosed volcanic rocks or intrusive types of intermediate to basic composition.

IGNEOUS ROCKS

Hornblende gabbro is abundant and widespread in that part of the district east and northeast of the W. T. Smith and Ernest Smith mines and seems to be uncommon west of them, although the soil map of Stokes County (Davis and Goldston, 1940) suggests that a large body may occur a few miles northeast of Sandy Ridge and continue to the west-southwest (fig. 60). The hornblende gabbro forms masses several hundred feet long. Many are elongated parallel to the trend of the enclosing metamorphic rocks, but their contacts are at least locally discordant. Typical gabbro is exposed at the Pace and De Shazo mines, where it is an aggregate of black hornblende and gray plagioclase. A few

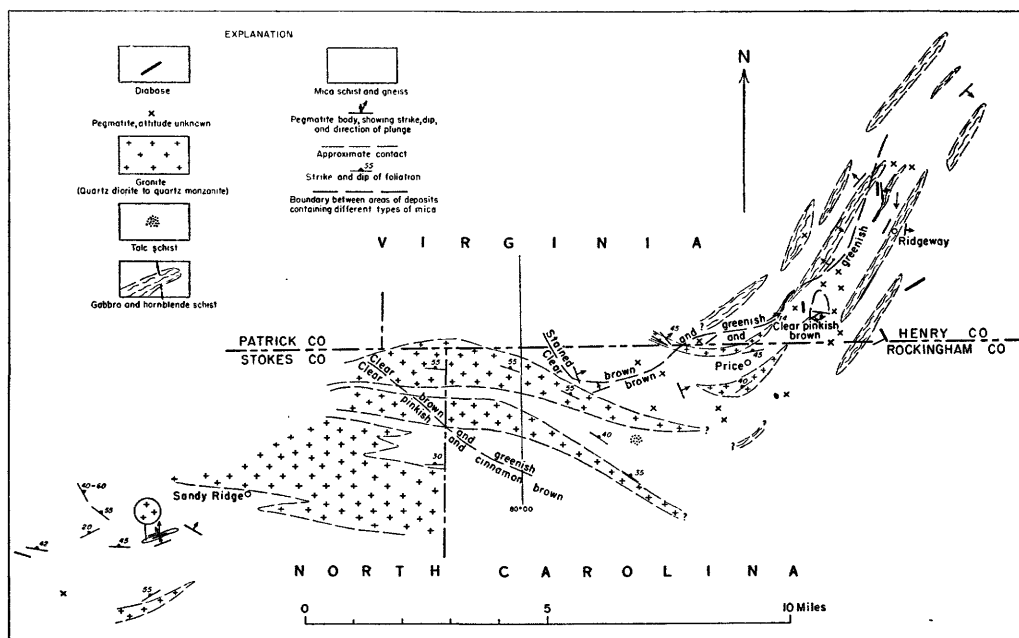


FIGURE 60.—Geologic sketch map of the Ridgeway-Sandy Ridge district, Virginia and North Carolina. Virginia portion modified from A. A. Pegau.

coarse layers contain hornblende grains as much as an inch long, but in most of the rock the grains are $\frac{1}{16}$ to $\frac{1}{8}$ in. across. The gabbro is nearly homogeneous but has a faint foliation caused by the parallel arrangement of hornblende grains and hornblende-rich layers. In other exposures, like those $1\frac{1}{2}$ miles south of Price, N. C., the rock is essentially a hornblende schist. Discordant contacts exposed at the Pace mine and elsewhere indicate that the gabbro was intruded into the mica schist and associated metamorphic rocks.

Sills, stringers, and concordant pods of light-gray, foliated granite (quartz monzonite to quartz diorite) are exposed throughout the district. They appear to be most abundant and largest near Sandy Ridge, where the thickness of some is 200 ft or more. Most are bounded laterally by sharp, even contacts, although many finger out irregularly along strike or down dip to form zones of lit-par-lit injection gneiss. The thinner sills at the Hawkins mine also are traceable into lit-par-lit gneiss. Several contorted masses of similar rock are exposed in the main open-cut at the Short Tom Smith mine, where they cut the foliation of the country rock at small but distinct angles (fig. 2, chapter A of this series). The foliation of these dikes, like that of the sills, is parallel with the country-rock foliation. Linear structures are locally well developed, and clearly defined streaks of biotite flakes at the Pace mine plunge 30° to 40° NE. In most places the foliation of the rock is due to a parallel orientation of evenly distributed biotite flakes, but at the Hawkins mine distinct layers are composed largely of quartz and feldspar or of garnet and mica.

The granite is composed of microcline, oligoclase, quartz, biotite, muscovite, garnet, and apatite. Apatite tends to occur with biotite. Epidote also is associated with biotite, from which it may have formed by alteration. A little calcite occurs at the Hawkins mine, where it is embedded in fresh feldspar. Microcline tends to occur as small grains in the granite at the Hawkins and Short Tom Smith mines and is interstitial to larger particles of oligoclase and quartz. Many of the larger grains in the rock at Hawkins are bent or otherwise strained, and thin layers of quartz cut aggregates of small feldspar grains. These layers may have been developed after granulation of the earlier minerals. Masses of granite at the De Shazo mine apparently are similar to those at the Short Tom Smith mine, except that microcline is present in a much smaller proportion.

The granitic rocks probably are equivalents of the Leatherwood granite of Jonas (Stose, Jonas, and others, 1928), which occurs in northern Henry County, Va. (fig. 73). Accessory minerals reported by Pegau (1932, pp. 29-31) from the Leatherwood granite of Jonas and identified in the rock from North Carolina include zircon, magnetite, sphene, and sericite, and J. B. Mertie, Jr., reports that monazite is present in

some parts of the granite mass (oral communication 1949).

A small area about a mile south of the Rosa Evans mine is covered by float blocks of talc, which contain sparsely scattered flakes of chlorite and grains of a black metallic mineral. Similar rocks farther south in North Carolina are known to have been formed by the alteration of peridotite.

Dikes of fine-grained diabase, 2 in. to at least 25 ft thick, cut the other rocks in the district. According to Pegau (1932, pp. 31-92), the diabase is composed largely of labradorite and augite, with minor quantities of quartz, orthoclase, magnetite, pyrite, biotite, apatite, hornblende, chlorite, and serpentine. Some of the augite is altered to hornblende and chlorite. Like many masses of similar rock in both North Carolina and Virginia, these are considered Triassic in age.

STRUCTURE

The granite sills and the foliation of the enclosing metamorphic rocks between the Hole and Ernest Smith mines trend nearly east and are warped into a broad arch, the northward-plunging axis of which lies near the Stokes-Rockingham County line (fig. 60). In plan this arch is convex toward the north. The strike bends rather sharply northeastward a short distance east of the Ernest Smith mine, and a broad area of northeasterly strikes and northwesterly dips includes most of central and eastern Henry County. The axis of the resulting trough plunges to the north or northwest. The structural trend is well shown by the distribution and orientation of the masses of gabbro and hornblende schist. Similarly, the broad structural trends over the entire district are reflected in the shape of the district. Few of the rocks in the North Carolina portion of the district are severely contorted, but in Virginia some exposures several hundred feet in diameter consist chiefly of contorted rock.

DISTRIBUTION AND GENERAL STRUCTURAL FEATURES OF THE PEGMATITES

Most of the pegmatite bodies are concordant, and the trend of the pegmatite belt is parallel to the trend of the country-rock structure. The largest concentration of pegmatite deposits is in the eastern part of the district, between the Knight and Ridgeway mines. A smaller group occurs around the Hawkins mine, near the west end of the district. The pegmatites range from lenses a few inches thick and about a foot in diameter, like those in the road cut northeast of the Ridgeway mines, to pinching and swelling sills at least 700 ft long. The sill mined in the Short Tom Smith open-cuts is an excellent example of such a large body.

Sills and concordant lenses are common throughout the district, but, as the pegmatite belt is traced westward, dikes become increasingly abundant and the

bodies taper abruptly along their strike, so that blunt lenses and tongues are more common than gradually tapering ones. Many of the deposits in granite are discordant, and they are much less regular than those in the metamorphic rocks. The pegmatite in the Coleman No. 2 mine, for example, is very irregular in shape and attitude, and many apophyses extend from it into the granite country rock, whereas the pegmatite in the nearby Knight mine closely reflects the regular structure of the enclosing schist.

INTERNAL STRUCTURE OF THE PEGMATITES

The degree and sharpness of mineral segregation into zones apparently increases westward in the district. Many sills in Henry County are poorly zoned or contain only cores of massive quartz surrounded by plagioclase-quartz pegmatite. Farther west, in Rockingham and Stokes Counties, the pegmatites commonly contain thin or discontinuous quartz cores and irregular intermediate zones rich in coarse, blocky perthite. The zones are less regular and less symmetrically distributed than those in some other districts. In the Hole pegmatite, for example, several parallel tabular masses of quartz are separated by feldspathic pegmatite.

In the Steele dike a blocky perthite layer south of the massive quartz core is locally separated from it by lenses of plagioclase-quartz pegmatite, and the plagioclase-quartz pegmatite of the wall zone contains scattered blocks of perthite. Another unusual type of zone distribution is well shown in the Knight pegmatite, which contains lenticular core segments as much as 8 ft. in maximum thickness. The intermediate zone, an irregular unit rich in large perthite blocks, is best developed in the central parts of broad bulges in the sill, where the core generally is not present. The quartz core of the Ruby King pegmatite locally splits into two well-defined layers, one of which lies above the other.

Despite the structural irregularities in some deposits, the general pattern of zoning is consistent and is similar to that in most other districts. The simplest pegmatites are aggregates of plagioclase, quartz, and muscovite, with or without potash feldspar. They increase in coarseness inward from the walls. The most complexly zoned pegmatites, on the other hand, consist of massive quartz cores, coarse-grained intermediate zones that are rich in perthite, and wall and border zones of plagioclase-quartz-muscovite pegmatite. The inner units are characteristically discontinuous, and some intermediate zones are represented by rows of individual perthite crystals or large "A" books of mica that fringe cores or core segments. Wall zones generally are the best-developed units, and they commonly form the bulk of the pegmatite. The border zones pinch and swell markedly and pinch out entirely at many places. They are similar to the adjacent wall zones in composition but are finer-grained and locally

are marked by an abundance of quartz and fine-grained mica or by an arrangement of elongate grains normal to the walls.

The central part of the Rosa Evans pegmatite is finer-grained than the enclosing units but does not appear to be a true core. Its contacts suggest that it was injected into the coarser pegmatite to form a composite sill. The Short Tom Smith pegmatite contains thin, tabular masses of quartz that lie parallel with the borders of the sill. The Hawkins pegmatite, even more distinctly layered, contains thin plates of quartz, lenses of plagioclase, and small books of mica. All these features are oriented parallel with the sill. Many of the mica books are bent, and some perthite blocks are bent or broken, so that the deposit appears to have been much sheared before final consolidation. Such late movement, accompanied by injection of new material (particularly quartz), may account for some of the irregularities noted in several deposits.

MINERALOGICAL FEATURES OF THE PEGMATITES

Most of the pegmatites in the Ridgeway-Sandy Ridge district are simple in composition. The most common minerals, in order of decreasing abundance, are oligoclase, quartz, perthitic microcline, muscovite, albite, biotite, spessartite, beryl, and tourmaline. In addition, the Knight pegmatite contains small quantities of uraninite, autunite, uranophane (?), other secondary uranium minerals, and allanite (?).

Plagioclase, associated with subordinate quartz and mica, constitutes at least half of most pegmatite bodies. It characteristically occurs as 1- to 4-in. grains that are separated by thin layers and interstitial masses of quartz. Some of the grains contain irregular lenses and spindles of quartz, but graphic intergrowths are rare. Plagioclase-quartz pegmatite forms most of the unzoned or poorly zoned deposits but is largely restricted to wall zones in the others. Veinlets of a fine-grained plagioclase-quartz rock cut the perthite and quartz of the inner zones in the Knight and Hawkins sills. Plagioclase is one of the more readily weathered pegmatite minerals; therefore it is represented in many places by kaolin.

Perthite is the principal intermediate-zone constituent of the pegmatites in Stokes and western Rockingham Counties. A little occurs in the core of the Hawkins pegmatite and in the wall zone of the Steele pegmatite. In the Garrett No. 2 and several other deposits in Henry County it is scattered through the plagioclase-perthite-quartz rock that constitutes most of the pegmatite bodies. In contrast to the plagioclase, the perthite is hard or only slightly friable, even in the thoroughly weathered Ruby King and Steele pegmatites. Quartz occurs as small grains in both plagioclase- and perthite-rich pegmatite, and in most well-zoned bodies it forms massive cores. A mass of quartz 200 ft long and 100 ft

wide crops out northeast of the road and 1¾ miles due south of the Rosa Evans mine.

Muscovite occurs in plagioclase-quartz pegmatite and, to a lesser extent, along the margins of the quartz cores. Concentrations of books generally are associated with granular quartz. Spessartite also is most abundant in plagioclase-quartz pegmatite. Uranium minerals occur in similar pegmatite near the hanging wall of the Knight deposit, and green biotite is interlayered with stained dark brownish-olive muscovite in the same deposit.

ORIGIN OF THE PEGMATITES

The general course of pegmatite crystallization in the Ridgeway-Sandy Ridge district appears to be similar to that in the other districts of the southern Appalachian region. Plagioclase, quartz, and muscovite generally appear to have developed first, followed by perthite and a little quartz and then by quartz with few associated minerals. This sequence is not evident in all deposits. The periods of crystallization characteristically overlap, and different parts of certain deposits appear to have crystallized in slightly different sequences. The lenses of plagioclase-quartz pegmatite—normally an early formed material—between the intermediate zone and core of the Steele dike, as well as some of the quartz layers in the Hole sill, may represent late movements of fluid material within partly crystallized masses of pegmatite.

A few mica books that lie along the margins of the Hawkins and De Shazo sills appear to have grown from the pegmatite into the country rock. The foliation planes of the schist generally bend outward around them. Some wall-rock material may have been incorporated into the growing books, whereas other material was rejected. Scattered feldspar crystals in the schist at the De Shazo mine may have had a similar origin. The mica at the contacts between pegmatite and wall-rock in the Hawkins mine may have crystallized early during consolidation of pegmatite, as it is similar in form and color to the early-crystallizing books within the deposit and is markedly different from the late-stage mica. Possibly it formed in the fracture that guided the pegmatite fluid, but at a stage prior to emplacement of the main body. Despite these local occurrences, there is little evidence of large-scale replacement of either older pegmatite or country rock by pegmatite minerals.

Several groups of mica deposits in the Southeastern States appear to be related to adjacent bodies of granite. The mica in the deposits nearest the granite is characteristically greener and more heavily stained than the mica in those farther away. These broad relations are apparent in the Ridgeway-Sandy Ridge district and in a large area to the north and northeast. A discontinuous halo of stained mica deposits in Henry, Pittsylvania, and Franklin Counties, Va., surrounds a large,

irregular mass of the Leatherwood granite of Jonas (fig. 73). The Ridgeway-Sandy Ridge district is separated from the largest group of these deposits by a barren area several miles across. The deposits in the northeastern part of the district and near the broad bend in the pegmatite belt are southeast of the southerly prong of the granite body (figs. 60 and 73). They contain yellowish and brownish-olive mica, some of which is stained. Farther west, away from the large granite mass, the mica is cinnamon brown and pinkish buff. Much of the mica in the Bedford area, some 20 miles north of the granite, also is brown. This systematic variation of mica color suggests that the pegmatites are genetically related to the Leatherwood granite of Jonas.

The thick granite sills near Sandy Ridge appear to be the Leatherwood granite of Jonas and may be satellites of a batholith of that rock that lies about 15 miles to the north (fig. 73), but they have no apparent effect upon the color of mica in the neighboring pegmatite deposits. The pronounced shearing during the consolidation of the granite and the pegmatite at the Hawkins mine suggests that both were emplaced while the same crustal stresses were active and that they may be of similar age. It is possible, however, that the granite sills are sufficiently older than the pegmatites to have behaved essentially as country rock and that the source of the pegmatite solutions thus lay some distance to the north, rather than near the sills themselves.

ECONOMIC ASPECTS OF THE PEGMATITE MINERALS

MICA

Three general types of mica occurrences are common in the district. The richest and most abundant deposits are those in which the books are scattered through the medium-grained plagioclase-quartz pegmatite that forms the bulk of the unzoned or poorly zoned bodies and the wall zones of the other pegmatites. Mica fringes the quartz cores of a smaller number of pegmatite bodies. The mica books are evenly distributed through some masses of plagioclase-quartz rock, as in the Eanes No. 2 deposits. In others they are concentrated near the hanging walls, as in the Hawkins; near the footwalls, as in the Ruby King; or near both walls, as in the Knight pegmatite. The Short Tom Smith deposit contains rich concentrations of mica in its inner part, but not along the edges of the core segments.

The mica content of the pegmatite varies markedly along the strike of some deposits. In the Hawkins and Ridgeway mines book mica constitutes 10 percent or more of the pegmatite in several narrow, gently plunging shoots, whereas it amounts to 2 percent or less of the pegmatite outside these shoots. In the Knight deposit mica is most abundant in a broad shoot, but the contrast in the mica content of this and the adjacent rock is not as great as in some other deposits. The shoot in the

Price mine occurs along the gently plunging keel of a steeply dipping pegmatite body. The main mica shoot in the large Ridgeway mine plunges south, whereas nearly all the others in the district plunge in the north-eastern quadrant.

The mica of the district ranges from yellowish olive through dark brownish olive to cinnamon brown and pinkish buff. Few deposits contain book mica of more than one general color, although the mica along the footwall of the Ruby King pegmatite is more pinkish than that from other parts of the body, and a few small books of light-green mica, which occur along the edges of the quartz masses in the Ruby King and Hawkins pegmatites, contrast sharply with the cinnamon-brown mica near the walls. Cinnamon-brown mica occurs in eastern Stokes County and in a small area around the Eanes No. 2 and Garrett mines (fig. 60). Brownish and yellowish-olive mica occurs in western Rockingham County and southern Henry County, whereas greenish mica is most abundant in the northeastern part of the district.

Most of the stained mica in the district occurs in wall zones and in the plagioclase-rich rock of poorly zoned deposits. The stained mica is largely restricted to deposits along the inner part of the bend in the pegmatite belt, although one unexplored deposit north of the Hawkins mine contains small books of stained green mica. Curdy green, primary, inorganic vegetable stain is prominent in some mica from the Rosa Evans and Hawkins mines.

Most of the mica books in the district are very slightly spotted with black, opaque or nearly opaque hematite and magnetite, and some from the central part of the district contain feathery streaks and latticelike patterns of light-brown, reddish-brown, and black hematite.

The mica that occurs near the walls generally is flat, whereas the books in the inner parts of some pegmatites are reeved. Most books that occur in the inner parts of zoned deposits are strongly reeved, but some yield 2 to 3 percent sheet material. Most of the mica that fringes quartz masses is reeved, and some is stained; the largest known deposit of this type is that in the Lovelace mine. The books in plagioclase-quartz pegmatite generally are flat or slightly reeved, and some yield as much as 12 percent sheet material. Most books contain peripheral cracks that are not long or abundant enough to reduce the recovery of sheet mica seriously. Mica from the Hole, Hawkins, and Spencer mines is somewhat wavy, whereas that from the other deposits lacks this defect. Few deposits contain badly ruled books, and lockiness is not widespread. The sheet mica from the Ridgeway, Knight, and Hawkins mines is unusually large, with diameters of as much as 2 ft.

FELDSPAR AND KAOLIN

Coarse perthite occurs in many deposits and has been recovered as a byproduct in mica mining at the Hole

and Ridgeway mines. Several carloads of feldspar were shipped many years ago from deposits near the Eanes mines. None of the deposits examined during the present investigations contain large enough concentrations of blocky feldspar to permit operations for that mineral alone, but some of the unexamined deposits in the southeastern part of the district may be richer in such material. In evaluating these deposits, however, it must be borne in mind that the feldspar concentrations, like the mica shoots in this part of the district, may be small and lenticular.

Kaolinized plagioclase is abundant in most of the pegmatites, but individual masses and concentrations probably are too small to permit large-scale kaolin mining. Large deposits are most likely to occur in Rockingham County, where quartz and perthite are not major constituents of the pegmatites. Moreover, several large pegmatite bodies are known in this part of the district. Few of the pegmatite cores are thick or continuous enough to yield large quantities of quartz.

MINING

HISTORY

Little is known of the early mining operations in the district. Mining probably began about 1890, when Joe Hawkins opened the Hawkins mine. A Captain McCraw is reported to have opened the Brown mine in 1895, and at about the same time Randolph Smith began work at the Long Tom Smith deposit. The Ridgeway mine and several prospects were opened during the period 1900-1910 by Captain McCraw and the Pittsburgh Mica Co. Shortly before 1915 the Ridgeway Mica Co. became active, taking over the Ridgeway mine and several small prospects.

Operations in the district were intermittent, with few mines simultaneously active until 1942, when the Short Tom Smith, Hawkins, Hole, and Ridgeway mines were reopened. Between 1942 and 1945 as many as 27 other deposits were mined and at least 40 were prospected. All but the Hawkins mine were closed before March 1945, but later in that year operations were resumed at the Knight mine.

MINE WORKINGS AND MINING METHODS

The mining methods employed in the district vary with the size, attitude, and shape of the deposit, the nature of the rock, and the equipment available to the miners. Prior to 1942 deposits in soft, weathered rock were worked by pick, shovel, and windlass, chiefly through shallow shafts and short adits and drifts. Few workings were carried below water level. Most of the hard-rock mines were operated in a similar manner, except that short holes were drilled by hand and the rock then blasted. The Hawkins and Ridgeway mines, both in hard rock, were worked on a larger scale with power drills and hoists.

During World War II gasoline-driven hoists were used at most mines, and rock was hoisted in buckets, drag pans, or cars, depending in part upon the attitude of the deposit. Portable compressors provided power for drills and pumps. The Short Tom Smith and De Shazo pegmatites were worked in part by small-scale methods and later in part by means of earth-moving machines. The large-scale operations of these two mines were not profitable.

PRODUCTION

No accurate record of the early production of mica in the district is available. At least 200,000 lb of sheet mica probably was recovered from the Ridgeway and Hawkins mines prior to 1942, and 168,000 lb of book mica (largely scrap) is reported to have been recovered from the Short Tom Smith deposit. These mines probably accounted for half the total production from the district. The output of mica during World War II was very large in relation to the number of mines operated. Between early 1942 and March 31, 1945, a total of 44,735 lb of clear trimmed punch and sheet mica was obtained. Five percent of this was classed as no. 1 quality, 30 percent as no. 2, and 65 percent as no. 2 inferior. In addition, at least 32,000 lb of punch and 10,000 lb of trimmed stained, or electric, mica are known to have been obtained. Both clear and stained mica books were unusually large, and about two-thirds of the trimmed clear sheet material measured 1½ by 2 in. or more. The bulk of the output was obtained from the newly opened Knight mine and from the Hawkins mine, the oldest in the district.

FUTURE OF THE DISTRICT

Many of the mica deposits do not appear to have been exhausted. The Knight, Short Tom Smith, Hawkins, and Hole pegmatites may well contain large reserves of mica similar in quality to that obtained in the past. Several small lenses of mica-bearing pegmatite have been mined at the Eanes and Garrett mines, and additional lenses probably occur in the vicinity. The Spencer mine, the prospects on Brown Mountain, and several deposits of stained mica in the middle and eastern parts of the district have received scant attention since 1903. Further prospecting in these areas might disclose deposits not now known, and extensions of several known deposits also are worthy of further testing. In addition, several deposits probably remain undiscovered in wooded areas.

DESCRIPTION OF DEPOSITS

HENRY COUNTY, VA.

ABNER COX MINE

The Abner Cox mine, 3.4 miles N. 30° E. of Ridgeway (location 1, fig. 59), is owned by Abner Cox and was operated in 1943 by J. D. Whitlow and G. S.

Whitlow. The workings include a 20-ft shaft and two shallow pits. The pegmatite is a sill that strikes N. 45° E. and dips 40° SE. in weathered schist. Its length and thickness are not known. The core, 1 ft thick, consists of massive quartz. The surrounding wall-zone pegmatite is rich in plagioclase and contains scattered books of light-green mica. Some of the mica is reeved, and most contains black specks and is clay-stained.

RIDGEWAY MINES

The Ridgeway mines are on the west side of U. S. Highway 220, about a quarter of a mile northwest of Ridgeway station on the Norfolk and Western Railway (location 3, fig. 59). They were first operated extensively during the period 1895–1907 by the Pittsburgh Mica Co. and later by the Ridgeway Mica Co., an outgrowth of the original organization. During World War I large quantities of mica were obtained by the Chestnut Mountain Mica Co., but the deposits lay idle for many years thereafter. Gus Grindstaff, of Sontag, reopened the main workings in the fall of 1941, and he is said to have obtained mica valued at about \$500. In August 1942 the deposits were purchased from Homer Hise, the owner, by the Meyer and Brown Corp., of New York City, and were worked until January 1943. During this period about 6 tons of mine-run mica is said to have been produced, and nearly 1,500 lb of punch and sheet material was recovered. The earlier output from the deposits is reported to have included 58,000 lb of mica and several carloads of feldspar (Pegau, 1932, p. 71).

The only rock exposures in the area are in the mine workings and in a long highway cut nearby. The surface elsewhere is underlain by clayey residual soil to a depth of several feet. The country rock, chiefly quartz-biotite schist with chlorite schist and markedly schistose gabbro, is locally impregnated with much pegmatitic material. In many places it is distinctly gneissic, owing to closely spaced sill-like layers of pegmatitic granite. Small float blocks of a coarse-grained gabbroic rock are scattered on the slope west of the mine workings. In general the country-rock foliation trends north-northeast and dips steeply east-southeast in the vicinity of the main mine workings and trends north to northwest with steep to very steep easterly dips beside and near the highway. The foliation is much contorted along many of the pegmatite contacts, where the wall rock commonly is impregnated with much biotite.

The foliated rocks enclose many pods and sills of granite and medium- to coarse-grained pegmatite that range in thickness from a fraction of an inch to more than 30 ft. Most of the large bodies are aggregates of plagioclase, quartz, perthite, and muscovite. Others consist chiefly of quartz, fine-grained plagioclase, and abundant scales of green muscovite. Some of the small

sills are composed almost wholly of granular quartz, and one veinlike mass exposed in the road cut contains kyanite, muscovite, and biotite in a matrix of quartz. Most of the finer-grained bodies are distinctly foliated, owing to orientation of their contained muscovite scales.

Mining and prospecting for mica have been carried on at several places on the property. The workings of the main, or northern workings include an open-cut 80 ft long, 40 ft wide, and 25 ft in maximum depth, a long incline from the bottom of the cut, two shafts, and irregular stopes (pl. 7). The underground workings, now flooded, are said to extend for a strike distance of about 200 ft and to a maximum depth of at least 120 ft. Mining was begun from the open-cut, and the incline was developed as a rich mica shoot was followed down its moderate south-southwestward plunge. Much of the later mining was done through shafts, at first through the steeply inclined east shaft and later through the vertical west shaft. These were sunk to connect with the incline.

The pegmatite body is very irregular and ranges in thickness from 1 to about 30 ft. It trends N. 27° E. and dips 75° WNW. in the cut and upper underground workings, but its strike is nearly due north in the lower workings. The footwall contact in the incline is essentially conformable with the foliation in the adjacent biotite schist. Constrictions and bulges in the deposit are reflected by irregularities in the mine workings.

Most of the pegmatite is an irregular aggregate of quartz, plagioclase, muscovite, and perthite. Book mica occurs sparingly in a footwall zone 1 to 6 ft thick. Only pillars of this mica-bearing zone remain in the stope. The mica shoot from which the largest and most abundant books were obtained plunged 35° to 45° S. 25° W. and was mined down its plunge to points not far below the water level shown in plate 7. The richest concentrations of mica evidently did not extend beyond the bend in the pegmatite body at the base of the old stope. During the most recent operations, a drift was run 40 ft southward along the footwall from the face of the old workings, and crosscuts were driven into both walls. Very little book mica is said to have been encountered.

The southern workings, immediately west of the highway, comprise a small open-cut in partly decomposed pegmatite, two 20-ft shafts from the bottom of the cut, and at least two old shafts and rather extensive caved drifts and stopes. The pegmatite is a fine- to medium-grained aggregate of quartz, plagioclase, and muscovite with large pods of massive gray quartz and a little perthite. It contains scattered books of mica about 3½ in. in average diameter. A fault that strikes N. 10° W. and dips 60° W. offsets the deposit (section A-A', pl. 7).

A third group of workings, 360 ft west of the main mine, includes three small slumped cuts. These expose at least two pegmatite bodies that trend north-northeast. Numerous small cuts have been dug in other parts of the mapped area.

The mica from the north and south mines ranges from cinnamon brown through brownish olive to greenish olive. Most is greenish. Many of the mica books obtained during the mining operations were exceptionally large, and 200- to 800-lb flat-A books were not uncommon. Some of the books were as much as 2 ft in diameter, and many yielded 18- by 20-in. trimmed sheets (figs. 43 and 44, chapter A of this series). The chief defects are ruling, "A" structure, and local slight waviness, but a high proportion of the sheet material recovered from the deposit during the recent operations was classed as no. 1 quality.

Several other mica prospects and mines were opened many years ago on both sides of the road along the ridge northeast of the main mine, and the following brief descriptions have been extracted from Sterrett's report (Sterrett, 1923, 325-326). Good mica was found in several pits on the west side of the ridge a few hundred yards north of the mine, and fairly fresh blocky perthite was found in two test pits east of the road and about 100 yd northeast of the main line. Another opening was made for feldspar about 600 yd farther northeast.

A pit was sunk in mica-bearing pegmatite southeast of the highway and two-thirds of a mile northeast of the main mine. The dump contains small flakes of brownish-olive mica. About 200 yd farther north, on the northwest side of the road, good mica is reported to have been obtained in a 27-ft shaft. A pegmatite mass with a 2-ft quartz core crops out in a plantation road about 60 ft to the southwest. Mica books as much as 4 in. in diameter occur in feldspathic pegmatite along the southeast side of the core.

A trenchlike cut 60 ft long and a 25-ft shaft were excavated in mica-bearing pegmatite about a mile northeast of the main mine and a hundred yards northwest of the highway. The work was done by a Captain McCraw, who is said to have recovered mica valued at about \$1,500. The pegmatite body is 6 ft thick in the end of the cut, where it is flanked by schistose gabbro. It consists chiefly of plagioclase. A 30-ft shaft was sunk by Captain McCraw about a quarter of a mile to the northeast, at a point 150 yd northwest of the road.

Several 18- to 30-ft shafts and short drifts were sunk in decomposed pegmatite about a quarter of a mile southeast of the main McCraw prospect and 1¼ miles northeast of the main Ridgeway mine. Small crystals of free-splitting but somewhat specked mica were recovered.

JONES NO. 1 AND NO. 2 MINES

The Jones No. 1 mine is in an open pasture northeast of the high school in Ridgeway (location 6, fig. 59). An old slumped cut was partly cleaned out in 1943 or 1944 by E. C. Burton, and a tunnel was then driven about 10 ft from the northwest wall of the cut. This tunnel exposes kaolinized plagioclase-quartz-muscovite pegmatite, but the thickness and attitude of the deposit are not known. The pegmatite contains sparsely scattered books of green mica as much as 5 in. in diameter. Most are cracked and slightly wavy or somewhat locky.

The Jones No. 2 mine, behind the Jones residence and east of the Ridgeway high school (location 6, fig. 59), was opened in the fall of 1944 by F. M. McCall, F. H. Lamb, and D. D. Dodson of Walnut Cove, N. C. The pegmatite body strikes N. 30° E. and apparently pinches out at a very shallow depth. It contains 2- to 3-in. books of green mica.

PACE MINE

The Pace mine, 1 mile west of Ridgeway, (location 7, fig. 59), is said to have been opened in 1918 by a Mr. Doyle, who excavated a shallow cut. It was reopened in 1944 by F. H. Lamb, F. M. McCall, and D. D. Dodson. At least four pegmatite bodies have been mined. Pit 1, which is 150 ft east of a house that lies at the end of a dirt road, was cleaned out in 1944 and abandoned almost immediately thereafter. It is 30 ft long, 20 ft wide, and 27 ft deep and exposes a thin pegmatite body that strikes N. 20° E. and dips 40° to 50° ESE. The pegmatite lies between gabbro and gneissic granite. The planar structure in the granite, which is beneath the pegmatite, strikes N. 30° E. and dips east-southeast, and rows of biotite flakes in the granite plunge 30°-40° NE.

The pegmatite is composed of kaolinized feldspar, small pods of quartz, and book muscovite. Locally it pinches out, and its position is marked by scattered mica books along the granite-gabbro contact. A steeply dipping 1-ft pegmatite dike strikes due east from the northeast corner of the pit. It is a medium-grained aggregate of quartz, kaolinized plagioclase, and small mica books. Other, smaller pegmatite bodies are exposed in the northwest face of the pit, where they lie along the margins of gabbro and schist inclusions in the granite. The mica in all the pegmatite bodies is flat, hard and brownish olive. Some books contain scattered specks, and many are badly ruled and fractured.

Pit 2, which is 400 ft S. 72° W. of pit 1, is 75 ft long, 30 ft wide, and 15 ft deep. Its floor is choked with debris. A 13-ft incline slopes at an angle of 35° from the north end of the cut, and a 40-ft drift extends N. 50° E. from the base of the incline. The pegmatite is an irregular sill that strikes northeast and dips 25° NW. between the hornblende gabbro of the hanging wall and the mica gneiss of the footwall. The gabbro is fine- to

medium-grained, dark greenish gray, and faintly foliated, especially near the pegmatite contact.

The deposit is 3 ft in average thickness and is indistinctly zoned. A discontinuous quartz core is flanked by quartz-plagioclase pegmatite that is coarsest along the margins of the core segments. Book mica occurs sparingly near the wall-rock contacts. It is brownish olive. Most of the books are less than 4 in. in diameter, and many are badly warped, broken, tied, and marred by inclusions of garnet.

A second, parallel pegmatite body lies 6 ft below the main deposit and is exposed in the open-cut. It appears to be a flat lens about 3 ft in maximum thickness and is bounded on its footwall side by granite.

A 27-ft shaft 40 ft north of pit 2 exposes two small pegmatite sills that strike north to northeast in granite. The upper sill is a medium-grained aggregate of feldspar, quartz, and muscovite, and the lower sill consists chiefly of quartz. Mica occurs along the margins of the lower body, as well as in minor apophyses.

LOVELACE (JOHN DOYLE) MINE

The Lovelace mine, 1½ miles southwest of Ridgeway (location 8, fig. 59), was opened in 1916 and was again worked in 1923. The main opening, a cut 90 ft long, 10 to 45 ft wide, and 20 ft deep, was excavated in a pegmatite body that trends N. 40° E. and dips about 60° NW. Small books of muscovite are scattered through the pegmatite. All are stained, and most are of scrap quality.

Smaller pits on the same property expose concentrations of stained green "A" mica. Most of the books occur with feldspar along the margins of quartz cores.

T. W. CARTER PROSPECT

The T. W. Carter prospect, about 1¾ miles southwest of Ridgeway (location 9, fig. 59), was opened in November 1943 by A. W. Newberry, who stripped the overburden from a northward-trending series of small pegmatite lenses. None of the lenses is large, and production of mica was small.

DE SHAZO MINE

The De Shazo mine is 2½ miles southwest of Ridgeway (location 17, fig. 59) and can be reached from that town over U. S. Highway 220 and Virginia Highway 689. It was first worked about 1890, when several small cuts and pits were excavated. Additional mining was done in 1918 and 1919 and intermittently thereafter by E. C. Burton, a Mr. Richardson, and others. C. R. McIver began mining in May 1943 and continued small-scale operations under the name of the Ridgeway Mica Co. until September 1944. During this period a little mining also was done near the northwest edge of the property by A. G. Owen and W. S. Harless. The deposit was sold in September 1944 to R. M. Griffiths, of Potts-

ville, Pa., and it was being worked by dragline methods in April 1945.

The most extensive of the McIver workings is an incline that slopes at an angle of 20° from the northeast face of an open-cut (pit 1) and connects with a crosscut and drift. A second incline, reported to be 40 ft long, was driven by Griffiths from a point in the cut beneath the old incline portal. The McIver incline was intersected 4 ft south of the eastward crosscut. A large east-west trench about 30 ft deep was later excavated near the bottom of the adjacent valley. Other workings in the mine area include a long north-south cut and shaft in the bottom of the valley and numerous pits, trenches, shallow shafts, and irregular cuts and stopes on both sides of the valley. The map (pl. 8) was prepared before the Griffiths operation; hence none of his workings are shown on it.

The mine area is one of relatively complex geology (pl. 8). The country rock comprises biotite schist, hornblende schist, gneissic "granite," hornblende gabbro, and diabase. Exposures are poor, and nearly all the rocks are weathered to depths of 10 ft or more. The country-rock foliation trends northeast but locally is much folded and contorted.

The hornblende gabbro, one of the predominant rock types in the vicinity of pit 1, is fine- to medium-grained and dark greenish gray. Hornblende constitutes 40 to 60 percent of the rock and appears as crystalline clots a quarter of an inch in maximum diameter and in coarse layers ½ to 2 in. thick. Much of the rock is faintly foliated. The hornblende schist is distinctly foliated, and both it and the biotite schist are cut by the gabbro and granite. The "granite," a distinctly foliated light-gray rock, is a fine- to medium-grained aggregate of plagioclase, quartz, and muscovite. It probably is a quartz diorite. The diabase dikes trend north and are nearly vertical. They appear to follow fractures that cut all the other rocks in the area, and they probably are Triassic in age.

Most of the pegmatite bodies trend northeast, but the trends of individual bodies tend to converge in the northeast end of the mine area. Pegmatite generally lies along contacts between schist and "granite," and pegmatite also occurs within the "granite" as well-defined dikes, narrow lenses, or merely small knots of feldspar and mica. Most of these pegmatite bodies appear to cross the layering and foliation in the "granite" at very small but distinct angles. Many appear to have been injected along fractures or other planes of weakness and to have formed in part by replacement of the host rock. The "granite" contains much mica immediately adjacent to such pegmatite bodies, and thin, tapering mica-rich septa commonly project into the pegmatites.

The pegmatites consist of sodic oligoclase and quartz, with minor perthite, muscovite, and garnet. The

plagioclase, which is thinly twinned and locally glassy, occurs in crystals ¼ to 8 in. in maximum dimension. Much of it contains blebs and rodlike to tabular masses of quartz in a crudely graphic arrangement. Perthite generally occurs at or near the centers of the pegmatite bodies.

Two masses of pegmatite between pit 2 and pit 4 are distinctly zoned. Cores of quartz are flanked by aggregates of medium- to coarse-grained feldspar and interstitial quartz. Offshoots from the cores cross the outer zones and extend into the adjacent country rock as quartz veins. Little zoning was apparent in the pegmatite mined in the drift beneath pit 1.

Mica appears to be concentrated in or near the central parts of the pegmatite bodies that are more than 3 ft thick. The books commonly are 3 to 8 in. in diameter and 1 to 3 in. thick. Scattered mica books as much as 6 in. in diameter also occur along the walls of the smaller pegmatite masses, and some books are isolated in the granite. The mica is dark brownish olive, hard, flat, and free splitting. Most is of very good quality. The chief defects are fractures, hair cracks, and scattered black mineral specks. Trimmed 4- by 4-in. sheets are said to have been obtained from many of the books mined in and beneath pit 1.

Almost all the mine area has been gophered so extensively that further surface exploration would be difficult. Many of the pegmatite bodies are so small that they do not warrant large-scale operations. Unmined mica-bearing pegmatite is known to occur in and near the workings of pit 1, and this appears to offer the best possibilities for future production.

PRICE MINE

The Price mine is about 3 airline miles southwest of Ridgeway (location 19, fig. 59) and can be reached from that town over 3 miles of U. S. Highway 220 and about 0.6 mile of dirt road that extends to the west (fig. 59). It was opened in July 1943 by E. C. Burton, who mined it intermittently until late in 1944. The deposit is discontinuously exposed by many small pits over a strike length of 300 ft. The main openings are a caved pit and an incline that extends down the plunge of the deposit from the pit floor (fig. 61).

The country rock is chiefly quartz-biotite schist in which the foliation strikes uniformly northeast and dips steeply southeast. Fine-grained granite is exposed along the footwall of the pegmatite in one of two closely spaced pits. The pegmatite body trends N. 60° E., dips moderately to steeply north-northwest in most places, and ranges in thickness from 3 to about 10 ft. It dips steeply south-southeast in the main pit. The keel of the dike, along which the incline was driven, plunges northeast at an angle of about 15°. It is exposed in the east end of the main pit at a depth of 21 ft.

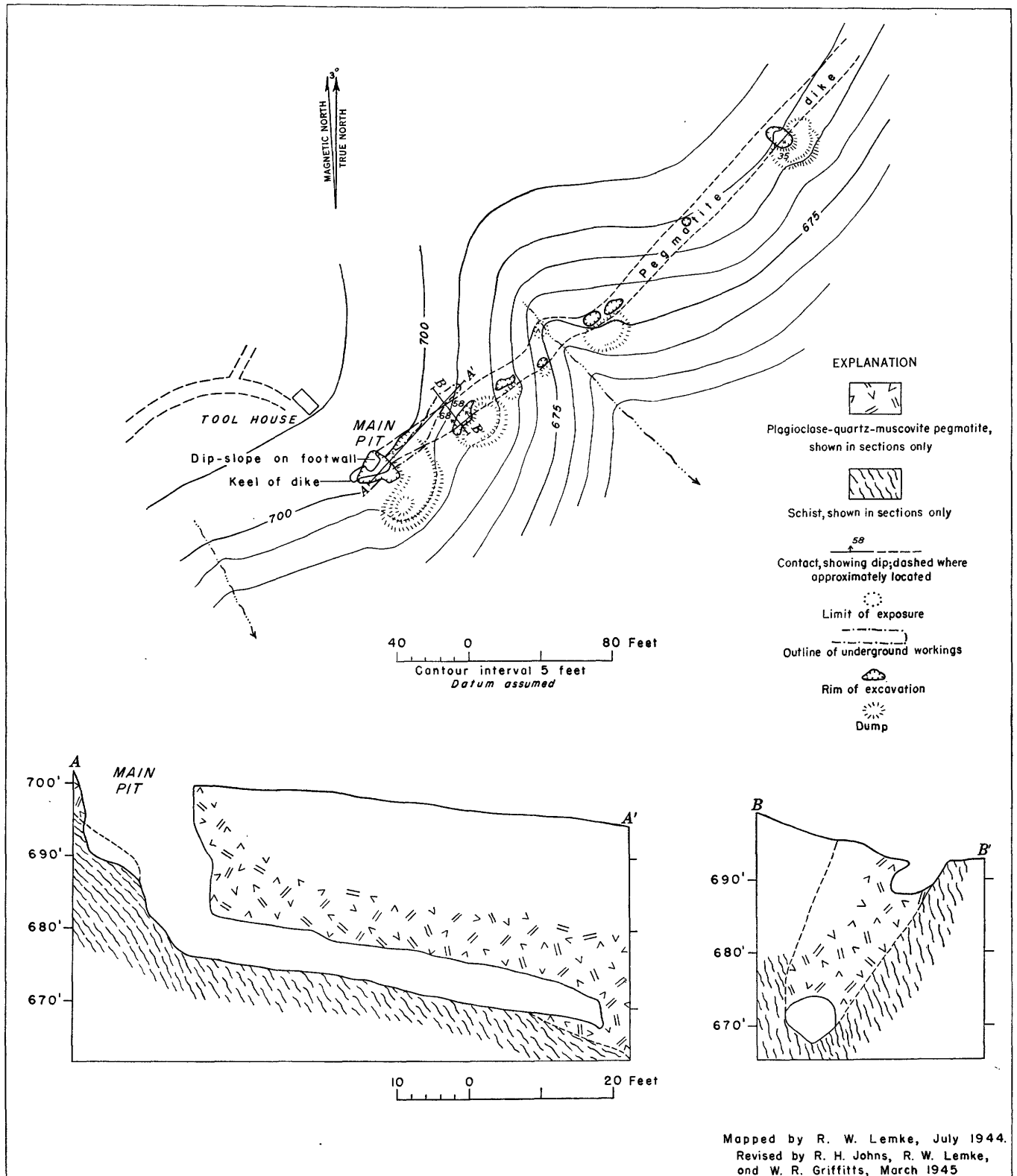


FIGURE 61.—Geologic map, plan, and sections of the Price mine, Henry County, Va.

The deposit appears to be discontinuous and irregular where it lies against granite.

Pods and irregular lenses of quartz occur in most parts of the pegmatite but are most abundant near the

middle. The remainder of the pegmatite is chiefly kaolinized plagioclase, interstitial quartz, and scattered books of mica. Some large blocks of white to flesh-colored perthite with crudely graphic intergrowths of

quartz are present in the dumps. Some of these blocks are fringed with fine-grained aggregates of quartz, mica, and plagioclase.

Book mica probably is most abundant along the keel of the dike, where the rock commonly is coarser than elsewhere. Some sheet material also was recovered from other parts of the deposit. The books are irregular in shape and are 4 to 8 in. in diameter. Some rich concentrations of smaller books in quartz (coarse burr rock) are exposed in the small workings east of the main pit. All the mica is dark brownish olive, and is flat, hard, free splitting, and little marred by ruling or clay stains. Its chief defects are fractures and black specks. The proportion of specked books appears to increase down the plunge of the deposit. Many of the books yield 4-by-4-in. trimmed sheets, but the average size is 2 by 3 in. or less.

Recent mining operations have demonstrated that the concentration of mica along the keel of the deposit is fairly uniform, and moderate quantities of mica-bearing pegmatite may well be present beyond the face of the incline. It is reported, however, that operations in the incline were abandoned because of an increasingly high proportion of heavily specked books.

EANES NO. 1 MINE

The Eanes No. 1 mine is about 2 miles south-southwest of Ridgeway (location 14, fig. 59) and is connected with that town by 1.9 miles of U. S. Highway 220 and 0.5 mile of Virginia Highway 658. It is owned by H. L. Eanes (who operated it during the spring and summer of 1944). The main opening is a partly caved cut about 35 ft long, 15 ft wide, and 27 ft deep.

The mica-bearing pegmatite is one of several subparallel bodies in decomposed quartz-biotite schist. It trends N. 55° E., dips steeply southeast, and is more than 10 ft thick. Most of the mining was done near the hanging-wall contact. The pegmatite is an aggregate of kaolinized feldspar and quartz, with scattered pods and stringers of massive quartz 1 to 2 ft long.

Book mica is moderately abundant along the hanging wall and is scattered irregularly throughout the remainder of the deposit. The average diameter of the books is about 4 in. and the maximum at least 15 in. The mica is light brown to yellowish olive, and most is marked by "A" structure. Much is fractured and clay-stained, but trimmed sheet material of excellent quality was recovered during the operations. Mining is said to have been halted because of labor shortages, low recovery of trimmed sheets from the mine-run books, and possibly some caving along the sides of the cut. Additional mica-bearing pegmatite probably remains in the deposit.

EANES NO. 2 AND GARRETT MINES

The Eanes No. 2 and Garrett mines are 1.3 miles east of a point on U. S. Highway 220 that is 1.9 miles south

of Ridgeway (location 14, fig. 59). The workings are on both sides of a dirt road a short distance south-south-east of the Eanes No. 1 mine and include several shafts, pits, and irregular cuts and stopes (fig. 62). The Eanes No. 2 mine was opened about 1904 and was subsequently worked by Gus Grindstaff, Edd Martin, and others. H. L. Eanes, the present owner, mined the deposit in 1944 and, with Albert Knight, during the spring of 1945. Moderately large quantities of trimmed punch and sheet mica were recovered.

The 30-ft Garrett shaft was sunk in partly pegmatitized schist by Knight early in 1944, but it was abandoned when no mica-bearing pegmatite was encountered. Two open-cuts were dug west and north-west of the shaft in the spring of 1944. The main Eanes workings, on the west side of the road, are two elongate open-cuts with appended small stopes and irregular drifts. Most of the underground openings are caved.

The country rock is a thinly foliated muscovite-biotite schist with local hornblende layers as much as a foot thick. Many tiny, pale-lavender grains of garnet occur in the schist near some of the pegmatite masses, where they locally are accompanied by needles of black tourmaline. The foliation is much contorted, and locally the country rock is impregnated with abundant feldspar and quartz. All the schist contains knots and stringers of granite and pegmatite.

At least four irregular pegmatite lenses have been mined. One of these, exposed in March 1945, trends west and dips 50° S. A second, which is a short distance to the north, trends west-northwest but swings southeast near its east end. Its southerly wall dips north, and the other wall appears to be vertical. A third lens of mica-bearing pegmatite, exposed in the incline in September 1944, trends N. 35° W. and dips 50° SW. Two other pegmatite bodies in the incline apparently contain little mica. The fourth mica-bearing lens was mined in the Martin pit (fig. 62). Some of the pegmatite exposed in the different workings may be parts of the same irregular body, but few correlations between openings can be made.

The pegmatite lenses are 2 to 6 ft thick, and some may be less than 50 ft long. They tend to be concordant but locally transect the foliation of the enclosing schist. The pegmatite is a medium-grained aggregate of plagioclase, quartz, muscovite, and minor sericite. Zoning is not distinct, and the book mica appears to be scattered from wall to wall in each deposit. The muscovite is clear and is pinkish buff to cinnamon brown. Some of the books are 5 in. or more in diameter, but many are cracked and slightly warped. Substantial quantities of mica might be recovered by further gopher holing in the deposit, but the small size of the mica-bearing pegmatite bodies would make any large-scale operations very difficult, unless the lenses that were

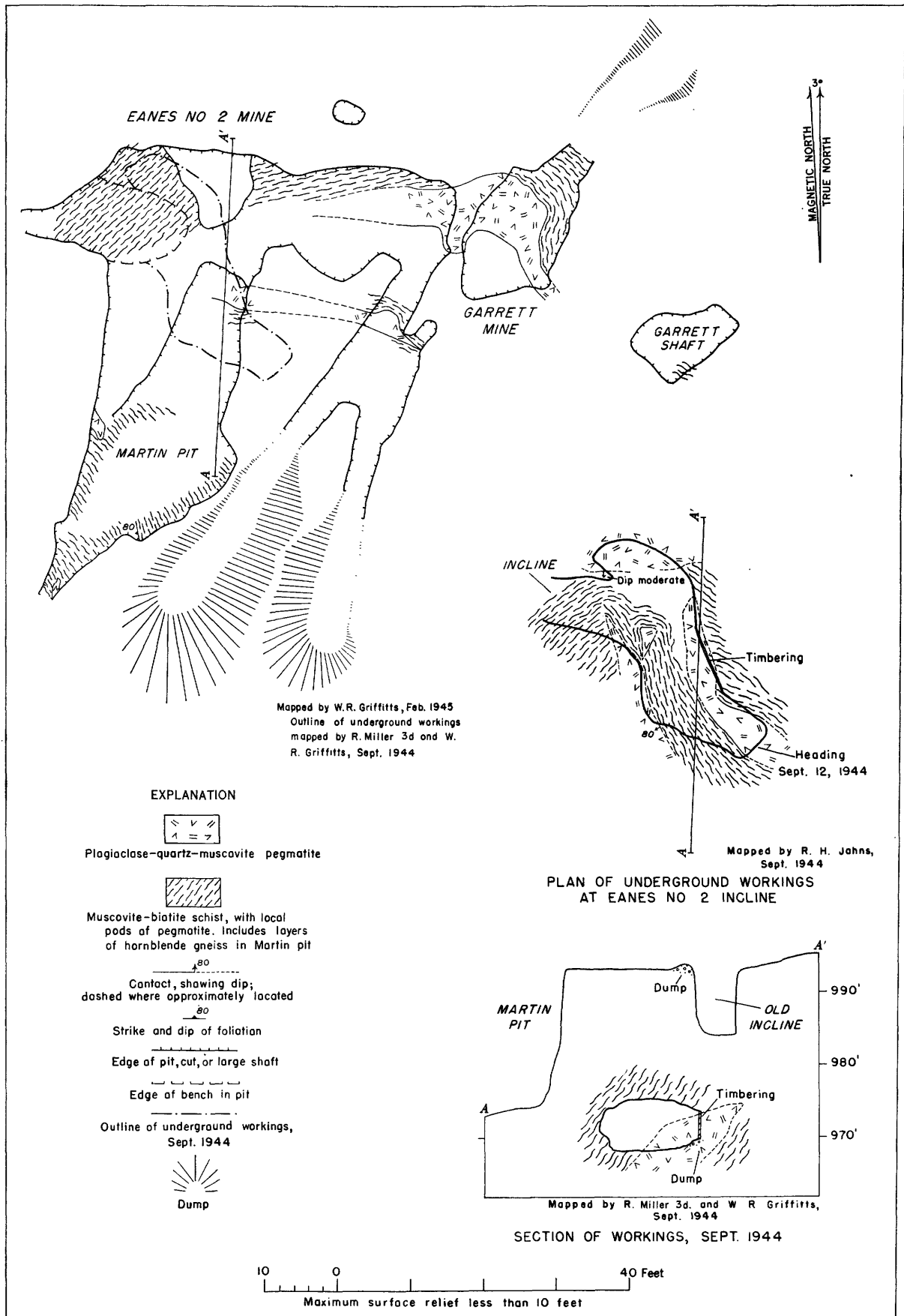


FIGURE 62.—Geologic maps, plan, and section of the Eanes No. 2 and Garrett mines, Henry County, Va.

mined were only a part of a much more extensive series of closely spaced lenses in the schist.

COLEMAN NO. 1 AND NO. 2 MINES

The Coleman mines are about 6 miles west-southwest of Ridgeway (location 20, fig. 59) and can be reached from that town over U. S. Highway 220 and Virginia Highways 692 and 691. The No. 1 workings are on a broad ridge, and the No. 2 mine is near the bottom of a small, steep-sided valley about 500 ft to the northeast (pl. 9). The property was first prospected in 1913 by Dewey Callam, who excavated a pit about 20 ft deep and drove a 200-ft drainage tunnel. The mines were reopened in 1920 by Gus Grindstaff. At the No. 1 he excavated a cut 70 ft long, 30 ft wide, and 15 ft deep, sank a 45-ft shaft, and drove a drift 30 ft to the south.

The No. 1 mine was reopened and worked by E. J. Tyler, of Asheville, N. C., from January to July 1944. A steeply inclined 56-ft shaft was sunk from a point near the east corner of the cut (pl. 8), and an irregular 65-ft drift was driven to the southeast. Large quantities of trimmed punch and sheet mica were obtained as a result of these operations. In 1943 Tyler briefly explored the No. 2 deposit. He drove a 40-ft incline northeast from the open-cut but recovered little mica of good quality.

The country rock, a distinctly foliated quartz-biotite schist, is locally much contorted. In general the foliation strikes west and dips moderately to steeply north. Many granitic sills 6 in. to at least 20 ft thick occur in the schist. They are rich in muscovite and are sugary, fine- to medium-grained, and distinctly foliated parallel with their walls. Small irregular pods and stringers of mica-bearing pegmatite occur in the gneissic granite and are most abundant along certain horizons. Most strike west and dip moderately to very steeply north.

Much of the pegmatite is composed of medium-grained feldspar, quartz, and small books and flakes of mica. Both perthite and oligoclase (Ab_{86}) are present, but the perthite is distinctly more abundant. The mica generally occurs with quartz and is most abundant near the walls of the pegmatite bodies. Some of the lenses are marked by 1-in. border zones of fine-grained plagioclase-quartz pegmatite in which rods and spindles of quartz lie normal to the contacts, whereas others contain quartz-rich border zones that reach thicknesses of 3 in. or more.

The largest mica books occur in oligoclase-rich parts of the deposits. The books are without distinct crystal form and commonly range from 4 to 12 in. in diameter and 3 to 6 in. in thickness. The mica is brownish olive, flat, free splitting, and little marred by ruling or clay stains. Some is severely fractured, and some contains black specks. Most of the specks can be eliminated by careful rifling and trimming. During the recent operations many 6-by-8-in. trimmed sheets were recovered, but the average size was 2 by 3 in. or less.

The No. 1 mine was abandoned because the main pegmatite body was found to pinch out near the southeast end of the drift. The last 10 ft of the drift was driven in schist. Mica-bearing pegmatite is exposed almost continuously along the southwest side of the drift, however, and some sheet-mica-bearing pegmatite may well be present in this direction. Mica-bearing pegmatite also was encountered in a short drift driven westward from the Tyler shaft at the 43-ft level. The east heading in the No. 2 mine contains little mica-bearing pegmatite. Moreover, much of the mica is marred by numerous black specks.

Several pegmatite lenses in an outcrop of gneissic granite 250 ft northeast of the No. 2 mine contain mica books 4 in. across, but nearly all the sheets are heavily specked. Exposures and float blocks of mica-bearing pegmatite are abundant on the west slope of the valley between the two mines.

OTHER DEPOSITS

The descriptions of the following eight deposits are based chiefly upon the data of Pegau (1932):

Oliver deposit.—Mica-bearing pegmatite crops out on the J. W. Oliver property, north of the Eanes mines and on the east side of U. S. Highway 220 (location 10, fig. 59). Some of the mica is flat and clear, and some is reeved and moderately to heavily specked. One 8-by-10-in. book has been reported, but the average diameter is said to be about 3 in. Most of the pegmatite bodies are very irregular lenses.

Garrett No. 1 prospect.—The Garrett prospect, about 2 miles S. 30° W. of Ridgeway and a short distance north of Matrimony Creek (location 14, fig. 59), exposes a sill-like mass of pegmatite that is enclosed by biotite-rich schist. The deposit is a medium- to coarse-grained aggregate of plagioclase, quartz, perthite, and scattered book mica, and it contains a large but discontinuous core of massive quartz. Some of the mica is severely reeved, and some is badly broken.

Garrett No. 2 prospect.—An incline and several short, irregular drifts on the east side of the lane a short distance southeast of the Eanes No. 2 mine are known as the Garrett No. 2 prospect (location 14, fig. 59). These workings expose pegmatite that consists of kaolinized plagioclase, quartz, fresh to partly kaolinized perthite, and a very little muscovite. The perthite occurs as scattered gray to pinkish blocks. The country rock is quartz-biotite schist.

Grindstaff mine.—The Grindstaff mine, about 2 miles south-southwest of Ridgeway and near the Eanes No. 2 mine (location 13, fig. 59), consists of shafts and tunnels in partly weathered pegmatite. The deposit trends north-northeast and is flanked on the west by schistose gabbro and on the east by mica schist and gneiss. It is a medium- to coarse-grained aggregate of perthite, quartz, plagioclase, and muscovite. The book mica

yields 4-by-6-in. sheets. The output of the mine is said to comprise much mica and several carloads of feldspar.

Garrett Spar mine.—The Garrett Spar mine (location 12, fig. 59), an eighth of a mile north-northeast of the Grindstaff mine, may be in the same series of pegmatite lenses. The deposit is 30 ft thick and is thoroughly kaolinized to a depth of 20 ft. It is enclosed by hornblende gabbro and biotite-rich schist. Much of the feldspar is coarse, blocky perthite, which is associated with pods and stringers of massive quartz. Both feldspar and mica have been shipped from the mine.

Garrett-Penn mine.—The Garrett-Penn mine (location 11, fig. 59), about a mile south-southwest of Ridgeway and three-quarters of a mile southeast of U. S. Highway 220, is on a northern branch of Matrimony Creek. Feldspar and mica were obtained in several irregular cuts, pits, and shafts. The pegmatite, like that in the Grindstaff and Garrett Spar mines, is flanked on the west by hornblende gabbro and on the east by mica gneiss. It is a medium- to coarse-grained aggregate of perthite, quartz, plagioclase, and mica, and in its central parts it contains large blocks of the potash feldspar.

Oliver prospects.—Much prospecting was done during the period 1905–10 on the Oliver property, 2½ miles south-southwest of Ridgeway and 1 mile southeast of U. S. Highway 220 (location 15, fig. 59). Most of the old pits, trenches, and cuts lie south of Matrimony Creek, near the North Carolina State line. The pegmatite dikes are subparallel and trend north-northeast to northeast. Most consist of kaolinized plagioclase with interstitial quartz, minor perthite, and scattered books of muscovite. Some of the mica is in moderately large books and is of good quality.

Phillips mine.—The workings of the Phillips mine, an elongate open-cut and a tunnel, are near the North Carolina State line, 2½ miles south of Ridgeway and 1½ miles southeast of U. S. Highway 220 (location 16, fig. 59). The deposit was last worked in the summer of 1928. It is 50 ft wide at the center of the workings but narrows along the strike to 20 ft. It trends east-northeast and has been exposed for a strike length of 450 ft. The pegmatite is an aggregate of kaolinized feldspar, quartz, and muscovite. Several carloads of scrap mica were recovered from the soft, decomposed rock.

The following description is based upon the data of Sterrett (1923):

H. A. Knight prospect.—Several mica deposits were prospected between 1905 and 1910 on the H. A. Knight property, 250 yd east of Ridgeway station on the Norfolk and Western Railway. Several pits and cuts expose pegmatite bodies that trend N. 25° E. and dip moderately to steeply east-southeast. They are enclosed by biotite-rich schist, schistose gabbro, and gneissic pegmatitic granite. Books of clear mica 6 to 8 in. in diameter were encountered during the prospecting.

The following eight descriptions are based on data obtained from the Colonial Mica Corporation:

Clingingpeel (Old Pittsburgh, Old Mica Farm) mine.—The Clingingpeel mine is in a wooded area east of U. S. Highway 220 and about 1½ miles north of Ridgeway. It was worked by the Pittsburgh Mica Co. prior to 1910, chiefly by open-cut methods, and was reopened in 1943 by the Keystone Mica Co., of Stoneville, N. C. Green mica books occur in feldspathic pegmatite along a thick quartz core. Many of the books are wavy and locky, and some are stained.

Cole Compton prospects.—A prospect on the Cole Compton property, near a poor dirt road 400 ft west of U. S. Highway 220 and 1 mile north of Ridgeway, was opened in 1943 by E. C. Burton and Edd Martin. The pegmatite body, which strikes northeast, contains mica books as much as 10 in. in diameter. Most are badly broken.

Curtis Knight prospect.—A prospect three-quarters of a mile northwest of Ridgeway was opened by Curtis Knight in the summer of 1944. The pegmatite dike strikes nearly north. It is about 2 ft thick at the surface but pinches out at a depth of 10 ft in the prospect opening. The mica books are fairly large.

Hundley prospect.—A prospect on the J. E. Hundley property, 7 miles southwest of Ridgeway, was opened in 1943 by Hundley and Sanford A. Roberts. The pegmatite body strikes nearly north and dips 57° W. The dumps from the prospect openings contain abundant small books of clear mica.

W. M. Carpenter prospect.—The Carpenter prospect is east of U. S. Highway 220 and an eighth of a mile north of Ridgeway station on the Norfolk and Western Railway. Several pits expose a vertical pegmatite body that strikes N. 10° W. and is about 15 ft thick. It is unweathered and contains small books of greenish mica, some of which would yield punch material.

Shropshire prospect.—A mica deposit near a creek and 350 ft from the Shropshire filling station in Ridgeway was opened by J. H. Martin and W. E. Land in 1944 (location 5, fig. 59). The pegmatite body, which is at least 10 ft thick and 500 ft long, strikes nearly north and dips 5° E. It contains abundant clear, pale-green mica, but the books are soft, ruled, and broken. Some are locky. The recovery of sheet material from the books is very low.

Frazier deposits.—Several pegmatite dikes are exposed on the G. U. Frazier property, east of Virginia Highway 639 and three-quarters of a mile by road north-northwest of the Shropshire filling station in Ridgeway (location 4, fig. 59). The dikes, which strike N. 35° E. and dip 35° to 45° NW. on a hill slope, are 6 in. to 15 ft thick. They contain small books of greenish mica that is chiefly scrap.

R. L. Harris prospect.—Several prospect openings on the R. L. Harris property, north of Virginia High-

way 687 and 0.7 mile northwest of Ridgeway (location 2, fig. 59), expose pegmatite bodies that strike northeast and dip northwest. Both clear and specked mica books are sparsely scattered through hard, unweathered feldspathic pegmatite. A few large books are exposed in a 40- to 50-ft incline that was driven by a Captain McCraw prior to 1913. This opening slopes 50° NW.

ROCKINGHAM COUNTY, N. C.

HOLLAND MINE

The Holland mine, south of a county road 3¾ miles N. 13° W. of Stoneville (location 25, fig. 59), was opened many years ago and was last worked in 1944 by C. P. Robertson and by J. L. Craddock, the tenant on the J. A. Holland farm. Several pits about a hundred feet from the road expose a pegmatite body at least 20 ft thick and several hundred feet long. No country rock is exposed in or near the workings.

The pegmatite consists of kaolinized plagioclase, perthite, quartz, and muscovite. Several masses of quartz are as much as 5 ft in diameter, but the other minerals are distributed rather evenly through the remainder of the pegmatite body. Greenish books of flat-A mica are scattered through the feldspathic units.

Float mica books of fair size and quality are reported to be present on the Martin property, about a quarter of a mile northwest of the Holland mine.

ERNEST SMITH MINES

Two mines on the Ernest Smith property, 5½ miles N. 27° W. of Stoneville (location 27, fig. 59), were first worked about 1900 and were reopened by E. C. Burton in 1944. One mine, near a tobacco barn, consists of several open-cuts, pits, and caved shafts. The other, in a field about 1,000 ft to the north, consists of a shaft and a drift at the 30-ft level. Mica-bearing pegmatite also is exposed in several small prospect pits elsewhere on the farm.

Both deposits are composed of plagioclase, perthite, quartz, and brown muscovite. The mica is flat and splits freely, but much is stained. The mine near the barn appears to have yielded a higher proportion of clear sheet mica than any of the other openings on the property. The deposit in the field may well contain moderate quantities of unmined pegmatite beneath the water level, or beyond a depth of about 30 ft.

LONG TOM SMITH (W. T. SMITH) MINE

The Long Tom Smith mine is about 6 miles southwest of Ridgeway, Va., and can be reached from that town over U. S. Highway 220, Virginia Highways 692 and 691, and a mile of ungraded dirt road (location 26, fig. 59). The deposit was opened about 1895 by Randolph Smith, who sank pits 3 and 4 (fig. 63). A little exploratory work was done in pit 1 by C. P. Robertson in 1943, in pit 2 by W. T. Smith in the summer of 1944, and again in pit 2 by H. A. Knight, Jr., in the fall of 1944.

Pit 1 is flooded but is said to be 15 ft deep and to connect with a 20-ft incline that slopes eastward down the dip of the pegmatite body. Pit 2 is about 20 ft deep, and the other openings are caved and slumped.

The country rock is biotite schist and gneiss in which a distinct foliation strikes nearly north and dips about 45° E. The rock is deeply weathered, and exposures are poor. The northeastern pegmatite sill, about 20 ft in outcrop breadth, is complicated by irregular apophyses and many inclusions of schist. It is not clearly zoned. Both perthite and plagioclase are present. The plagioclase is thoroughly kaolinized to a depth of 20 ft, but much of the potash feldspar is hard and unweathered. Other minerals include interstitial colorless to smoky quartz, muscovite, and garnet.

Mica is moderately abundant throughout the pegmatite, but the richest concentrations appear to lie along and near the walls, particularly the footwall. The mica books are irregular and without distinct crystal form. They are 4 to 10 in. in diameter and 2 to 6 in. thick. Most consist of light-green flat-A material. They are moderately hard, free splitting, and little marred by ruling, but some books are severely warped and buckled and most contain abundant black specks. The flat parts of many books yield trimmed sheets 2 by 2 in. in average size.

Present exposures do not indicate large reserves of pegmatite that contains coarse books, but many small mica books may remain. The last operations indicated a fairly rich mica concentration in pit 2, and additional stained mica might well be obtained from this part of the deposit.

ROSA EVANS MINE

The Rosa Evans mine is on a moderately steep northeast slope 3 miles S. 55° W. of Price (location 28, fig. 59) and can be reached from that town over 3.1 miles of all-weather road and a mile of ungraded dirt road. The deposit is owned by Rosa Evans, of Price, and was first worked in 1917, when the openings above the Lower Knight pit (pl. 10) were excavated. It was operated on a much larger scale during the summer and fall of 1943 by C. P. Robertson, of Stoneville, and throughout 1944 by H. A. Knight, Jr., of High Point. Production from the Knight operations was moderately large.

The country rock exposed in the mine workings is a thinly foliated quartz-biotite schist that contains many sills and stringers of schistose, fine-grained granite. The foliation trends west to northwest and dips north to northeast at low to moderate angles. The main pegmatite is a sill-like body that is 8 to at least 20 ft thick. Above its hanging wall and separated from it by 1 to 6 ft. of schist is a prominent and continuous 2- to 5-ft layer of sheared granite. The surface trace of the pegmatite trends slightly north of east, and its dip is a little steeper than the slope of the hillside. Its outcrop breadth ranges from about 30 to nearly 80 ft,

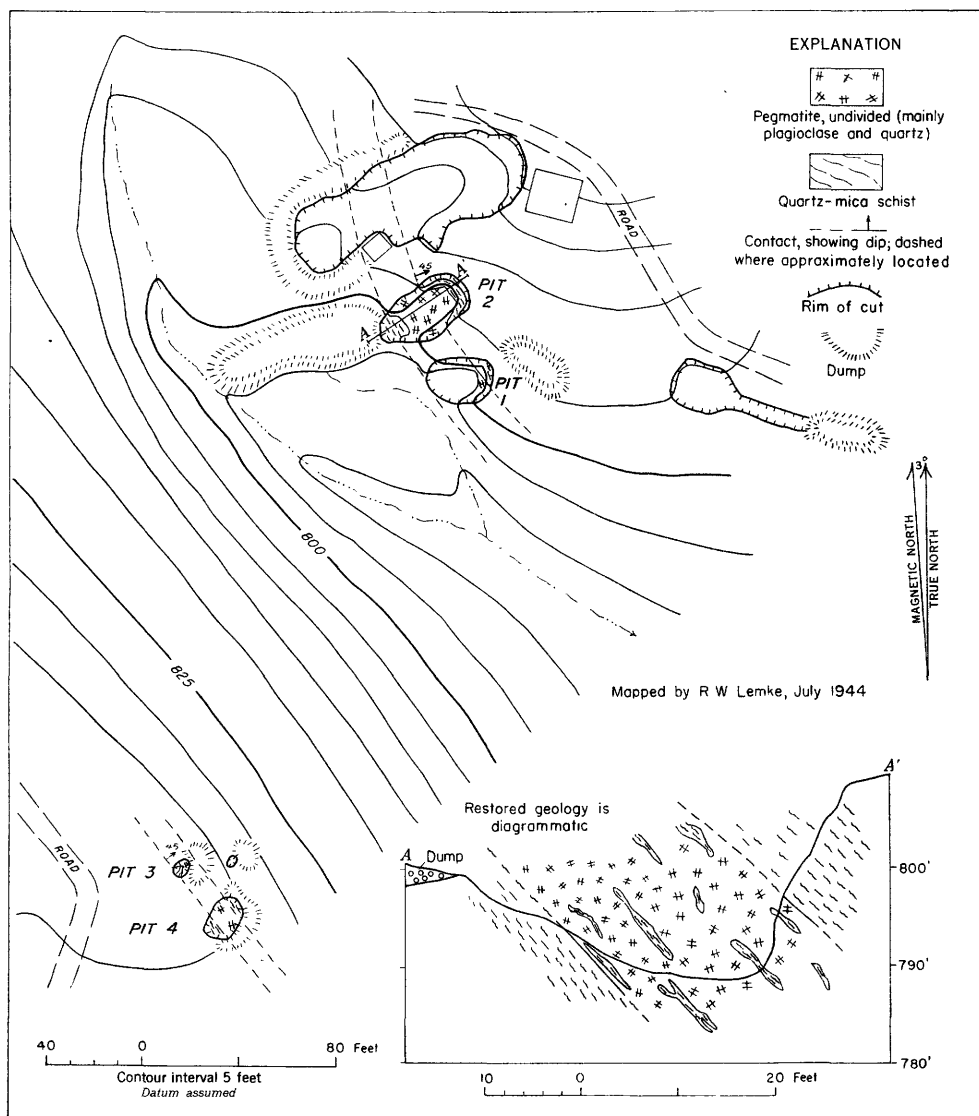


FIGURE 63.—Geologic map and section of the Long Tom Smith mine, Rockingham County, N. C.

and it can be traced along the strike for a distance of at least 400 ft.

The irregular old workings, which are now caved, appear to have been in the footwall part of the deposit. Robertson drove an adit to the hanging wall from a point lower on the slope and mined out a rich concentration of mica. Inclined raises that were driven west and south encountered the old workings, which were then robbed wherever they had not already caved. A second tunnel, driven south-southeast from a point west of the Robertson adit, exposes the hanging wall of the pegmatite a few feet beneath the surface, but little mica is present. The Lower Knight pit, which was excavated early in 1944, encountered both the Robertson workings and the older workings. A drift and irregular incline were extended west and northwest from the pit in the footwall portion of the deposit, but relatively little mica was obtained. A small but rich pocket was mined out in a short raise that was extended

southward from the drift during August and September 1944.

The Upper Knight pit, which is 40 ft long and 25 ft wide, was sunk in one of the thickest parts of the deposit. Its maximum depth was 30 ft, but its floor is now covered with backfill. Substantial quantities of mica were obtained, especially from a discontinuous concentration along and near the hanging wall of the sill. From a point near the southeast corner of the pit a series of shallow gopher-hole workings extends east and southeast. A second, probably smaller pegmatite sill is exposed in old workings 60 ft south-southeast of the Lower Knight pit. It appears to dip beneath the main sill.

Most of the pegmatite is a medium-grained aggregate of plagioclase (probably oligoclase), quartz, and muscovite. Perthite occurs locally in its central part. The rock is much coarser immediately beneath the hanging wall than elsewhere in the deposit. A few lenses of

quartz are exposed in the Lower Knight workings. Spessartite is present as individual small crystals and as sugary crystalline aggregates. Fine-grained yellowish-green muscovite and dark smoky quartz occur as fracture fillings in the Upper Knight pit.

Most of the mica is yellowish to brownish olive, but some books are brown to cinnamon brown. The mineral is hard, but much of it is marred by breaks, reeves, ruling, and hair cracks. "A" structure is not common, but nearly all the sheets are rippled to broadly wavy. A curdy green primary vegetable stain is widespread. The average size of the books is 3 by 4 in., and many are 6 by 8 in. or larger. The mine-run material is said to have yielded 4 to 7 percent trimmed punch and sheet mica, almost none of which was of no. 1 quality.

The hanging-wall mica concentrations appear to be richer and more continuous than those near the footwall of the sill. Moreover, the footwall mica tends to occur as much smaller books. Down-dip continuations of the hanging-wall mica shoots could be worked with relatively little difficulty by stripping the thin cover of thoroughly weathered country rock down to the level of the nearby stream. Parts of the deposit farther down dip could be worked by underground methods.

SHORT TOM SMITH (BEN SMITH) MINE

The Short Tom Smith mine is on the south side of the Price-Sandy Ridge road, approximately $3\frac{1}{4}$ miles west-southwest of Price (location 29, fig. 59). It is owned by T. W. Smith, whose residence is near the mine workings. The deposit was opened in 1918 by J. E. Burleson, of Spruce Pine, who is reported to have taken out 168,000 lb of "A" mica. Richard Fortner and his sons were in charge of the mining. The Keystone Mica Co., of Stoneville, reopened the mine in 1942 and obtained about 80,000 lb of mica under the direction of C. P. Robertson. No further work was done until early in 1944, when Benjamin D. Smith, son of the owner, reopened the central part of the deposit. In August 1944 the property was leased to the Joseph E. Bird Co., and a large cut was excavated with heavy earth-moving equipment. The mine was abandoned in November 1944.

The deposit was prospected and mined by means of five open-cuts; at least five shafts, with irregular stopes and drifts; and numerous small pits (fig. 64). From west to east, the main workings included the 16-ft Smith No. 1 shaft; the West End pit with appended short tunnels; the 25-ft Keystone No. 1 shaft; the 50-ft Keystone No. 2 shaft; the Copperhead cut and extensive shallow, irregular underground workings; the old Fortner shaft; the Shear Zone incline; and several irregular pits. Most of the early production was obtained from underground workings reached from the Fortner shaft, Copperhead cut, and Keystone No. 2 shaft. The Smith No. 2 shaft was sunk in 1944 in an

attempt to reach the pegmatite down dip from these old workings but never was completed. Much of the recent output from the deposit was obtained in the Shear Zone incline. Most of the old workings were partly or wholly obliterated during the excavation of the Bird cut, which is nearly 600 ft long, 90 ft wide, and 22 ft in maximum depth (fig. 65). Timbers from at least two of the old shafts are visible in the bottom of this cut. A second cut, 110 ft long, 40 ft wide, and 20 ft deep, was excavated near the east end of the deposit.

The country rock is thinly foliated biotite-muscovite schist with minor interlayered hornblende gneiss. Several sills of gneissic hornblende gabbro also are present. The country-rock foliation strikes N. 45° to 75° W. and dips 30° to 65° NE. to NNE. Sills of gneissic granite, which is locally schistose, are abundant in the west end of the Bird cut and in a ramp that extends south from the east end of the smaller cut. A large sill or a series of closely spaced small sills lies about 10 ft beneath the pegmatite. The schist is cut by small, highly contorted dikes of sugary, fine-grained muscovite granite (fig. 2, chapter A of this series). The foliation in both the concordant and discordant bodies of granite is parallel with the structure of the enclosing schist. Both the pegmatite and the wall rocks are cut by diabase dikes that range in thickness from 1 to more than 25 ft. Most strike northwest and dip moderately to steeply northeast, and others strike north and are nearly vertical. All the rocks are thoroughly weathered to the maximum depth of mining, and only a few small nodules of diabase, together with the quartz and perthite of the pegmatite, remain hard.

The mica occurs in a large, irregular pegmatite sill that can be traced along the strike for at least 700 ft. It swells to a thickness of 25 ft near the east end of the Bird cut, thins eastward to about 5 ft, and bulges again to thicknesses of 15 to 20 ft near the east edge of the mine area. The deposit strikes west-northwest and dips 35° to 70° NNE. Its dip appears to be gentlest where the pegmatite is thickest.

The pegmatite minerals include medium- to coarse-grained kaolinized plagioclase, quartz, perthite, green "A" mica, and accessory garnet. Zoning is not prominent except in the thickest parts of the sill, where several 3-in. to 4-ft platy lenses of quartz form a discontinuous core. Much of the pegmatite exposed near the east end of the Bird cut consists of alternating thin layers of quartz- and feldspar-rich pegmatite. This sheeted structure appears to be the result of shearing, at least part of which occurred after consolidation of the pegmatite. Spessartite occurs as isolated small crystals and as crystalline aggregates half an inch or more in diameter. Some flattened crystals are embedded in the mica books. Seams of late-stage smoky quartz and fine-grained, yellowish-green muscovite fill

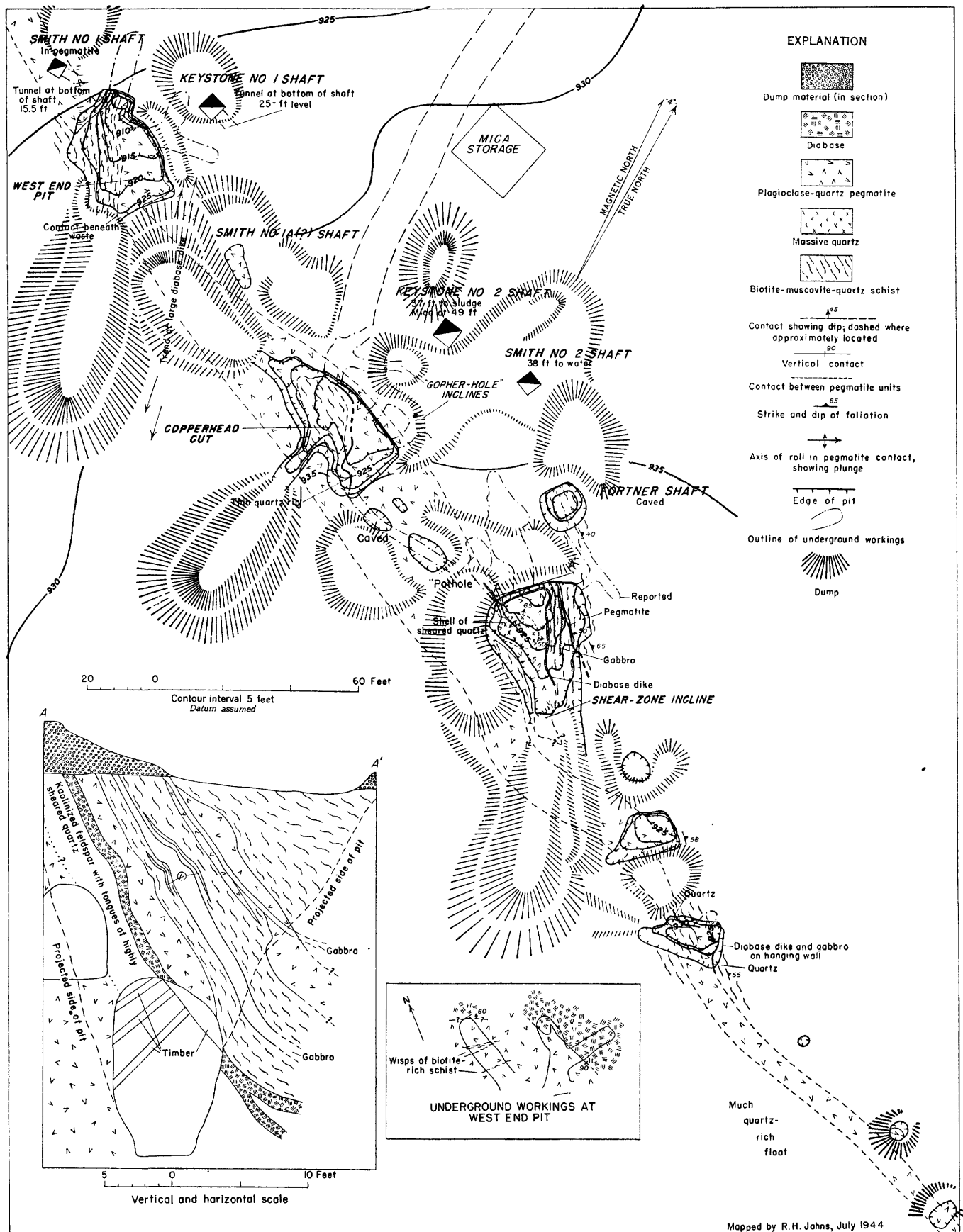


FIGURE 64.—Geologic map, plans, and section of the old workings, Short Tom Smith mine, Rockingham County, N. C.

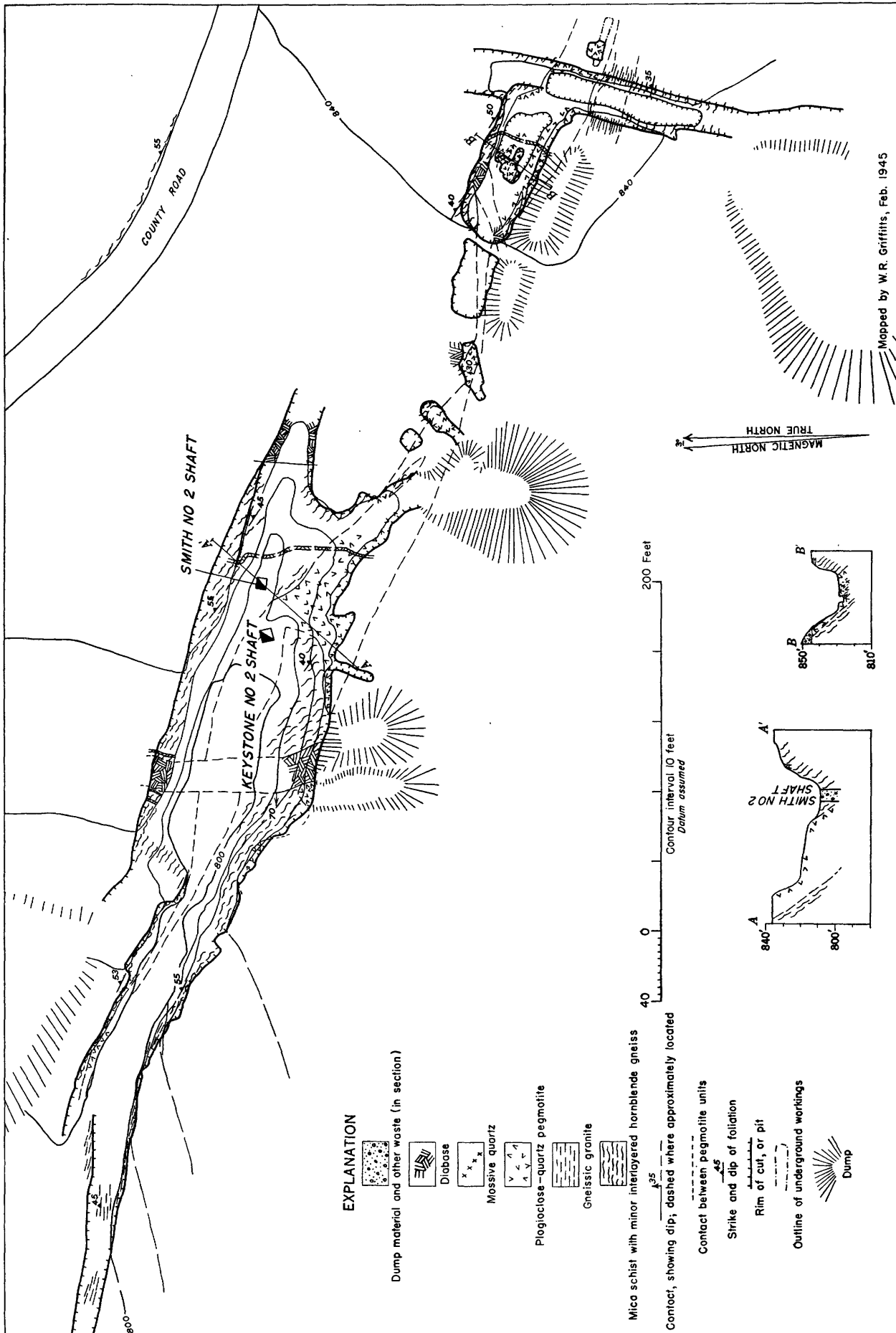


FIGURE 65.—Geologic map and sections of the Bird workings, Short Tom Smith mine, Rockingham County, N. C.

fractures in the pegmatite, especially in the vicinity of the West End pit and Shear Zone incline.

Nearly all the mica in the deposit is light to dark yellowish olive and is strongly marked by "A" structure. Many of the books are soft and broken, and most of those in or near shear zones are severely ruled. Some of the mica is lumpy, much contains flattened inclusions of garnet, and a little is marred by mineral spots. The richest concentrations of books were encountered in the thickest parts of the sill, particularly in the middle and near the hanging wall. Many 10-by-15 in. books have been obtained, but the average size is about 5 by 6 in. Wedge and herringbone structure force immediate rejection of most of the mica as mine scrap, but a few books from the exceptionally rich concentrations found in parts of the deposit yield sheet material. The mica books obtained above the 27-ft level in the Bird cut are said to have yielded 0.8 percent trimmed sheets, whereas those obtained in the lower parts of the cut yielded 3.0 percent trimmed sheets. The recovery of sheet mica from flat-A books in the Shear Zone incline during 1944 ranged from 0.5 percent to 2.0 percent. Nearly all the mica produced during World War II was classed as no. 2 and no. 2 inferior.

A small test pit on the adjacent property, east of the mapped area, exposes pegmatite exceptionally rich in flat-A and wedge-A mica. Book mica constituted 65 percent of the mined rock, but a test lot yielded only 0.3 percent trimmed sheets after the extraction of obvious scrap amounting to 70 percent of the lot.

KNIGHT MINE

The Knight mine, from which very large quantities of trimmed punch and sheet mica were obtained during World War II, was opened in July 1943 by H. A. Knight, Jr., of High Point. It lies about 3 miles west of Price and about 6 miles southwest of Ridgeway, Va., and can be reached from Ridgeway over U. S. Highway 220, Virginia Highways 692 and 691, and 0.5 mile of ungraded dirt road (location 30, fig. 59). The main surface opening is a cut, triangular in plan, that is about 45 ft in maximum depth. It gives access to an incline and irregular drifts and low stopes (fig. 66). By the end of 1943, this cut was 80 ft long, 30 ft wide, and about 20 ft in maximum depth. From its face the main incline was driven 110 ft down the dip of the pegmatite, and branches were extended to the north, east, and southeast. The incline was connected with the surface by means of an air shaft. During the later stages of operations the overburden was removed from the upper half of the incline, and the original cut thus was considerably enlarged in a northeasterly direction.

The country rock is a fine-grained biotite-quartz schist in which the foliation trends north-northwest and dips 25° to 40° E. The pegmatite body is a pinching and swelling sill that ranges from 2 to 5 ft in thickness near

the surface to as much as 15 ft in some of the lower mine workings. It is known to continue down the dip for at least 120 ft from its outcrop and along the strike for at least 100 ft (fig. 67). Most of the workings expose the footwall contact; the hanging wall was intersected underground only in the air shaft and at a few places on both sides of the incline. The sill splits northwest of the incline into two prongs, 1 to 5 ft thick, that are separated by 6 in. to 4 ft of schist. The lower prong pinches out along the wall of the open-cut. Near the present portal of the incline a sinuous branch pegmatite 6 in. to 2 ft thick extends from the hanging wall of the deposit to the surface (fig. 6, chapter A of this report). Many other apophyses extend from the hanging wall of the sill for distances of 2 to 10 ft and then bend to conform with the foliation of the enclosing schist.

The sill contains a discontinuous core of massive quartz that forms lenses 3 in. to 8 ft thick. An intermediate zone rich in perthite blocks as much as 18 in. in diameter is best developed in the thickest parts of the deposit where the core generally is not present. Elsewhere the pegmatite is relatively rich in perthite in its central parts, but there is no sharp contact between perthite rich and perthite-free rock. The wall zone is a medium- to coarse-grained aggregate of white to cream-colored oligoclase, clear to slightly smoky quartz, and muscovite. Large mica books are scattered throughout this zone but are most abundant near its margins, particularly near the footwall of the deposit. A thin, discontinuous border zone contains platy to rodlike grains of quartz that are nearly normal to the wall-rock contact and are embedded in a fine-grained matrix of plagioclase and quartz.

Accessory minerals include spessartite, uraninite, autunite, uranophane(?), other secondary uranium minerals, and allanite(?). Most of the uranium minerals form yellow to orange stains on fracture surfaces and in cleavage cracks in coarse perthite. All the zones are cut by ¼- to 4-in. veins of quartz, plagioclase, and yellowish-green mica. Most of the mica flakes are concentrated near the centers of these feldspathic veins and, where accompanied by quartz, form corelike burr-rock units.

Muscovite books are abundant in the wall zone, especially in a shoot about 40 to 50 ft wide that trends east-northeast (fig. 66). Within this shoot the books are exceptionally abundant near the footwall of the sill, are somewhat less abundant near the hanging wall, and are scattered throughout the inner part of the wall zone. Relatively few books occur in the inner units. The books are 1 to 10 in. thick and 3 to 22 in. in diameter, with probable respective averages of 3 and 10 in. The mica is light to dark brownish olive. Most is flat and free splitting. In general it is little broken by ruling, crenulations, or cracks, although a few books

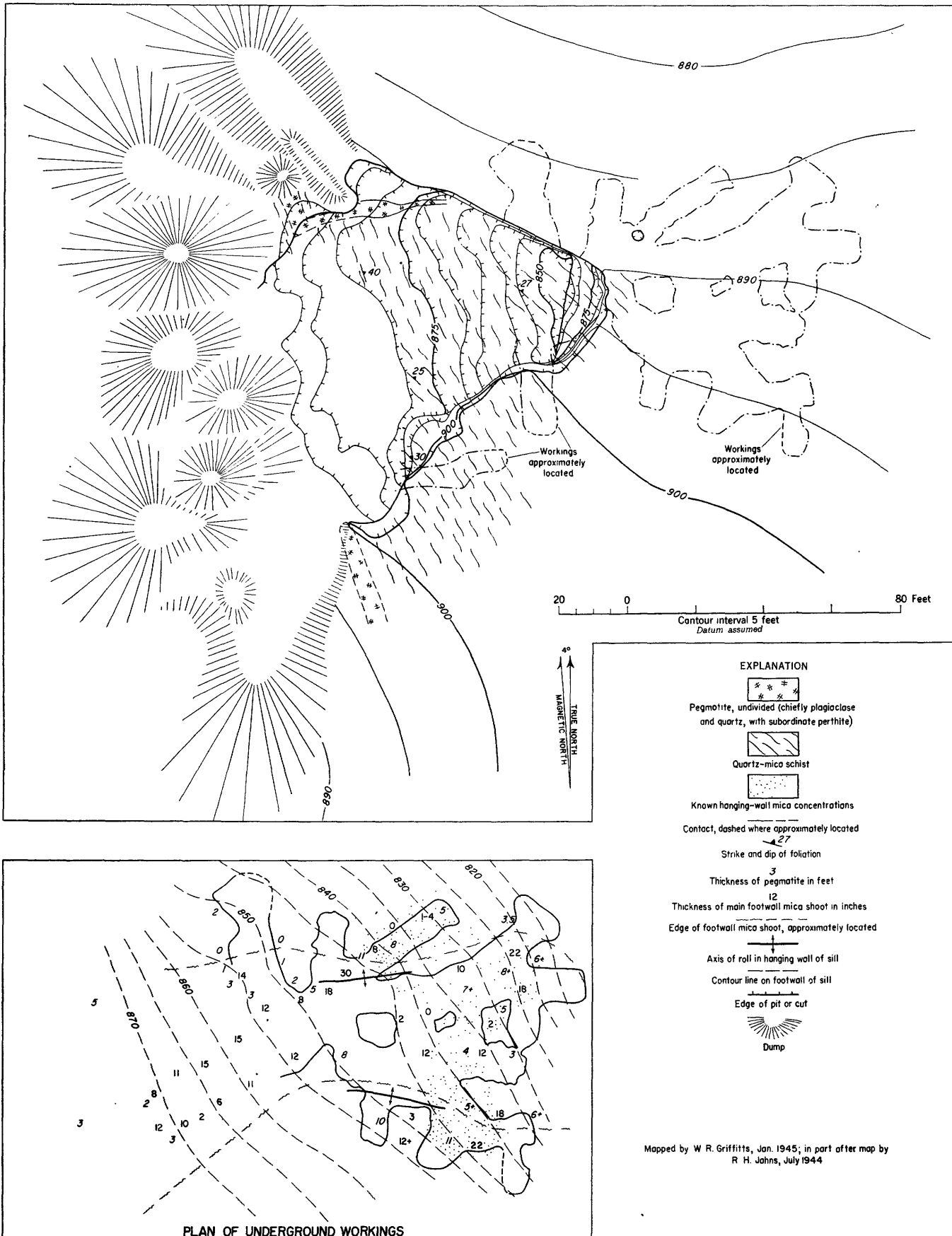


FIGURE 66.—Geologic maps and plans of the Knight mine, Rockingham County, N. C.

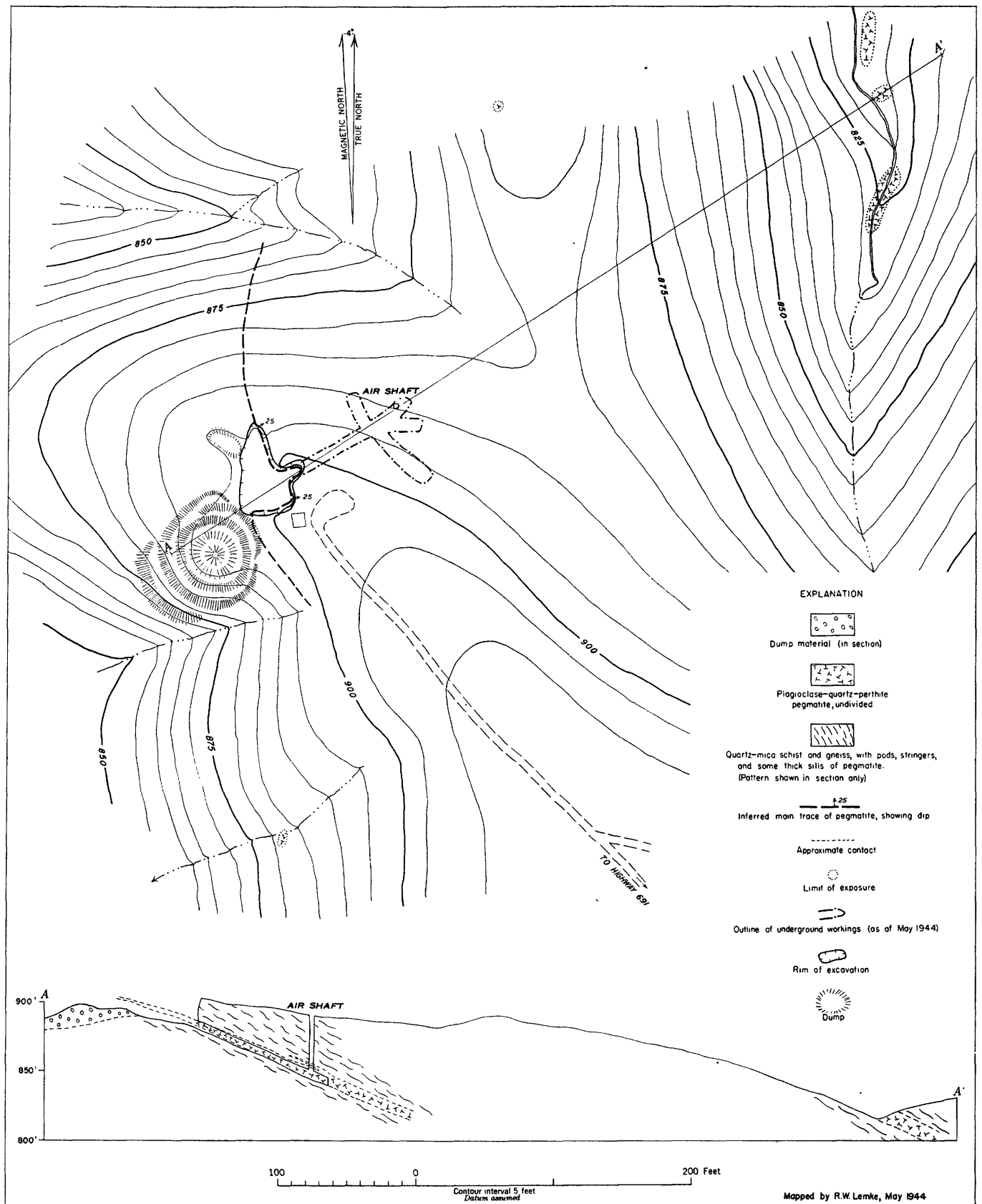


FIGURE 67.—Geologic map and section of the Knight mine area, Rockingham County, N. C.

along the walls of the deposit are warped and badly broken. The most serious defects are black specks and thin, rectangular lattices of brown to black hematite. These are particularly common in the hanging-wall mica. Some can be eliminated by careful rifting and trimming, but others are almost evenly distributed throughout the books.

The Knight deposit has yielded a high proportion of the larger sizes of trimmed sheets. Most of the larger books yield sheets 8 by 10 in. or larger, and the average size is about 3 by 3 in. Approximately half the trimmed mica obtained during World War II was of electric grade, and about half the clear material was classified as no. 1 and no. 2 by the Colonial Mica Corporation. According to Knight, approximately 9,500 lb of half-trimmed electric-grade mica, chiefly in the medium- and large-size groups, was recovered during the period 1943 to 1945. The total production of clear sheet and punch material has amounted to 12,727 lb, valued at \$73,240. During the summer of 1944 the output of such mica averaged more than 1,000 lb per month.

The outlook for continued production of sheet mica from the mine is fairly good. Substantial reserves of mica-bearing pegmatite may be present down the dip of the deposit beyond the present headings, as well as in unmined blocks of ground at shallower levels. There also is a possibility that sill-like branches or even separate sills may lie beneath the deposit that has been worked. One of these is said to have been prospected by Knight during the fall of 1945. During periods of operation when the price differential between clear and stained sheet mica is less than it was throughout World War II, there would be less tendency to obtain a maximum yield of clear stock from the mine-run books. Thus preparation costs probably would be reduced, and the total output of sheet mica from the deposit increased as well.

OTHER DEPOSITS

The description of the following mine is based upon the data of Pegau (1932):

Clifton mine.—The Clifton mine, near the Virginia State line about a mile west of Price (location 23, fig. 59), is said to have yielded several tons of feldspar, as well as mica valued at \$4,500. The deposit is 10 ft thick, and can be traced for a distance of 500 ft along its northeast strike. It consists of perthite, quartz, plagioclase, muscovite, and accessory garnet.

The following two descriptions are based upon the data of the Colonial Mica Corporation:

J. W. Jones deposit.—A partly weathered pegmatite deposit on the J. W. Jones property, about a mile south-east of Price (location 21, pl. 27), contains both stained and clear book mica. None of the books is more than an inch in diameter.

Grapevine mine.—The Grapevine mine is 300 ft from the Long Tom Smith workings and 3½ miles west of

Price. It is owned by Everett Smith and was worked by C. P. Robertson in 1943. The deposit contains large flat-A books of green mica, some of which yield 6-by-8-in. trimmed sheets.

STOKES COUNTY, N. C.

BROWN MINE

The Brown mine, 3.5 miles N. 50° E. of Sandy Ridge (location 31, fig. 59), is owned by A. J. Brown and J. N. Brown. It is said to have been opened in 1895 by a Captain McCraw, who sank a 50-ft shaft and drove a 200-ft drainage tunnel from its bottom. The mine was leased in 1943 to H. A. Knight, Jr., who cleaned out the old shaft and enlarged its upper part to form a pit 50 ft long and 30 ft wide at the surface.

The nearly vertical pegmatite dike strikes N. 85° W. between decomposed quartz-biotite schist and gneissic granite. Along the north wall of the deposit the foliation in the schist strikes east and dips 75° N. Granite forms the south wall of the cut. A few pods of plagioclase-quartz pegmatite 6 to 18 in. in diameter occur in the schist at the east end of the cut. The deposit is 10 ft thick near the rim of the cut, but it thins to 3 ft at a depth of 50 ft and is said to be only 1 ft thick at the 55-ft level. Little pegmatite is exposed in place, but quartz, perthite, plagioclase, muscovite, and biotite are present in the dump. Muscovite and biotite form fine-grained aggregates in quartz.

The mica books are scattered sparingly throughout the deposit and in general are small. Many, however, yield sheet mica of good quality. It is clear, cinnamon brown, exceptionally hard, flat, and free splitting. Clay stains are rare. The central parts of some books are lumpy. Mica-bearing pegmatite is known to occur at several other places on the Brown property.

WILKINS PROSPECT

A mica deposit on the Sarah E. Wilkins property, about 3 miles west of the Brown mine, was leased in 1944 to H. A. Knight, Jr., who dug a pit 11 ft long, 10 ft wide, and 11 ft deep. The pegmatite body strikes nearly east and dips 45° N. in quartz-biotite schist. It is 3 to 4 ft thick near the surface but thins to 1 ft or less along the floor of the pit.

The pegmatite is an aggregate of kaolinized feldspar and subordinate quartz, with local pods of massive quartz 1 to 2 ft long. Much mica of good quality was encountered in the pit at depths of 3 to 8 ft. Many of the books were 6 in. in diameter and yielded 5 to 10 percent trimmed sheet material. The mica is clear, cinnamon brown, flat, hard, and free splitting. A few books are cracked and contain quartz inclusions.

Abundant mica and quartz float indicate that the deposit extends about 125 ft west from the pit. Additional exploration seems to be warranted.

STEELE MINE

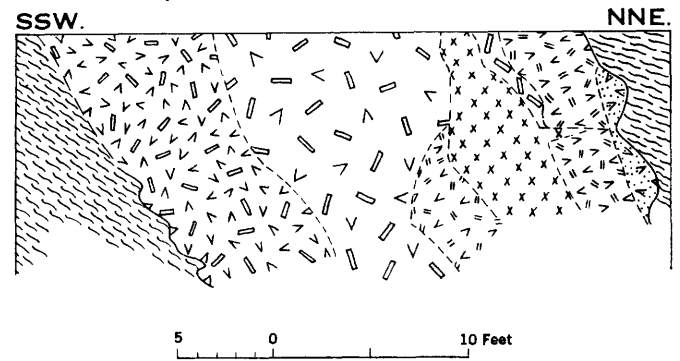
The Steele mine is near a hilltop 1.4 miles S. 55° W. of Sandy Ridge (location 32, fig. 59). The surface rights of the property were owned in 1944 by Shelton Steele, of Stokes County; the mineral rights were owned by W. G. Petrie, of Stokes County, and J. C. McBee, of Mitchell County. The mine was first worked about 1903 by the Southern Mica Co., and was last reopened in the summer of 1944 by Scott Thomas, foreman for C. P. Robertson, of Stoneville. Operations were abandoned in February 1945. The workings comprise an open-cut said to be 30 ft deep, a partly caved shaft, and a tunnel that connects these two openings.

The country rock is mica schist whose foliation strikes N. 60° to 70° E. and dips 50° NNW. near the hanging wall of the pegmatite. The pegmatite strikes N. 60° W. and dips 70° NNE. Several cigar-shaped pegmatite apophyses are elongated parallel to the contacts between pegmatite and wall rock and extend into the schist for distances of 1 to 1½ ft. They appear to plunge about 30° E. The footwall of the deposit is exposed only in the south wall of the open-cut, where the dike is about 23 ft thick.

A core of massive quartz lies somewhat northeast of the center of the dike, which is asymmetrically zoned (fig. 68). A layer of blocky perthite above the core tapers downward and pinches out at a depth of about 5 ft. It partly separates the massive quartz from a 4- to 5-ft hanging-wall zone composed of plagioclase, in blocks 4 to 12 in. in diameter, and scattered books of "A" mica. The hanging-wall border zone, which is as much as 2 ft thick in the bulges or apophyses (fig. 68), consists of medium-grained plagioclase, interstitial quartz, and books of flat mica. A tongue of quartz extends from the core 2 ft into the wall zone, almost reaching the outer margin of the pegmatite body. Beneath the core is a lens or tonguelike unit of medium-grained plagioclase and "A" mica, and beneath this are thick layers of blocky perthite, with minor quartz and plagioclase, and of plagioclase-quartz pegmatite with minor perthite.

Most of the mica recovered during the mining operations was flat-A material that yielded trimmed sheets as large as 3 by 4 in. Some of the "A" books are clay-stained, and a few are lightly specked. The mica content of the pegmatite exposed in January 1945 was less than 1 percent, and most of the mine-run books were found to yield not more than 3 percent sheet material. Pegmatite with a higher mica content may occur along the strike from the present workings. A continuous layer of medium-grained plagioclase-quartz pegmatite like that along the hanging wall in the cut would yield mica of higher quality than that heretofore recovered.

Several old slumped pits west or southwest of the cut may be in a different pegmatite body.



Prepared by W. R. Griffiths, Feb. 1945

EXPLANATION



Massive quartz



Coarse, blocky perthite



Coarse, blocky perthite with minor quartz and plagioclase



Medium-grained plagioclase-quartz pegmatite with minor perthite



Coarse-grained plagioclase with "A" mica and minor quartz



Medium-grained plagioclase-quartz pegmatite with flat mica



Mica schist

Contact, dashed where approximately located

Contact between pegmatite units

FIGURE 68.—Cross section of the Steele deposit, Stokes County, N. C.

RUBY KING (J. C. HAWKINS) MINE

The Ruby King mine, 2.6 miles by road southwest of Sandy Ridge (location 33, fig. 59), is owned by Jonah C. Hawkins. A few small holes were dug in the deposit about 1920, but little mining was done until 1944, when C. P. Robertson began extensive gopher-hole operations. The workings include an open-cut 53 ft long, 18 ft wide, and 30 ft deep, an incline, a shallow shaft, and many irregular drifts and crosscuts in an area of about 3,000 sq ft (fig. 69).

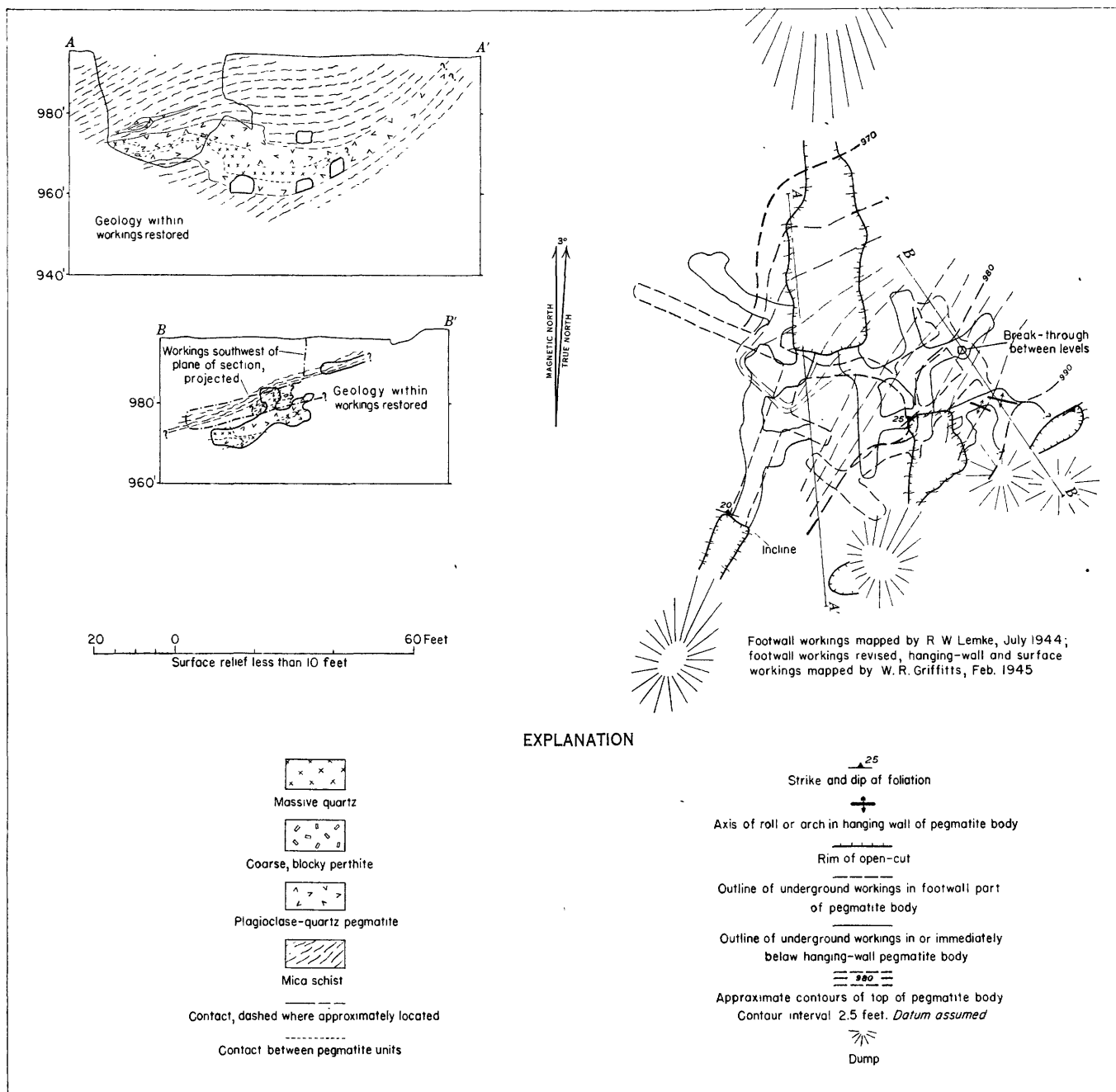


FIGURE 69.—Plan and sections of the Ruby King mine, Stokes County, N. C.

The country rock is feldspathic quartz-biotite schist that trends east and dips north. It is locally much contorted, and several broad folds occur in different parts of the mine. The pegmatite body is very irregular in shape. It strikes N. 50°-70° E. within the mine workings and dips 5° to 40° NW. to NNW. In a few places it rolls sharply to vertical, and several sharp bends are shown by structure contours in figure 69. The gently dipping parts of the deposit are essentially concordant, whereas the more irregular and thicker steeply dipping parts are distinctly discordant. The pegmatite ranges in thickness from a few inches to 17

ft, with an average of about 7 ft. It is thoroughly weathered.

The massive quartz core of the deposit is discontinuous and very irregular in shape and attitude (sections A-A' and B-B', fig. 69); in places it splits into two layers. A few large crystals of perthite and books of "A" mica occur along the margins of the core and may represent a very discontinuous intermediate zone. The wall-zone pegmatite is composed of kaolinized plagioclase and quartz with a little mica.

Flat books of pinkish-buff mica occur along the foot-wall of the deposit, and both flat and flat-A books occur

less abundantly along the hanging wall. Brown and brownish-olive "A" books fringe the margins of the core. Black specks are common but not abundant, and few of these books are ruled or badly cracked. The best flat-A books yield 3 percent sheet material, whereas the flat books yield about 12 percent. Mica is scattered irregularly in the parts of the deposit thus far explored, and no well-defined shoot of mica-rich pegmatite has been revealed. Substantial quantities of unmined pegmatite probably remain beyond the headings of the present workings, most of which have caved.

HAWKINS (JOE HAWKINS, SANDY RIDGE) MINE

The Hawkins mine, 2.1 miles west-southwest of Sandy Ridge (location 34, fig. 59), was opened in 1890 by Joe Hawkins and was reopened and worked in 1903 by the Empire Mica Co., of New York. At the close of these operations the workings comprised two open-cuts, three shafts 20 to 30 ft deep, and nearly 150 ft of tunnels and incline (Sterrett, 1923, p. 263). The Sandy Ridge Mica and Mining Co., of Washington, D. C., reopened the mine in 1942 and worked it constantly until January 1944. In September 1944 it was reopened by Lewis Aldridge and W. S. Flynt, of Spruce Pine. Large quantities of trimmed punch and sheet mica were recovered from books obtained during both recent operations. A little prospecting was done in the open-cut and in small holes to the south, but all the mining was done in the lower part of the incline and in short west and northeast branches. The main openings include a cut 250 ft long, 6 to 45 ft wide, and 10 to 35 ft deep and a 250-ft incline that slopes north-northwest from the cut (pl. 11).

The country rock is distinctly foliated biotite schist and gneiss, with thinly interlayered hornblende gneiss. The foliation strikes N. 60° to 70° E. and dips 18° to 25° NNW. Much of the rock is feldspathic, and some of the hornblende layers contain angular metacrysts of feldspar and thin veinlets of quartz.

Two large sills of fine- to medium-grained gneissic granite are exposed in and near the mine. The lower sill is about 30 ft thick in the open-cut and incline and the upper sill, about 30 ft higher, is exposed over the portal of the incline and in the adjacent creek bed. The granite consists chiefly of oligoclase, microcline, and quartz, with a little mica and garnet. The mica flakes are oriented parallel to the walls, and most are segregated into thin layers. Stringers of quartz $\frac{1}{4}$ to $\frac{1}{2}$ in. long and about $\frac{1}{40}$ in. thick also lie parallel to the walls of the sills. Most of the garnet occurs in the mica-rich layers. Crystals of feldspar and sharply bounded lenticular masses of pegmatitic granite are scattered through the sills.

Several thinner sills of granite are exposed in the walls of the incline. One in the upper part of the incline is 1 to 5 ft thick and in most places is separated

from the hanging wall of the pegmatite by a similar thickness of gneiss. Some of the smaller sills above the pegmatite finger out down dip into lit-par-lit injection zones, in which $\frac{1}{4}$ - to 3-in. layers of granite alternate with somewhat thicker layers of schist. At least one of the granite sills exposed in the incline is cut by the mica-bearing pegmatite (fig. 9, chapter A of this series).

The main pegmatite body is essentially a large sill that, in the upper half of the incline, lies along the hanging-wall contact of the lower of the two thick granite sills. In the lower half of the incline and in the crosscuts to the west, it lies within the granite sill. The hanging wall of the pegmatite body dips steeply in the south wall of the crosscut, crossing the foliation of the granite at an angle of 30°. The pegmatite body pinches and swells abruptly along the strike in many places but in general tapers gradually down dip.

The pegmatite minerals include plagioclase, perthite, quartz, and muscovite, with accessory garnet, pyrrhotite, and other sulfides. Tiny crystals of pyrite and pyrrhotite also coat fracture surfaces in the adjacent granite. Much of the quartz in the pegmatite is segregated into masses 6 in. to 2 ft thick and 3 to 10 ft long. Most of these are near the middle of the sill, but a few, like those exposed near the water hole north of the crosscut, lie along the hanging wall. The perthite generally occurs along the margins of the quartz lenses, or in the middle of the sill wherever no massive quartz is present. Some perthite crystals 3 to 5 in. in diameter and some intergrowths of quartz and perthite occur within the massive quartz. A few exceptionally large perthite crystals project into the quartz from adjacent feldspathic pegmatite. The cleavage surfaces in the potash feldspar are distinctly curved, and many of the crystals have been broken and cemented with plagioclase.

The oligoclase-quartz-muscovite wall zone contains streaks of quartz and small muscovite flakes, as well as plagioclase-rich lenses that are fringed by thin sheets of muscovite. Both the streaks and the lenses lie parallel to the walls of the deposit. The streakiness of the wall zone, the bent and broken perthite crystals of the inner units, and the bending and warping of many mica books suggest that the pegmatite was subjected to shearing stresses and flowage during the later stages of its crystallization. Moreover, many of the mica books in the wall zone are parallel with the adjacent wall-rock contact, rather than randomly oriented or normal to the contact.

Book mica is abundant within 2 ft of the hanging wall, and a few books lie along and parallel with the actual contact. Some project into the hanging-wall schist, and the country-rock foliation bends around them. Scattered books occur along and near the foot-wall of the deposit, and a very few light yellowish-green

"A" books occur along the margins of the quartz masses. The wall-zone mica is pinkish buff, and most is clear. Many of the books are large, and some yield 6-by-8-in. trimmed sheets. The chief defects are warping and cupping, scattered black specks, and widespread curdy primary vegetable stain. Flat rosettes of pyrite and pyrrhotite mar some sheets. Most of the book mica is reported to yield an exceptionally high proportion of sheet material.

The pegmatite mined in both branches of the incline at its north, or lower, end was found to thin progressively northward. Operations were stopped when the mica content of the rock broken at the face became too low for satisfactory returns. Sustained production of mica can be restored only through the discovery and mining of another shoot, which, if present, may lie either east or west of the present workings.

SPENCER MINE

The Spencer mine, about 400 ft west of the Hawkins workings (location 35, fig. 59), was operated many years ago, and only a little prospecting was done at the deposit during World War II. The openings include several cuts, pits, and shallow caved shafts. The pegmatite sill lies in or along the top of a thick sill of gneissic granite and is structurally similar to the Hawkins sill. The dumps contain pinkish-buff mica books that are smaller than those in the Hawkins deposit but otherwise are similar.

MOOREFIELD MINE

An old mine on the Percy Moorefield property, 4.5 miles by road westsouthwest of Sandy Ridge (location 36, fig. 59), was reopened in the spring of 1944 by D. O. Blevins and Will Young, of Spruce Pine. The main openings include a cut 100 ft long and 15 to 60 ft wide, a 30-ft drift that extends northward from the northeast corner of the cut floor, and a shaft 30 ft southeast of the cut. The shaft is 40-ft deep to water level.

The deposit is enclosed by weathered mica schist. Small books of flat-A mica occur in kaolinized feldspathic pegmatite. Some of this mica is specked. Blocks of quartz with prismatic tourmaline crystals are present in the dumps. The recent operations were hampered by the softness of both pegmatite and country rock.

G. R. SHELTON MINE

The Shelton mine is 5 airline miles west-southwest of Sandy Ridge (location 38, fig. 59). It was opened in 1907 by U. G. Cruise but lay idle until 1944, when it was reopened by A. G. Owen and W. S. Harless. The main workings are a cut 80 ft long, 17 ft wide, and 25 ft deep and 30- and 60-ft drifts that extend southeast at the level of the cut floor.

Two nearly parallel pegmatite sills about 6 ft apart strike N. 75° W. and dip 30° to 60° NNE. in mica

schist. The upper sill contains a core of tourmaline-bearing quartz and a wall zone rich in kaolinized plagioclase. Most of the lower pegmatite is an aggregate of kaolinized feldspar, interstitial quartz, and muscovite. Mica books are scattered sparingly through both deposits and fringe the quartz core in the upper sill. Many of the books are of the flat-A type, and most are 3 to 4 in. in diameter. The mica is clear, hard, and pinkish buff.

A pit and a drift at least 20 ft long were opened at a second locality several hundred feet south of the cut. The pegmatite contains mica similar to that from the main opening.

U. G. CRUISE MINE

The Cruise Mine, 4.4 miles S. 75° W. of Sandy Ridge (location 37, fig. 59), was worked in 1926 by the owner, U. G. Cruise, who sank a 40-ft shaft. At the bottom of the shaft a 4-ft mass of quartz is flanked by mica-bearing feldspathic pegmatite. Large books of mica are said to be abundant along the margins of the quartz, but little mica is present in the dump.

HOLE (JACK HOLE) MINE

The Hole mine is about 4 miles southeast of Francisco, on the north bank of Big Creek and not far from its confluence with the Dan River. It can be reached over a dirt road that extends west from North Carolina Highway 89 on a hilltop between Danbury and Francisco. The deposit is said to have been first worked in 1901, and it was last reopened in June 1943 by the Sandy Ridge Mica and Mining Co., of Washington, D. C. Large quantities of sheet and punch mica were obtained from mine-run books within a period of several months during World War II. The main opening is an irregular inclined stope 65 ft long, 20 ft high, and 15 ft wide (pl. 12). An older, smaller, waste-filled incline lies immediately east of the stope, and short inclines and benchlike cuts lie about 30 ft to the west and 120 ft to the east. A short crosscut that was driven early in 1944 extends westward from the main stope.

Most of the hillside north of Big Creek is underlain by garnetiferous mica schist, in which a well-developed foliation trends uniformly east and dips 30° to 40° N. A sill of coarse granite crops out about 60 ft north of the creek. It can be traced for a strike distance of at least 265 ft and is 10 to 20 ft thick. Its thickest part is east of the main mine workings, and at the east edge of the area it splits into two branches 3 and 4 ft thick. In all its exposures the rock is a medium- to coarse-grained aggregate of quartz, plagioclase, perthite, and fine flake muscovite. It contains no sheet mica.

The mica-bearing pegmatite body also is concordant in general, but its walls are very irregular in detail. The deposit appears to be about 220 ft in outcrop length. It is about 30 ft thick in the main stope but thins abruptly along the strike to the east and west. It is

cut by at least three faults, the most prominent of which strikes N. 85° W. and dips 25° S. The fault plane is marked by a layer of red clay 5 in. thick. Minor drag is evident along the faults, as well as along several slip joints that are exposed in the workings.

The pegmatite minerals include perthite, albite, gray quartz, muscovite, and garnet. Much of the deposit is markedly streaked with irregular quartz-rich layers that are parallel with the walls. Three of these layers, 3 to 5 ft thick, were exposed along the outcrop of the pegmatite prior to the recent operations (Sterrett, 1923, p. 264), and at least six similar but thinner and less continuous layers are present in the walls of the main stope. Quartz-rich stringers, ½ to 4 in. thick, and shear planes that are coated with fine flakes of green muscovite also are parallel with the walls of the deposit. Some of the quartz stringers may well have been formed by injection of pegmatite fluids along fractures in previously consolidated feldspathic pegmatite. On the other hand, the thickest layers appear to be cores or core segments.

Mica books were scattered in moderate abundance throughout all three of the principal feldspathic layers in the deposit along and near the outcrop of its main bulges (Sterrett, D. B., oral communication, 1945), but the richest concentrations exposed in the present stope are 2 to 4 ft beneath the hanging-wall contact, above and below a schist septum that projects into the pegmatite from the east wall of the stope (section *B-B'*, pl. 12), and locally near the footwall of the deposit. In general the mica-rich part of the deposit is its thickest part, immediately west of the crosscutting hanging-wall contact that forms the east side of the main bulge. Mica also occurs at the end of the short west drift.

The mica is yellowish green to yellowish olive, and some is clouded by a brownish stain. Nearly all the books are marked by "A" structure, but many of them are so large that sheets can be trimmed from their flat parts. The chief defects are primary vegetable stain, warping, cracks, and ruling, particularly along and near cross faults and slip joints. Book mica is fairly plentiful in the deposit, the recovery of sheet material from the mine-run books is low.

A second mica-bearing pegmatite mass lies about a third of a mile east of the mine. It is exposed along the steep hillside for a strike length of about 200 ft, chiefly in small open-cuts and a 20-ft incline. The deposit is several feet thick, trends east, and dips 30° to 45° N. It consists of quartz, unkaolinized feldspar, and mica. The book mica is clear and dark yellowish olive. Nearly all the books are small and badly ruled.

OTHER DEPOSITS

The reports on the following prospects were abstracted from the report by Sterrett (1923):

Richard Forest prospect.—At the Forest prospect, on the north end of Brown Mountain and 4 miles west-southwest of the Hole mine, a 15-ft incline exposes a sill-like pegmatite body in coarse-grained mica schist. The country-rock foliation strikes N. 50° E. and dips 35° NW. The pegmatite contains several stringers and thick tabular masses of quartz that are parallel with its walls. Mica occurs in the surrounding feldspathic wall zone. The dump contains light yellowish-olive "A" mica of fair quality.

Martin prospect.—Mica-bearing pegmatite was prospected by means of a shaft on the William Martin property, at the north end of the top of Brown Mountain. The country rock is garnetiferous mica schist. Flakes and small books of mica are strewn around the old shaft collar, and float fragments are present along the surface for some distance on both sides of the shaft.

Mica prospects also are reported on the properties of Samuel Simmons, William Hills, Thomas Bundurn, and William Nunn. All are on the top of Brown Mountain.

The following four mine descriptions are based upon data provided by the Colonial Mica Corporation:

J. B. Robinson deposit.—Mica-bearing pegmatite occurs on the property of J. B. Robinson, near the Sandy Ridge road and 9 miles from U. S. Highway 220. No prospecting has been done. The deposit contains mica books that would yield 2-by-2-in. sheets.

C. P. Jones mine.—Mica was obtained prior to 1905 from a deposit near North Carolina Highway 87, at a point 7 miles from Danbury. It was owned by C. P. Jones in 1944.

Odel Jones mine.—A mica mine on the Odel Jones farm, 4 miles south of Francisco, was owned in 1944 by the Sandy Ridge Mica and Mining Co., of Washington, D. C. A 35-ft incline exposes a pegmatite body that contains abundant mica and some coarse feldspar. Some of the mica is marked by "A" structure, but the books are large.

Otis Shelton prospect.—Prospect openings near the creek on the Otis Shelton property, near the county line northeast of Sandy Ridge, expose a body of mica-bearing pegmatite that strikes N. 5° E. and dips 60° W.

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PART 4. OUTLYING DEPOSITS IN VIRGINIA

By RICHARD H. JAHNS and WALLACE R. GRIFFITTS

ABSTRACT

Thirty mica mines were examined in Virginia outside the Amelia and Ridgeway-Sandy Ridge districts. Many fall into definite groups, but others are widely separated. The general geology is similar to that of the better-studied districts.

The pegmatites near the Anna River are dikes and discordant lenses. Potash feldspar is abundant, but the wall zones are plagioclase-rich. The mica is dark brown, and most is clear. The pegmatites in the Goochland-Powhatan area are lenticular, simple, unzoned, or trizonal bodies. One has been hydrothermally altered and contains several uncommon accessory minerals. Reddish-brown mica occurs in the wall zones and along the margins of cores. The deposits in the Cullin-Charlotte Court House area have zones similar to those of deposits in other Piedmont areas. Much of the mica is stained and green or olive. Beryl is a common accessory mineral. The pegmatites of the Otter River-Moneta area are the most productive source of feldspar in the Piedmont. The bodies are large and rudely zoned, and flat, light-brown mica is scattered sparingly through wall zones. The deposits in the Pittsylvania area are well zoned. Much of the mica is reeved, but large flat sheets can be obtained, most of them heavily stained. The mica from the Chestnut Mountain area likewise is stained. Some of the pegmatite bodies are parallel to the foliation; others cross it. Zones are poorly developed, and perthite is uncommon. The Axton area yields stained mica that is brown, olive, and green. The deposits occur near a granite stock and may be parallel or transverse to the foliation of the enclosing rock.

Other deposits, containing clear and stained mica, are scattered through central and northwestern Henry County.

INTRODUCTION

Mica-bearing pegmatites are scattered over much of the Virginia Piedmont, chiefly in a belt 10 to 40 miles wide that extends from the Anna River southwestward for 160 miles to the Virginia-North Carolina State line. Deposits in Amelia County and southern Henry County have been described in parts 2 and 3 of this report. In addition, many others are present in western Hanover and eastern Louisa Counties, in central Goochland and eastern Powhatan Counties, in eastern and southern Bedford County, in northern and southwestern Pittsylvania County, and in the northern half of Henry County (pl. 13). Others are reported in Rappahannock, Spotsylvania, Pittsylvania, Caroline, Fluvanna, Buckingham, Prince Edward, Charlotte, Halifax, Franklin, Patrick, and Grayson Counties. At least 200 mica mines and prospects have been recorded as present in areas beyond the boundaries of the Amelia and the Ridgeway-Sandy Ridge districts, and probably 400 or more are present in the State.

A few deposits are scattered widely, but most are grouped within small areas or well-defined belts. Many of these have common structural and mineralogical features, and the mica they contain generally is similar over broad areas. Individual deposits and groups of deposits have been described by Watson (1907, pp. 275-285, 385-392), Sterrett (1923, pp. 307-330), Pegau (1932), and W. R. Brown (in press), and the pegmatites of Goochland County have been described by C. B. Brown (1937, pp. 34-37, 41).

Recent investigations by the Geological Survey comprised the examination of 30 mines and prospects, of which 15 were mapped. Most of this work was done by W. R. Griffitts, R. H. Jahns, R. W. Lemke, R. Miller III, and W. C. Stoll during the period 1942-45. Additional data were obtained from the published record and from mine-examination reports in the files of the Colonial Mica Corp. It is a pleasure to acknowledge the helpful cooperation of Edgar B. Ward, field engineer for the Colonial Mica Corp., who supplied much helpful information concerning the history and production of mines and prospects and current problems connected with them and who accompanied the Survey geologists on many field examinations.

RAPPAHANNOCK COUNTY

One prospect, here called the Stringfellow, is known in Rappahannock County. This is an old prospect in Shenandoah National Park (location 85, pl. 13), about three-quarters of a mile below the Skyline Drive (section AB, station 190-00) between the Hazel River and Hazel Run. It was reopened in 1943 by B. W. Stringfellow. A shaft was sunk to a depth of 25 ft from an old pit 28 ft long, 20 ft wide, and 10 ft deep. The old workings are said to have been opened about 1903 by Nathan Jennings.

It is reported that no definite mica deposit was found, but the rubble of sandstone removed may have been fill in old workings. Mica books scattered sparsely through the material reached slightly more than 1 in. in maximum dimension. The mica is red or brown and is crumbly.

SPOTSYLVANIA, CAROLINE, HANOVER, AND LOUISA COUNTIES: ANNA RIVER AREA

GENERAL FEATURES

The Anna River area includes several mica-bearing pegmatites in eastern Louisa and western Hanover

Counties and extends north-northeastward into Spotsylvania and Caroline Counties (pl. 13). It is nearly circular, with an average radius of about 10 miles, and the part in southwestern Caroline County lies at the extreme east edge of the Piedmont province. The main east-west routes of travel are the Richmond-Charlottesville line of the Chesapeake and Ohio Railway and U. S. Highway 33. The chief north-south routes are Virginia Highways 27, 51, and 522. U. S. Highway 1 and the main line of the Richmond, Fredericksburg, and Potomac Railroad are near the east edge of the area. Nearly all the mines and prospects can be reached over good secondary routes and short access roads.

The very gently rolling Piedmont terrain is interrupted here and there by steep-sided stream valleys. Altitudes range from less than 150 ft along the principal rivers to 300 ft or more in some of the divide areas. The average altitude is about 250 ft. The area is drained by the North Anna River, the Little River, and the South Anna River and by tributaries of these streams. The principal directions of drainage are east and east-southeast. Most of the country is underlain by a thick mantle of soil and decomposed rock, so that fresh bedrock exposures are rare.

The Baltimore gneiss, a coarse-grained feldspathic rock with local garnetiferous and biotite-rich layers, forms a well-defined belt on the east side of the area. West of the gneiss is the Wissahickon schist (Stose, Jonas, and others, 1928), which consists of biotite schist and gneiss, chlorite-muscovite schist, and some thin interlayered greenstones. Distinctly thicker masses of hornblende metagabbro are exposed in several places. In general, the pegmatites occur in biotite schist and gneiss, much of which is garnetiferous. Some kyanite-rich layers also have been observed. Most of the foliated rocks in the area trend northeast, with moderate to steep northwesterly dips. The schist and gneiss contain abundant quartz, mica, and tourmaline near many pegmatite contacts and commonly are impregnated with granitic and pegmatitic material over broad areas.

PEGMATITES

Most of the pegmatite bodies are dikes and discordant lenses that strike northwest to north-northwest and dip very steeply. They characteristically taper along the strike and down the dip, and few can be traced for distances of more than 300 ft. Most contain well-defined quartz cores and surrounding kaolinized feldspar-rich zones. Potash feldspar is abundant, and coarse blocks of perthite form intermediate zones in many pegmatite bodies. Plagioclase, in contrast, is most abundant near the walls. Accessory minerals include spessartite, biotite, tourmaline, beryl, rutile, zircon, ilmenite, graphite, and sillimanite. The beryl in several deposits occurs both within and around the margins of the quartz cores.

Much of the muscovite in the area is hard, flat, free splitting, and of good quality; most books are dark brown and clear, but those in the Last Mile and other deposits are stained. The largest and richest mica shoots occur along the margins of massive quartz cores, and the largest books are in contact with the quartz. Most of these books are marked by strong "A" reeves, and other defects include cracks, warping, and inclusions of quartz and plagioclase. Large sheets can be trimmed from the flat portions of some "A" books.

Most of the mica obtained in the area was mined many years ago, and the Saunders mine is said to be the oldest mica mine in the State. Production of trimmed sheet mica prior to 1910 may well have amounted to more than 100,000 lb, most of which was used in the manufacture of stoves. Several deposits were prospected and a few old mines reopened during World War II, mainly by the Virginia Manganese Corp., of Richmond. The yield of mica was small, however, and many of the deposits appear to have been worked out during the earlier periods of mining.

DESCRIPTIONS OF DEPOSITS

EDENTON MINE

The Edenton mine is in Spotsylvania County. It is about 10 airline miles northeast of Mineral and can be reached from that town over 5.5 miles of Virginia Highway 522 and about 5 miles of Virginia Highway 613 (location 1, pl. 13). The mine workings, several hundred feet east of the highway, include three old pits and a 120-ft drainage tunnel that trends N. 75° W. The tunnel connects with the bottom of a 50-ft shaft that is said to have been sunk from the floor of the northwest pit. This pit is 25 ft in diameter, but the two southeastern pits are somewhat smaller and badly caved. The mine is owned by L. W. Edenton and was last worked about 1900.

The country rock is a decomposed quartz-biotite schist. The only pegmatite exposures consist of kaolinized feldspar with minor quartz, but a massive core is indicated by large blocks of clear to milky quartz in the dumps. The mica in the dumps is "A" material of fair to good quality. Some books would yield 3- by 3-in. trimmed sheets.

LAST MILE MINE

The Last Mile mine in Caroline County is about 6 miles west-southwest of Ladysmith and is connected with that town by 4.5 miles of Virginia Highway 229, 1 mile of Virginia Highway 603, and 1 mile of dirt road (locality 2, pl. 13). The deposit is on the Beasley farm and was worked during the spring of 1943 by W. E. Baltzley and David Sternberg. Development consists of a bulldozer trench 60 ft long, 20 ft wide, and 8 ft deep and 20- and 25-ft pits in the trench floor.

The nearly vertical pegmatite dike strikes N. 50°

W. in decomposed quartz-biotite schist. It is 10 ft thick near the middle of the cut but tapers to a mere stringer at both ends of the cut. A 2- to 3-ft core of massive quartz is flanked by a perthite-rich intermediate zone. Tourmaline and biotite are fairly plentiful in the inner zones, and green beryl crystals as much as 5 in. in diameter occur sparingly in the core. The poorly exposed wall zone is rich in thoroughly kaolinized plagioclase.

Mica is most abundant near the margins of the core. It is dark brown, and much of it is stained. The mica books are 4 in. in average diameter, but nearly all are severely fractured and few would yield much sheet material. Nearly all the mica-bearing part of the deposit appears to have been mined out.

SAUNDERS MINES

The four Saunders mines, in Hanover County, are reported to be the oldest mica mines in Virginia. They are approximately 3.5 miles southeast of Hewlett and 9 miles northwest of Ashland (location 3, pl. 13), near the south bank of the Little River. The deposits were worked from 1867 to 1870 by Barr, Johnson & Co., of Erie, Pa., and yielded more than 60,000 pounds of trimmed stove mica during this period (Watson, 1909, p. 104). Additional work was done in 1883 and 1907, and the most recent mining was carried on during the fall of 1943 by the Virginia Manganese Corp., of Richmond. Several pegmatites on the property have been prospected and mined, but the recent operations were confined to openings known as the No. 1 and No. 2 mines (fig. 70).

The No. 1 mine is an old caved open-cut about 130 ft long, 40 ft wide, and 20 ft deep. It once was 35 ft

deep at its east end (Sterrett, 1923, p. 321). No pegmatite is exposed in several recent prospect pits in the floor of the cut near its west end. The deposit, which appears to trend east, may be a lenslike pegmatite mass that has been almost completely mined out.

The Saunders No. 2 mine, about 150 ft south of the No. 1, is on the west side of a small tributary of the Little River. The main opening is a pit 55 ft long, 15 ft wide, and about 60 ft deep. During World War II, the pit was deepened from 45 ft, and additional mining was done along its west side. The vertical pegmatite dike strikes nearly east in garnetiferous biotite gneiss. The county-rock foliation strikes N. 30° E. and dips gently to moderately west-northwest.

The deposit is 12 ft thick near the center of the workings but thins to 6 ft at the east end of the cut and almost pinches out in the west end and floor of the cut. A massive quartz core 6 ft in maximum thickness is flanked by a zone of coarse, buff-colored perthite and minor quartz. At the east end of the cut the pegmatite consists chiefly of perthite, small fragments of quartz, and small books of mica. Graphic granite occurs in several places. Garnet is the chief accessory mineral.

Mica is fairly abundant in and along the margins of the core. The books range in diameter from 3 to 15 in. The mica is cinnamon brown to dark brown, hard, flat, and free splitting. The chief defects are cracks, warping, and inclusions of quartz. The mine-run mica obtained during the most recent operations yielded 2 to 3 percent trimmed sheets. Nearly all the mica books in the east face of the pit are too small to yield sheet material. Mining was halted in 1943 because no large mica books were encountered beyond the east end of the quartz core.

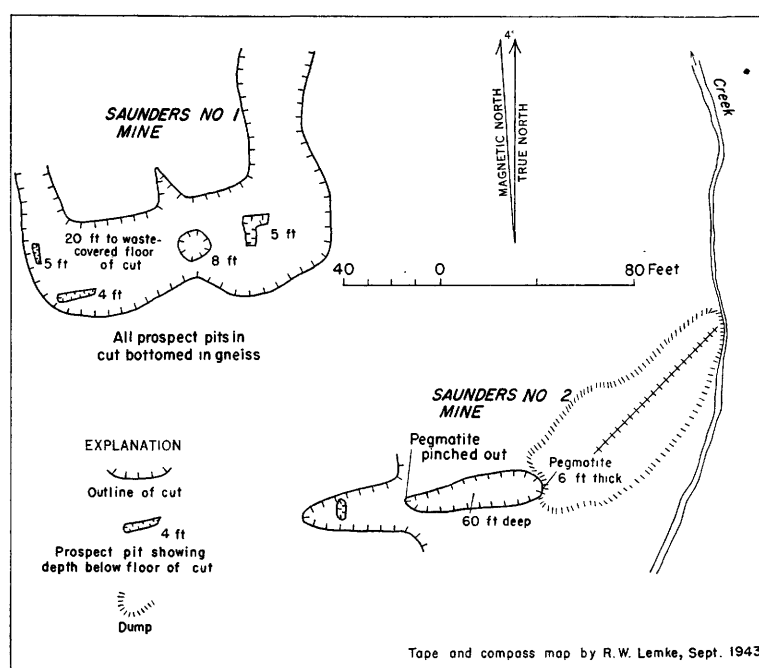


FIGURE 70.—Map of the Saunders No. 1 and No. 2 mines, Hanover County, Va.

The No. 3 mine, a partly flooded open-cut 100 ft long and at least 25 ft deep, is on a southwest slope about three-quarters of a mile south of the No. 1. The output from the deposit is said to have been large, and fragments and small books of mica are abundant in the dumps.

The Saunders No. 4 mine is about half a mile south-southwest of the No. 1. An old trenchlike cut 70 ft long exposes a mica-bearing pegmatite body that contains a massive quartz core. The country rock is weathered garnetiferous gneiss. Production from this mine is said to have been small.

POTEAT NO. 1 MINE

The Poteat No. 1 mine is in Hanover County, 0.5 mile west of the Saunders mines and about 3.5 miles southeast of Hewlett (location 3, pl. 13). An old cut 100 ft long, 50 ft wide, and about 30 ft deep is 400 ft west of the Poteat residence. The collar of an old vertical shaft was exposed in the floor of the cut when it was dewatered by Poteat in 1940. In the fall of 1943 the cut was partly dewatered by the Virginia Manganese Corp., of Richmond. The pegmatite body strikes nearly east and is reported to contain a core of massive quartz. When the cut was last pumped out, however, only 2 ft of kaolinized feldspathic pegmatite was exposed in the workings. The core may lie beneath the cut floor, where the mica-bearing pegmatite was worked in drifts from the old shaft.

Several prospects between the Poteat and Saunders mines expose mica-bearing pegmatite. Some of the pits were excavated in 1943 by the Virginia Manganese Corp., but no concentrations of large mica books were found. The dumps from the pits and from the main Poteat cut contain abundant small flakes and books of mica that appear to be of fair to good quality.

CHILDRESS MINE

The Childress mine in Louisa County, is 700 ft southwest of U. S. Highway 33, about 3 miles by road southwest of Cuckoo, and 10 airline miles southeast of Louisa (location 8, pl. 13). It is owned by J. L. Childress, of Richmond, and was worked about 1905 by means of an open-cut, a vertical shaft, and several trenches. The cut is 80 ft long and 30 ft wide and is filled to a level within about 10 ft of the surface.

The deposit is about 10 ft thick in the workings and strikes N. 10° to 15° E. Most of the mining was done along both sides of a persistent quartz core that is at least 100 ft long. About 2 tons of weathered mica is piled near the cut. The mica in the deposit is of the flat "A" variety and is reported to yield flat sheets of good quality. Substantial quantities of 6-by-8- and 8-by-10-in. sheets are said to have been obtained. The chief defects in the stockpiled mica are reeves, cracks, clay stains, and warping.

OTHER DEPOSITS

The following five descriptions of deposits in Hanover County are based chiefly upon information provided by the Colonial Mica Corp.:

Rose Hill prospect.—The Rose Hill prospect is on the C. H. Langford farm, near Virginia Highway 671 and 1.3 miles east of Negro Foot (location 4, pl. 13). It is said to have been worked prior to 1870 and was last reopened briefly in 1943 by the Virginia Manganese Corp. The mica-gneiss country rock encloses a pegmatite dike that strikes N. 80° E. and contains small quantities of scrap mica.

Hall prospect.—A small prospect on the D. C. Hall property, near the intersection of Virginia Highways 608 and 680, was opened in 1931 by W. A. Strong (location 5, pl. 13). The pegmatite contains mica books 3 in. or more in diameter, but many are badly ruled and cracked. All are brown and are free from serious mineral stains.

Harris prospect.—An 18-ft shaft on the Harris property, 100 ft north of Virginia Highway 631 and east of its junction with Virginia Highway 678 (location 7, pl. 13), was sunk in 1929 by W. A. Strong. The deposit was later prospected by H. F. Harris. The pegmatite dike strikes nearly east and may pinch out downward at a depth of 18 ft. It contains abundant flat-A books of clear mica. Some are as much as 8 in. in diameter.

Tyler prospect.—A mica deposit on the Harry Tyler property, 50 yd west of Virginia Highway 680 and a little south of its junction with Virginia Highway 608 (location 6, pl. 13), was opened in 1931 by W. A. Strong, who excavated a trench 15 ft long. The quartz core of the deposit is fringed with books of clear brown mica. Some are 4 in. in diameter, but many are locky.

Range prospect.—The Range prospect is on the farm of H. G. Hall, which adjoins Howard Mill. A very old pit 50 ft long and 30 ft wide was dewatered in 1943 by the Virginia Manganese Corp., of Richmond. The deposit consists of kaolinized feldspar, quartz, and sparsely scattered books of muscovite. Many of the mica books, though small, are of good quality.

The following three deposits are in Louisa County. The descriptions are based mainly upon data of the Colonial Mica Corporation.

Chisholm deposit.—A pegmatite outcrop on the L. T. Chisholm property, 1 mile south of Apple Grove (location 9, pl. 13), contains locky "A" books of heavily stained green mica.

Gardner prospect.—A prospect on the G. I. Gardner property, about 1½ miles south-southwest of Apple Grove and 100 ft from the South Anna River (location 10, pl. 13), was opened about 1923. Two 20-ft pits expose a pegmatite body that strikes N. 20° E. and dips 50° ESE. It is 10 ft wide and 740 ft long. The deposit contains quartz, perthite, kaolinized plagioclase,

clase, and muscovite. Coarse-grained perthite and quartz are most abundant in its central parts. Some of the mica is flat, and some is reeved. Mineral stains are widespread. A few of the books are 6 in. in diameter.

W. M. Shelton prospect.—Mica was obtained prior to 1890 from a deposit near the South Anna River, on the W. M. Shelton property half a mile southeast of Virginia Highway 601 (location 11, pl. 13). The vertical pegmatite dike strikes N. 20° W., is 1½ to 2 ft thick, and is at least 700 ft long. A thin quartz core is flanked by feldspathic pegmatite that contains small books of hard, free-splitting, clear brown mica. Some of the books are badly ruled and broken.

GOOCHLAND AND POWHATAN COUNTIES: GOOCHLAND-POWHATAN AREA

GENERAL FEATURES

Several mica deposits north and northeast of the Amelia district form a belt that extends from eastern Powhatan County north-northwestward for 30 miles into central Goochland County. This belt is 10 to 15 miles wide and is characterized by gently rolling slopes and steep-sided stream valleys. Stream dissection is especially prominent along the James River, which bisects and drains the entire area. Altitudes range from less than 150 ft along the river to more than 300 ft in the uplands.

U. S. Highways 60 and 250 and Virginia Highway 6 cross the area from east to west, and Virginia Highway 522 crosses it from north to south. Good secondary roads form a network that provides easy access to nearly all the mines and prospects. The James River branch of the Chesapeake and Ohio Railway also extends through the area.

Much of the bedrock is coarse feldspathic gneiss similar to that in the Amelia district. Its foliation trends northeast and dips northwest, but local variations are common. Other widespread rock types include biotite schist, quartz-muscovite schist, and hornblende gneiss. Several masses of hornblende metagabbro are present, and Pegau (1932, p. 62) describes one gabbroic dike in eastern Goochland County that is a quarter of a mile wide. It strikes N. 20° to 30° E. and dips 50° to 70° WNW. Most of the pegmatites occur around the west and southwest sides and the south ends of prongs of Baltimore gneiss (Stose, Jonas, and others, 1928). These prongs appear to extend south-southwestward from a very large mass, and much of the surrounding gneiss and schist contains abundant sill-like stringers of pegmatite and granite.

PEGMATITES

Many of the pegmatite bodies in the area are markedly lenslike in form. Few are more than 330 ft long, and most pinch out at rather shallow depths. Some

sills and concordant pods are recorded, but most of the bodies are discordant in section. They consist typically of plagioclase, perthite, quartz, and muscovite, with minor beryl, biotite, graphite, garnet, tourmaline, sillimanite, rutile, and tantalum-columbium minerals. Most are either granitoid aggregates of quartz and feldspars or simply zoned bodies with cores of massive quartz and feldspar-rich intermediate zones and wall zones. A striking exception is the Herbb No. 2 pegmatite, which appears to resemble the complex deposits of the Amelia district. It contains abundant cleavelandite and widespread tantalite-columbite, microlite, muscovite, and other minerals that appear to be at least in part of replacement origin.

Book muscovite is scattered through the wall zones of many deposits and occurs along the margins of cores and core segments in others. The core-margin mica books generally are of moderate to large size, but some of the largest books mined in the State during the period 1943-45 were taken from the wall zone of the White Peak No. 1 pegmatite. Some mines expose mica shoots of more than one type. Typically these include core-margin shoots of large flat-A books and wall-zone concentrations of smaller, flatter books. The mica in the Powhatan and Goochland deposits is brown to cinnamon brown and ordinarily is distinctly more reddish than that of the Amelia district. Its quality is generally good, and the chief defects are cracks, warping, softness, and clay stains. "A" structure and ruling are serious imperfections in some books.

Many of the deposits in the area are moderately rich, and production of sheet, punch, and scrap mica has been considerable since 1890, when some of the deposits were first worked intensively. Ordinarily production at any given time comes from a very few mines, and many of these have been worked out within a period of several years. Some of the deposits that yielded large quantities of mica during World War II appear to contain appreciable reserves of mica-bearing pegmatite, but future production in the area must depend in large part upon the discovery and exploitation of additional deposits.

DESCRIPTIONS OF DEPOSITS

MONTEIRO-AMBER QUEEN (MONTEIRO TRACT) MINE

The Monteiro-Amber Queen mine is in Goochland County. It is 3.9 miles N. 18° E. of Goochland (location 14, pl. 13) and less than half a mile south of U. S. Highway 250. The deposit, which is in a large tract of land owned in 1944 by Charles Monteiro of Richmond, is connected with county highways 612 and 634 by 0.7 mile of ungraded dirt road. Two main groups of workings, known as the Monteiro and the Amber Queen, are in a series of nearly vertical pegmatite lenses that strike north-northwest.

The Amber Queen, or southeastern, part of the deposit is reported to have been opened prior to 1900 by G. W. Wiltchane. It was not worked on a large scale, however, until the period 1916-18, when C. A. Gatrigh and T. J. Slayden shipped about 60,000 lb of selected mine-run mica to the Spruce Pine district, N. C., for further preparation. In 1943 and 1944, W. H. Thomas, of Micaville, N. C., and R. M. McCormick, of Fishersville, Va., reopened the workings and obtained small quantities of excellent sheet mica. This part of the mine was then owned by Thomas.

The workings comprise three ovoid cuts 20 to 30 ft in diameter, two shafts more than 50 ft deep, and several old shallow prospect pits (pl. 14). From the old shaft, drifts are reported to extend northwest and southeast at several levels. Large old dumps attest the presence of rather extensive underground workings. In the new Amber Queen shaft, which is about 80 ft deep, old drifts were encountered at the 52-ft level and at a somewhat higher level. At the 30-ft level a drift was driven 50 ft northwest and an airhole was raised to the surface in or near the shallow cut shown in plate 14. A short drift was driven southeast at the 75-ft level in rather rich mica-bearing pegmatite, but operations were halted by caving. These drifts are no longer accessible, and they are not shown in plate 14.

The Monteiro workings are said to have been opened about 1900 by J. H. Simpson, but little systematic mining was done until February 1944, when operations were begun by Colonial Homes, Inc., of Richmond. The Monteiro shaft was sunk to a depth of more than 55 ft, drifts were extended southeast at the 19-ft and 33-ft levels, two shorter drifts were driven northwest at the 24-ft and 38-ft levels, and an irregular opening was made near the bottom of the shaft. Surface exploration northwest of the shaft exposed a thin mica-bearing pegmatite body that presumably is a part of the series that has been mined. A moderate production of high-quality sheet mica was achieved during 1944.

The country rock in the mapped area is a thinly foliated quartz-mica schist. It strikes north and dips steeply east in the trench northwest of the Monteiro shaft and strikes east-northeast and dips steeply south-southeast in the Amber Queen workings. In the Monteiro workings the schist contains many lenses and stringers of sugary-textured pegmatite that are cut by the main pegmatite body. This body, which has yielded most of the mica, strikes northwest with an almost vertical dip. It ranges in thickness from a knife edge to 3 ft, is about 50 ft long, and plunges very steeply southeast (section A-A', pl. 14). Evidently it was emplaced along a fault or shear zone, as shown by the marked discrepancies in attitude of the country-rock schistosity on its two sides.

The top of another pegmatite lens is exposed in the lower part of the shaft, and similar thin, lenticular

pegmatites were mined in the Amber Queen workings to the southeast. In the main Amber Queen open-cut at least one chain of lenses strikes east-northeast and dips steeply south-southeast. Two similar chains are said to have been encountered at higher levels in this pit, but no traces of them can be seen in the present walls. A fourth series of lenses is exposed in the other two pits to the south.

The pegmatite is a medium-grained aggregate of plagioclase, quartz, perthite, and mica. The feldspars are kaolinized to depths of 30 ft or more. Spessartite is the only common accessory mineral. Most of the mica is scattered rather evenly throughout the pegmatite, but a few relatively rich pockets have been encountered in mining. The books are 1 to 18 in. in diameter, with an average of about 5 in. Some 65-lb books were obtained from the Amber Queen workings, and three 70-lb books are said to have been taken from the main Monteiro drifts.

The mica is clear, deep brownish olive to cinnamon brown and is hard, flat, and free splitting. Near-surface books are stained by clay and limonite. The chief defects are hair cracks, ruling, and local faint "A" structure. Many of the books yield trimmed sheets 4 by 4 in. or larger, and some 2- to 5-in. ribbon mica has been obtained. In general the quality is excellent, and nearly half the sheet material obtained during recent operations has been classed as no. 1.

Analysis of mining data for a period of several months in 1944 indicates that the main Monteiro pegmatite body yielded 4.5 percent mine-run mica. The proportion of recovered trimmed punch and sheet material in the books amounted to 6 percent. Such substantial recoveries of high-quality material suggest that exploration for other pegmatite lenses might yield a satisfactory return. The mine and prospect workings might well be extended to the northwest or southeast along the main pegmatite zone, for the results of past operations seem to indicate that much or most of the pegmatite in this zone contains mica. However, continued mining, especially at deeper levels, will necessitate the handling of a heavy flow of ground water.

HERBB NO. 1 MINE

The workings of the Herbb No. 1 mine (location 23, pl. 13) are in Powhatan County, 3.4 miles northeast of Flat Rock and about 0.9 mile northeast of the White Peak No. 1 mine (location 24, pl. 13). Surface exploration of the deposit was carried on during the spring of 1944 by Colonial Homes, Inc., of Richmond, under the direction of Carl Fleming, its president. Six deep trenches were excavated in thoroughly weathered rock, and a pit 100 ft long, 15 to 50 ft wide, and 17 ft in maximum depth was later dug.

A fairly large pegmatite dike is exposed in the pit and in trench 1 (fig. 71), where it is enclosed by thinly

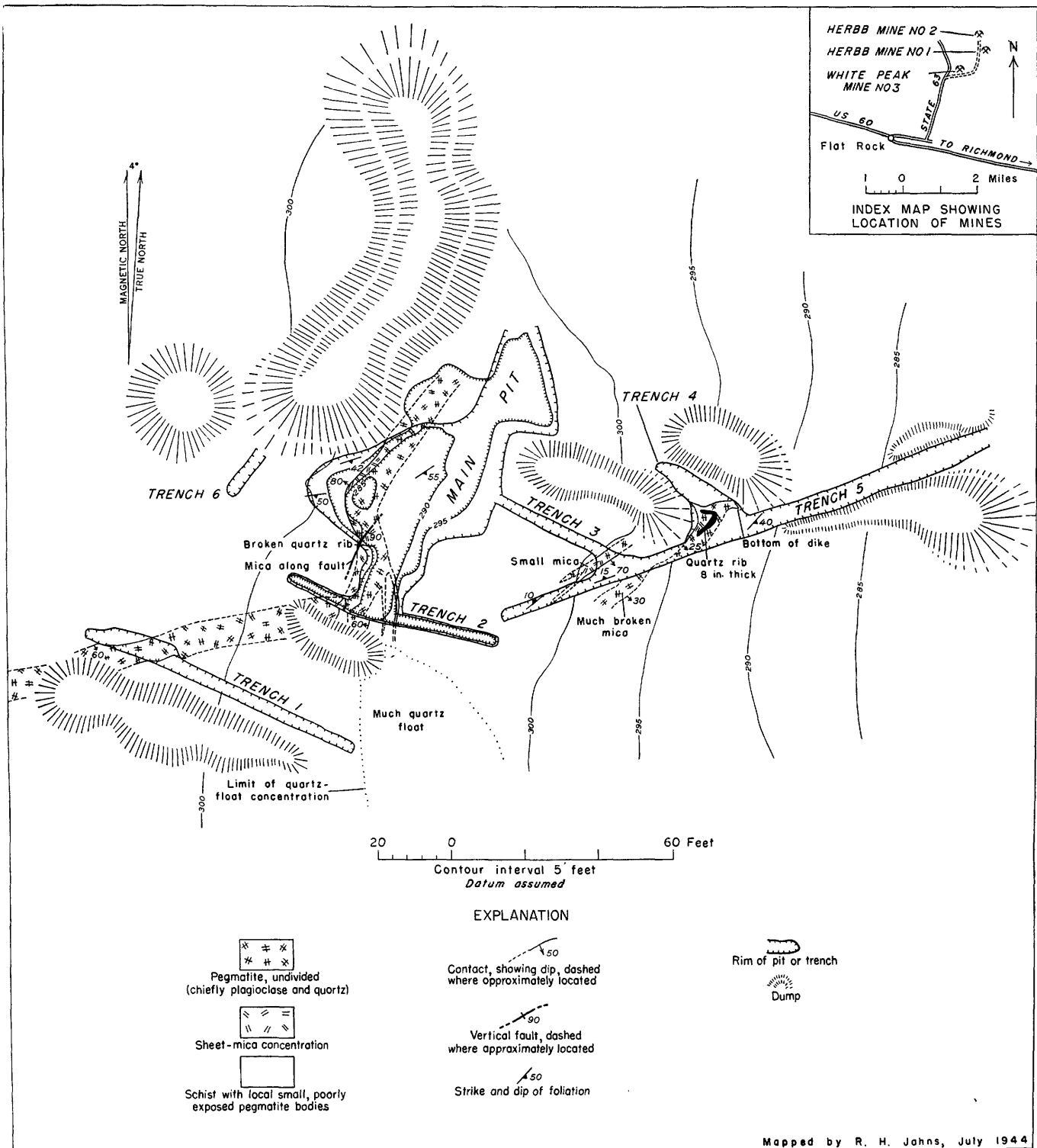


FIGURE 71.—Geologic map of the Herbb No. 1 mine, Powhatan County, Va.

layered quartz-biotite schist whose foliation strikes N. 40° to 80° E. and dips 10° to 20° NW. and 40° to 60° SE. Smaller pegmatite bodies were encountered in the other trenches. They tend to "horsetail" and pinch out along their strikes, and several lenslike masses are bottomed in a way to suggest an arrangement en echelon in vertical section. Most strike east-northeast to northeast and dip southeast. The main dike, however, swings sharply

north at trench 2, and in the pit it trends north to north-northeast and dips steeply west. Several thin branches extend southward from the trench toward an area of abundant quartz float.

Most of the pegmatite is a medium- to fine-grained intergrowth of kaolinized feldspar and anhedral quartz. Some of the feldspar in the central part of the main dike appears to have been perthite. Concentrations of scrap

mica occur along the hanging wall of this dike, as well as near a small fault exposed on the west wall of the pit. Books that would yield sheet mica are clustered along the margins of small quartz lenses that form a discontinuous core. Most of the sheet mica obtained from the deposit, however, occurred in the thinner pegmatite bodies exposed in trenches 3, 4, and 5. The maximum diameter of the books is 8 in., and the average size is 3 by 5 in. or smaller. The mica is brownish olive to deep brown and is flat, free splitting, and clear. The chief defects are clay staining, ruling, and breaks.

HERBB NO. 2 MINE

The Herbb No. 2 mine, also in Powhatan County, is 3.6 miles northeast of Flat Rock and 0.45 mile north-northwest of the Herbb No. 1 mine (location 23, pl. 72). The workings are dragline excavations that were made during the spring of 1944 by Colonial Homes, Inc., of Richmond. At least four deep trenches were dug across the pegmatite body, and a fifth follows it in a northerly direction. The two southernmost trenches were partly obliterated by a later cut, which is 125 ft long, 20 to 40 ft wide, and 20 ft in maximum depth (fig. 72).

The pegmatite body, which appears to be an elongate lens that cuts the foliation of the enclosing schist, trends north-northeast and dips east-southeast in the pit, where it is 4 to 25 ft thick. It is about 45 ft in maximum outcrop breadth at the north end of the pit. In the northernmost trenches its walls converge rapidly downward, and its keel probably is very near the surface (section *A-A'* fig. 72). This keel may well plunge gently south; hence its surface trace may not be far north of the workings. A large inclusion or septum of schist is exposed at the north end of the pit (section *B-B'*), but its surface relations are obscured by piles of dump material. The foliation of the thoroughly weathered biotite schist country rock dips rather gently.

The pegmatite is mineralogically complex, and, though not well enough exposed for systematic detailed study, appears to be strikingly similar to the Morefield and Rutherford pegmatites in Amelia County. A discontinuous core of massive quartz lenses 1 to 5 ft thick and 10 to 25 ft long is surrounded by an intermediate zone of coarse, blocky green perthite (amazon stone) and flesh-colored to reddish perthite. The wall zone, which is 2 to 4 ft thick, appears to have been a medium- to coarse-grained aggregate of perthite, quartz, and possibly plagioclase. Much of this material, however, has been corroded and almost completely replaced by albite, which occurs as fine-grained, sugary-textured aggregates and as clusters of platy cleavelandite crystals. The distribution of the late-stage feldspar appears to have been governed by fractures, cleavage cracks in perthite crystals, and cracks between individual mineral grains, but kaolinization is too thorough to permit detailed study of the relations in most places.

In the potash feldspar of the intermediate zone, which is distinctly less weathered, the fracture control of the distribution of albite is very plain.

Mica, garnet, and beryl occur in partly albitized perthite, especially adjacent to the quartz masses. The prismatic beryl crystals are as much as 27 in. in diameter and 59 in. or more long. Most are more than 5 in. in diameter, and all have some faces that bear impressions of cleavelandite crystals. Small, lustrous, tabular to equant crystals of columbite-tantalite are scattered through the albitized wall-zone pegmatite and are particularly abundant along the hanging wall opposite the northeast quartz mass in the pit.

The mica is pale yellowish-green to cinnamon-brown material of poor quality. "A" structure is common. Many of the books are soft, buckled, broken, and clay-stained. The majority are small, although a few as much as 14 in. in diameter were noted. Some sheets can be trimmed from the flat parts of the larger books, but the recovery is extremely low. A little sheet mica, several tons of scrap, and about 2 tons of beryl are reported to have been obtained during the mining. The deposit appears to have some commercial possibilities as a source of feldspar, with beryl and scrap mica as byproducts.

WHITE PEAK (PURCELL, MILLER) MINES

The four White Peak mines are 2.5 airline miles northeast of Flat Rock, Powhatan County, and can be reached from that town over Virginia Highway 613 and an ungraded dirt road (location 24, pl. 13). They were opened in 1895 by Messrs. Wells and Miller, of Richmond, and were worked in 1905 by a Mr. Strater. A little exploration was done in 1942 by W. W. Howe, and during the spring and summer of 1944 the mines were operated by the Virginia Manganese Corp., of Richmond. The largest mine, the No. 1, was worked by Jacob Van Doren from July to early December 1944. Production of trimmed sheet and punch mica from this deposit during the period March-December 1944 was very large.

The workings at the No. 1 mine include four power-shovel trenches, two pits, two shafts, and irregular drifts and short crosscuts (pl. 15). Pit 1 is filled with dump material but was 19 feet deep. A shaft sunk from the floor of this pit bottomed in country rock at a depth of 27 ft beneath the surface. The main pit or pit 2, is roughly rectangular in plan, with a maximum length of 60 ft, a width of 10 ft, and a depth of 31 ft at the close of the Virginia Manganese Corp.'s work (fig. 46, chapter A of this series). Van Doren continued mining on the pit floor and sank a shaft from the floor to a depth of 45 ft beneath the surface. A third pit was excavated several feet to the north to a reported maximum depth of 30 ft and then was partly backfilled with waste obtained from a drift driven eastward from its

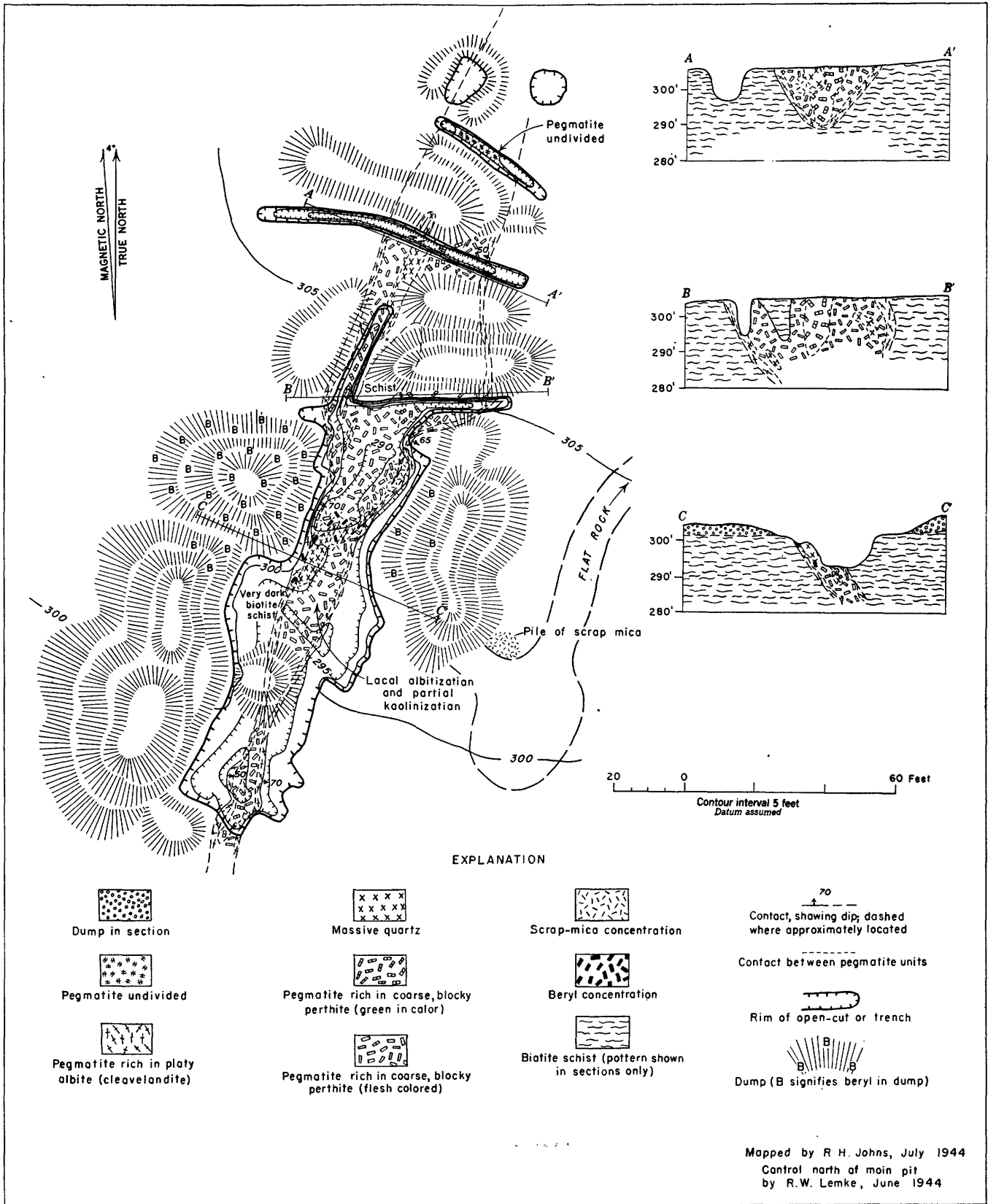


FIGURE 72.—Geologic map and sections of the Herbb No. 2 mine, Powhatan County, Va.

end. This drift was connected with old gopher-hole workings from pit 1.

The country rock is a much-weathered and poorly exposed mica schist, in which the foliation trends north-east and dips gently northwest. The pegmatite body is a lens at least 225 ft long. It is 35 ft in maximum exposed width, and its keel is at least 45 ft deep. It trends slightly north of east, is thickest in and near the mine workings, and tapers westward to trench 3 (pl. 15). In plan its western part curves gently. The country rock is exposed in a shallow cut east of pit 1; hence the deposit may terminate abruptly eastward. This blunt termination probably is the outcrop of the keel, which plunges westward past the bottom of shaft 1 to points beneath the workings from pit 2. Near shaft 2 the south wall of the deposit dips very steeply north, but its dip appears to flatten along the strike in both directions. The north wall is more irregular.

The core of the deposit is 12 ft thick and consists of massive quartz with minor subhedral perthite in blocks as much as 4 ft in diameter. A few blocks occur near the center of the core, but most are concentrated in its outer parts. The core is surrounded by a wall-zone aggregate of plagioclase, interstitial quartz, and large mica books. The plagioclase coarsens inward from the walls of the deposit and is very coarse-grained along the core. All plagioclase is kaolinized, and most of the perthite has become friable through weathering. The thin border zone consists of fine-grained plagioclase and quartz. Alternating layers of medium- and fine-grained feldspathic pegmatite were encountered in the west end of pit 2, but their relations to the other pegmatite units could not be determined.

Mica is moderately abundant in the plagioclase-rich wall zone. Many of the books are well-formed crystals that range in diameter from 6 in. to 4½ ft, with an average of about 12 in. (fig. 47, chapter A of this series). An 868-lb book was obtained during 1944. The mica is clear cinnamon brown, flat, hard, and free splitting. The chief imperfections are ruling, cracks, and clay stains. The average size of recoverable trimmed sheets is about 2 by 3 in., but full-trimmed 8-by-10-in. sheets are not uncommon. More than 25 tons of mine-run mica that was obtained from the deposit during the spring of 1944 yielded 2 to 3 percent trimmed punch and sheet material. The proportion of sheets classified as no. 1 in quality was fairly large.

Much of the mica-rich pegmatite above the 30-ft level appears to have been mined. This work has indicated that the deposit may extend to the greatest depth in the vicinity of shaft 2, and this part of the body probably offers excellent possibilities for future production. The mica books east of the shaft are small and of rather poor quality and probably lie near the keel of the deposit. A 45-ft drift driven west from the shaft at the 42-ft level, however, is in pegmatite that

contains abundant large books of mica. About 16 tons of mine-run books is said to have been recovered in the drift.

The openings of the White Peak No. 2 mine, 1,500 ft southwest of the No. 1, include four power-shovel trenches and several old shallow prospect pits. These expose a pegmatite dike that trends east-northeast and dips very steeply. Where exposed in trench 2 it is about 18 ft thick and dips 70° NNW. A discontinuous core of massive quartz is 1 to 2 ft thick in most places. The rest of the deposit is a medium- to coarse-grained aggregate of kaolinized feldspar with interstitial quartz. Very little book mica is exposed. Some mica obtained from trench 2 is light cinnamon brown; it is marked by "A" structure and is badly broken and of poor quality.

The White Peak No. 3 mine is about 600 ft west of the No. 1. The recent workings comprise seven trenches, 7 to 13 ft deep, that were excavated across the trend of the pegmatite body. Scattered dumps indicate the presence of older, caved workings. The deposit is an irregular lens that is somewhat sinuous in plan but trends north. It dips very steeply and tapers both downward and southward from the main workings near its north end. It is 45 ft in maximum outcrop breadth and at least 400 ft long.

The thickest part of the deposit contains a core of massive quartz about 100 ft long and 15 ft in maximum thickness. This is surrounded by a zone of kaolinized feldspar, interstitial quartz, and scattered mica books. Mica of fairly good quality is exposed in trenches 3, 4, and 5. Most of the large books are concentrated along the margins of the core. They are brown to cinnamon brown, hard, flat, and free splitting. Biotite in books 6 to 10 in. in diameter is abundant in trenches 5, 6, and 7.

The openings at the No. 4 mine, 600 ft northeast of the No. 1, are three power-shovel trenches that were dug in 1944 by the Virginia Manganese Corp. The pegmatite body is less than 200 ft long and is 11 ft in maximum exposed width. It trends east-northeast and dips moderately north-northwest. A discontinuous 2-ft quartz core is surrounded by a kaolinized feldspathic wall zone. Cinnamon-brown muscovite is scattered through the wall zone, but the books are small and badly broken and clay-stained.

FARLEY MINE

The Farley mine is north of Flat Rock, Powhatan County, and can be reached from that town over 1½ miles of Virginia Highway 613 and half a mile of farm road that extends to the west (location 25, pl. 13). The mine workings, a mile S. 65° W. of the farmhouse, include slumped pits and cuts and a shaft said to be 140 ft deep. The deposit strikes N. 35° E. to N. 10° W.

in mica gneiss. A large core of massive quartz is exposed south of the shaft collar, and flat books of brown muscovite are scattered through plagioclase-rich pegmatite that surrounds this core. Some would yield 4-by-5-in. sheets, but many are ruled, broken, and wavy.

CLINTON DOLPHIN MINE

Several mica-bearing pegmatite dikes on the Clinton Dolphin property (location 26, pl. 13), a few miles southeast of the White Peak mines, were worked by Dolphin in 1944. The largest openings are a 28-ft shaft, an open-cut, and an irregular 25-ft inclined tunnel that connects the cut and the shaft. These are about 600 ft east of the creek.

The country rock is feldspathic muscovite-biotite gneiss that is much weathered throughout the mine area. A well-developed foliation strikes N. 10° W. and dips 55° E. The footwall of the pegmatite dike trends N. 20° E. and dips steeply west-northwest. The shaft exposes several pegmatite tongues that dip eastward away from the main body. A similar eastward-dipping tongue was mined in the open-cut and in the southwest half of the drift. It steepens in dip and thins northward toward the shaft.

Most of the deposit is a medium-grained aggregate of quartz and muscovite, with scattered irregular masses of kaolinized feldspar 2 to 4 in. long. These masses constitute as much as 20 percent of the pegmatite. Mica books 8 in. in maximum diameter are scattered through the finer-grained quartz-muscovite pegmatite and are most abundant in the eastward-dipping tongues. The mica is pinkish buff and commonly is in well-formed crystals. It is clear and only slightly clay-stained, but most of the books are badly ruled and crumpled and many are hair-cracked and lightly reeved.

A pit 100 ft north of the main workings was excavated along the footwall of a pegmatite dike that dips west. A 2-ft wall zone of fine-grained quartz and mica contains scattered large books of mica. The west wall of the pit exposes kaolinized plagioclase-rich pegmatite with pockets of granular quartz and small mica. The exposed mica is similar to that in the main workings, but little of it is ruled or crumpled.

A lens of massive quartz is exposed at the property line about a quarter of a mile southeast of the shaft, where it trends N. 20° E. and is about 80 ft long and 25 ft wide. It tapers northward and is 5 to 15 ft wide at its end. Southward it terminates abruptly in a "nose" about 15 ft wide. A pit and a 15-ft incline near the north end of the quartz lens expose gneiss and kaolinized feldspar, and massive quartz is present at the end of the incline. A little mica occurs along the walls of the deposit. It is cinnamon brown and locally is much cracked and broken.

OTHER DEPOSITS

The following descriptions of deposits in Goochland County are based chiefly on data given in Pegau's report (1932):

Nicholas prospect.—The Nicholas prospect is 100 yd southwest of an old farmhouse on Virginia Highway 612. It is 0.3 mile east of Virginia Highway 635, about 1½ miles southeast of Perkinsville, and 5½ miles by road northeast of Goochland (location 12, pl. 13). It was opened in 1916, when about a ton of mica was recovered from a cut 20 ft long and 22 ft deep. The pegmatite dike strikes N. 30° E. and dips 60° ESE. in biotite gneiss. The country-rock foliation also strikes N. 30° E. but dips gently west-northwest. The deposit consists of kaolinized plagioclase, quartz, perthite, and muscovite. Flat brownish mica books are scattered near the walls, and brown to brownish-olive flat-A books are more abundant in the central, perthite-rich part of the deposit. The largest books are about 6 in. in diameter.

Wiltshire prospect.—A prospect on the Wiltshire tract, half a mile south of Perkinsville (location 13, pl. 13), was opened about 1900 and reopened in 1915. The main cut is 20 ft long, 10 ft wide, and 20 ft deep. It exposes a nearly vertical pegmatite dike that is 5 ft thick and strikes N. 45° W. in mica schist and gneiss. The country rock contains many sill-like pegmatite stringers. The deposit splits into two prongs at the northwest end of the cut. The pegmatite minerals include plagioclase, perthite, quartz, muscovite, and garnet. Both flat and flat-A books of brown mica are scattered through the deposit.

Slayden mine.—The Slayden mine is on the east side of a country road, about 2 miles by road west-southwest of Perkinsville and 3 airline miles north-northeast of Goochland (location 15, pl. 13). The deposit is said to strike west-northwest and to dip very steeply in mica schist. Small flakes of brown mica are abundant in the dumps from several old cuts and caved shafts.

Salter prospect.—The Salter prospect, on a west slope half a mile west of Virginia Highway 49 and 3 airline miles N. 15° W. of Goochland (location 16, pl. 13), consists of several shallow cuts and a pit 25 ft in diameter and about 20 ft deep. A pegmatite dike 5 ft or less in thickness is said to have yielded small quantities of good sheet mica as much as 4 in. in diameter. Several smaller dikes, evidently offshoots from the main deposit, contain sillimanite.

Turner prospect.—The Turner prospect, about half a mile south of the Monteiro-Amber Queen mine and 2.7 airline miles northeast of Goochland (location 17, pl. 13), consists of at least two shallow pits and a cut 70 ft long that were sunk in mica-bearing pegmatite about 1905. The deposit trends northwest and dips steeply in thinly foliated mica schist. Clay-stained fragments of brown mica are present in the dumps.

Irwin mine.—The Irwin mine, on the southwest side of Virginia Highway 6 and 2 miles by road west-northwest of Goochland (location 18, pl. 13), was first worked about 1897. The main openings are a cut 25 ft wide and 20 ft deep, a smaller pit, and a shaft reported to be 50 ft deep. The pegmatite dike strikes east-northeast and dips very steeply north-northwest. It appears to cut across a syncline in the mica gneiss country rock, which contains many pegmatitic stringers and pods. Book muscovite of fairly good quality is scattered through a medium- to coarse-grained aggregate of chalky white plagioclase, gray to smoky quartz, and minor flesh-colored perthite. The mica is clear and light brown. Some of the books are cracked and slightly warped.

Bradshaw prospect.—Clay-stained fragments of light-brown mica are present in the dumps from two old pits at the Bradshaw prospect, which is on the west side of Virginia Highway 634 about 1 mile north-northeast of Goochland (location 20, pl. 13).

Three additional descriptions of deposits in Goochland County are based upon the data of the Colonial Mica Corporation:

Reed mine.—The mine of Mrs. E. P. Reed $1\frac{3}{4}$ miles N. 20° W. of Maidens station on the Chesapeake and Ohio Railroad (location 19, pl. 13), was opened about 1895 and worked for several years. The main opening is a cut 75 ft long, 25 ft wide, and 20 ft deep. Shafts and drifts were once connected with the cut but are now caved. The deposit may strike northwest and dip steeply. The dumps contain small fragments of clear, light-brown mica. These are flat, free splitting, and of good quality.

Swann prospect.—The Swann prospect is about half a mile east-northeast of the James River and a similar distance west-northwest of Goochland (location 21, pl. 13). Several thin pegmatite dikes are said to have yielded small quantities of light-brown sheet mica many years ago.

Lewis prospect.—A prospect on the H. B. Lewis property, 0.2 mile north of Community Church and three-fourths of a mile west of Little Byrd Creek (location 22, pl. 13), was opened many years ago. A thin pegmatite dike containing mica books as much as 8 in. in diameter was exposed in a 10- to 12-ft pit.

FLUVANNA COUNTY

Information concerning the Haden prospect, which consists of several shallow pits dug in 1943 on the property of P. W. Haden, a quarter of a mile south of Hardware (location 27, pl. 13), was obtained from the Colonial Mica Corporation. The pits expose thin stringers of quartzose pegmatite that contains small flakes of mica.

BUCKINGHAM COUNTY

The descriptions of the following two deposits are based upon information provided by the Colonial Mica Corporation:

Forbes deposit.—Mica-bearing pegmatite crops out on the property of Mrs. Ira D. Forbes, a short distance southwest of Sheppards (location 28, pl. 13). The mica is free splitting and clear, and some of the books are large.

Myers prospect.—Two shallow pits were dug many years ago on the J. P. Myers property, 200 ft south of a point on Virginia Highway 613 that is 2 miles northeast of its junction with Virginia Highway 622. Several vertical pegmatite dikes strike northeast in weathered mica schist. They are 1 to 2 ft thick, and some are 300 ft long. They lie several feet apart. Mica books as much as 5 in. in diameter are locally abundant, and some 10-in. books are reported. The mica is green and lightly mineral-stained. Most is marked by "A" structure.

PRINCE EDWARD COUNTY

The Wheeler mica prospect is on the John Wheeler property and can be reached from Hampton Sidney College over a quarter of a mile of Virginia Highway 665 and $6\frac{1}{4}$ miles of country roads. A series of pits exposes a deposit of feldspar and high-grade vermiculite. This description is based upon information from the Colonial Mica Corporation.

CHARLOTTE COUNTY: CULLEN-CHARLOTTE COURT HOUSE AREA

GENERAL FEATURES

About 50 mica deposits are known in Charlotte County. Many of these occur in a narrow belt that extends southward from Cullen to a point near the junction of Wards Fork and Roanoke Creek. Most of this 10-mile belt is in rolling Piedmont country that is drained by westward- and southwestward-flowing tributaries of Wards Fork. The main line of the Virginian Railway crosses the northern part of the county, and the Richmond-Danville line of the Southern Railway lies south of the main mica belt. Virginia Highways 26, 40, and 47, as well as a network of fair to good secondary roads, provide adequate access to nearly all the deposits.

The chief rock type in the area is a feldspathic muscovite-biotite schist. It contains abundant layers of hornblende gneiss in many places. Still-like masses of white granite and coarse-grained pegmatite are locally abundant.

PEGMATITES

The pegmatite bodies range in thickness from a few inches to 10 ft or more. Most are essentially concordant but pinch and swell markedly along their strike and down their dip. The dip of some deposits alternately

flattens and steepens as traced downward, so that a step-like structure is formed.

Most of the pegmatite bodies contain cores of massive quartz, intermediate zones rich in coarse, blocky perthite, wall zones of plagioclase, quartz, and muscovite and border zones similar in composition to the wall zones but finer-grained. A few small pegmatite bodies consist almost wholly of plagioclase and quartz. Yellow and green beryl occurs in the massive quartz and perthite of the Crews No. 1 deposit and has been reported elsewhere in the district. Other accessory minerals include widespread spessartite and local tourmaline and biotite.

Flat books of muscovite occur in quartzose nodules in some plagioclase-quartz pegmatite, whereas flat-A books characteristically occur in perthite along the margins of massive quartz bodies. Much of the mica in the district is stained, although a few deposits, especially those west of Charlotte Court House, contain clear mica. All the sheets are flat, hard, and light green to brownish olive. Many trimmed sheets 2 by 3 in. and larger have been recovered.

Production of mica from the district has been small and has consisted chiefly of scrap and trimmed electric-grade sheet mica. Most of the latest prospecting and mining were done in the northern part of the pegmatite belt by C. T. Crews, of Cullen, in 1943. The large number of deposits, the rather large size and flatness of the book mica that they contain, and the small amount of exploration done on most of the pegmatite bodies suggest that further work might reveal workable concentrations of stained mica or of blocky perthite.

DESCRIPTIONS OF DEPOSITS

CREWS NO. 1 PROSPECT

The Crews No. 1 prospect is near the residence of C. T. Crews, about a mile north of Cullen (location 29, pl. 13). Two pits expose a pegmatite body that strikes N. 15° to 20° E. and is known to be several hundred feet long. It contains a discontinuous core of quartz and an intermediate zone rich in coarse, blocky perthite. The wall zone probably is rich in plagioclase.

The pegmatite in the south pit, near the house, apparently contains little large mica, but flat-A books as much as a foot long are moderately abundant in the north pit. Some of these books yield very flat trimmed sheets 3 by 5 in. in size. Most of the mica is light yellowish olive and moderately to heavily stained by trigonal latticelike inter-growths of hematite. A small proportion of clear sheet mica might be obtained by careful rifting.

CREWS NO. 2 PROSPECT

The Crews no. 2 prospect is near a spring east of the C. T. Crews residence (location 29, pl. 13). Pegmatite is exposed in the spring and in a pit about 70 ft to the

south-southeast. The deposit contains a core of massive white quartz, a perthite-rich intermediate zone, and a wall zone of kaolinized plagioclase, interstitial quartz, and muscovite. Crews states that both flat-A and flat mica books were obtained from the pit. Some of the mica is stained and some is clear, but all is brownish olive. Cracks and ruling are not abundant.

OTHER DEPOSITS

The descriptions of the following three deposits in the Cullen-Charlotte Court House area are based chiefly upon Colonial Mica Corporation data:

Vasser mine.—Pegmatite was encountered in 1937 during the digging of a well on the Vasser property, half a mile north of Virginia Highway 645 and 1.2 miles west of Charlotte Court House (location 30, pl. 13). The vertical pegmatite body strikes east. Flat mica books occur in the wall zone, which is rich in kaolinized feldspar, and "A" books occur in and around a quartz core. Some of the mica is lightly spotted, but most is clear. Trimmed sheets 3 in. in diameter can be obtained from the larger books.

Moore prospect.—A prospect on the Henry Moore property, near Virginia Highway 647 and 2.3 miles south of its junction with Virginia Highway 40 (location 31, pl. 13), was opened by the owner in 1941. A cut 25 ft long and 12 ft deep exposes a pegmatite body that strikes east and dips 35° S. A core of massive quartz appears to be flanked by a coarse perthite-rich intermediate zone. Mica is moderately abundant in the plagioclase-rich pegmatite of the wall zone, especially near the hanging wall of the deposit. It is clear brown. Many of the books are badly reeved and clay stained, and the recovery of sheet mica is low.

Evans prospect.—Heavily black-stained mica is exposed in a small pit on the L. E. Evans property, 100 yd northwest of the intersection of Virginia Highways 649 and 689. Some large flat sheets of electric-grade material can be obtained from the flat-A books.

HALIFAX COUNTY

Information in two deposits in Halifax County was obtained chiefly from data of the Colonial Mica Corporation:

Owens prospect.—A shallow pit on the T. B. Owens property, 1,800 ft west of Virginia Highway 664 and half a mile from Republican Grove (location 32, pl. 13), exposes a pegmatite body that may strike northeast. The deposit contains small, clay-stained books of mica.

Bates mine.—Feldspar was mined intermittently during the period 1927–33 from the Bates deposit, near Virginia Highway 670 and 5 miles north-northwest of Vernon Hill (location 33, pl. 13), by the Clinchfield Sand and Feldspar Corp., of Baltimore, Md. The deposit was later worked by a Mr. Pitts. The pegmatite body, which dips very gently, contains much perthite and many scattered books of clear, very pale green

mica. Most are less than 2 in. in diameter, but 12-in. books are said to have been obtained during the mining operations. The mica is flat and free splitting.

BEDFORD COUNTY: OTTER RIVER-MONETA AREA

GENERAL FEATURES

The Otter River-Moneta pegmatite deposits occupy a well-defined belt 30 miles long and 2 to 5 miles wide. This belt extends from a point near Lynchburg south-eastward through eastern Bedford County to the Roanoke River (pl. 13). The area is one of moderate relief, with altitudes ranging from about 500 ft along the James River to 1,150 ft on Stone Mountain. Rail transportation in the northern part of the area is provided by the main line of the Norfolk and Western Railway, in the southern part by the main line of the Virginian Railway. The James River line of the Chesapeake and Ohio Railway lies north of the area. U.S. Highway 460, Virginia Highways 122 and 43, and many good secondary roads form a network over the entire pegmatite belt. As little mica has been obtained from this area, it received less attention than other districts during the mica investigations. It is discussed in more detail by Pegau, who gives detailed location maps (Pegau, 1932, pp. 81-90).

A large mass of the Lovingson granite gneiss, an augen gneiss of quartz monzonitic composition, lies northwest of the belt (Stose, Jonas, and others, 1928). Many large tongues of this rock extend southwestward into the area from the mass east and northeast of Bedford (fig. 73). Most of the pegmatite belt itself is underlain by older crystalline rocks, chiefly biotite gneiss and schist with local layers of hornblende gneiss and dioritic rocks. These enclose regular sill-like masses of hornblende gneiss and gabbro, at least two of which are very large (fig. 73). Most of the schists and gneisses are very feldspathic and contain many stringers and concordant pods of granite and pegmatite. The foliation of all the rocks trends northeast to east-northeast, with steep northwesterly and southeasterly dips.

PEGMATITES

The pegmatite bodies are unusually large and in general are markedly more persistent than those in other areas. They contain much coarse-grained feldspar and relatively little mica. Most are long, thick, lens-like sills, but some cut across the country-rock structure at low angles. A few are as much as 350 ft thick, but more range from 20 to 50 ft. Some are simple in structure, whereas others are marked by complicated branches or abundant irregular apophyses. The general trend of the pegmatites is northeast to east-northeast, parallel with the country-rock structure. A few plunge gently northeast or southwest. Most of the contacts between pegmatite and country rock are sharp, but in some areas they are marked by 1- to

6-ft zones of lit-par-lit structure, as well as by broader zones in which the country rock is thoroughly impregnated with pegmatitic material.

The pegmatites are very coarse grained and are rudely but distinctly zoned. Many contain irregular cores of massive quartz with local large blocks of perthite; intermediate zones that are rich in coarse, blocky perthite and graphic granite; coarse-grained plagioclase-perthite-quartz wall zones; and fine-grained border zones that consist of plagioclase, biotite, muscovite, and quartz. Much of the border-zone biotite may have been developed as a result of contamination from country-rock material. Garnet is the most abundant and widespread accessory mineral, and others include tourmaline, pyrite, pyrrhotite, and other sulfide species, rutile, thulite, zoisite, and tantalite.

Most of the mica books are scattered sparsely through the wall zones or occur in irregular shoots within the inner pegmatite units. The mica is characteristically light brown to cinnamon brown and is hard and flat. "A" structure is common only in the largest books that occur in intermediate zones and cores. The most widespread defects are ruling, tangled intergrowths, some clay stains, and inclusions of biotite and garnet. The proportion of mica in the pegmatites is low, but the proportion of trimmed sheet mica ordinarily recoverable from the larger books is high.

MINING AND PRODUCTION

The earliest mining in the area is said to have been done near Forest, and subsequent operations were carried on in the vicinity of Moneta and Bells. Many of the deposits were first worked for kaolin, and later, when mining was carried beneath the weathered zone, they yielded feldspar and as a byproduct, mica. The total production of feldspar from the area amounts to at least 250,000 tons. Large-scale quarrying was begun in 1923 near Moneta by the Moneta Mining and Milling Co., which was succeeded by the Clinchfield Sand and Feldspar Co. Other active operators in the district include the Consolidated Feldspar Co. and the Seaboard Feldspar Co. Most of the mica produced in the area is a byproduct from feldspar operations, but additional quantities are obtained by small-scale operators and lessees. Much of the feldspar mined in the area was once trucked to a grinding plant at Brookneal, in southeastern Campbell County, but at least two grinding plants are now active within the area. Glass spar is ground by the Consolidated Feldspar Corp. in Bedford, and a general-purpose mill is maintained in the same town by the Clinchfield Sand and Feldspar Co.

DESCRIPTIONS OF DEPOSITS OVERSTREET MINE

The Overstreet mine (location 42, pl. 13) is about 300 ft southwest of a graveyard on the Hadens Branch

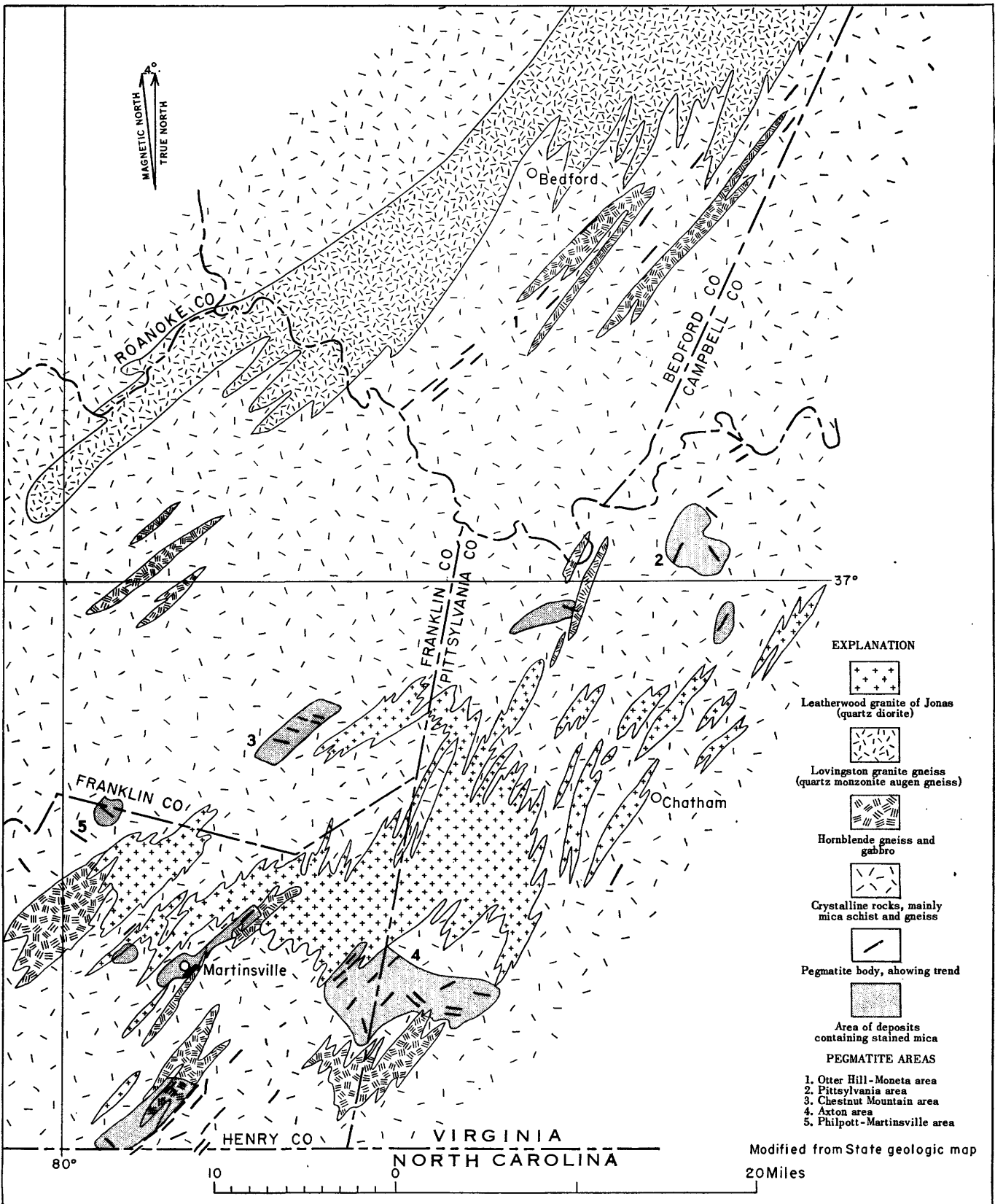


FIGURE 73.—Geologic sketch map of a part of southwestern Virginia.

road and about $7\frac{1}{2}$ miles east-northeast of Moneta. It is owned by H. A. Crouch, of Bedford, and was last operated in 1943 and 1944 by the Clinchfield Sand and Feldspar Corp. The principal opening is a pit 30 ft in diameter and 10 ft deep. The vertical pegmatite dike strikes northeast in biotite schist. It is 25 ft thick and contains moderately rich concentrations of "A" mica books along its east wall. The mica is brown, and some is stained.

WHEATLEY (MONETA) MINE

The Wheatley mine, about a mile east-southeast of Moneta (location 45, pl. 13), was opened in 1923 by the Moneta Mining and Milling Co. Later operators were the Seaboard Feldspar Co., of Richmond, Va., and the Clinchfield Sand and Feldspar Corp., of Baltimore, Md. The principal output from the deposit has been potash feldspar, with some soda feldspar and quartz. Approximately 90,000 tons of feldspar is said to have been shipped from the mine during the period 1934-44, and about 40 lb of tantalite is said to have been recovered during the early operations. A very little mica is sold from time to time as a byproduct.

The mine is a large open pit 640 ft long, 100 ft in average width, and about 100 ft in average depth (pl. 16). From its east-northeast end a drift 80 ft wide and 45 ft high extends 65 ft east. A prospect cut excavated by Wesley Hicks, of Bedford, lies about 500 ft northeast of the main pit. It is 80 ft long and about 20 ft. in average width. Other, smaller pits are lower on the hill slope west-southwest of the main pit.

The large pegmatite dike trends east-northeast and dips steeply southeast. It is continuously exposed for a strike length of 630 ft and is about 125 ft in maximum thickness. The walls are not well exposed but appear to be very irregular. Near the north corner of the main pit a pendant of country-rock schist extends downward into the deposit to a depth of about 55 ft beneath the surface (section A-A', pl. 16). The pegmatite dike appears to taper northeast of this pendant. It thins markedly west-southwest of the main pit and is offset a short distance along at least one cross fault. The country rock is chiefly dark-gray hornblende-biotite schist that is thoroughly weathered near the surface. A well-developed foliation is generally parallel with the pegmatite contacts but in places is sharply cut by them.

The pegmatite consists chiefly of light gray to pale greenish perthite, white calcic albite, and quartz, with minor muscovite, biotite, garnet, and thulite. It is very rudely zoned. The central part of the deposit is composed mainly of very large crystals and irregular blocks of potash feldspar in white to dark-gray massive quartz. This rock grades outward into perthite-plagioclase-quartz pegmatite that contains graphic granite masses of giant size. The wall zone contains much medium-

to coarse-grained plagioclase, and the thin border zone is similar in composition but finer-grained. This unit locally contains abundant biotite. The zones characteristically grade into one another, so that it is virtually impossible to assign their boundaries on a large-scale map.

The plagioclase is thoroughly kaolinized to depths of 20 to 40 ft. The microcline is much less weathered but is distinctly friable and chalky near the surface. Some of the coarse perthite blocks contain thin blades of biotite that appear to have been formed along fracture planes. Books of brown to brownish-olive muscovite are scattered very sparsely through the wall zone. Spessartite occurs as clusters of small crystals and as individual crystals as much as half an inch in diameter, particularly in plagioclase. Pale-pink radial aggregates of thulite as much as 2 in. in maximum dimension occur sporadically in the plagioclase of the wall zone. Greenish-gray zoisite also is present.

Most of the no. 1 feldspar shipped from the mine was taken from the central part of the deposit, where about 5 tons of waste is mined per ton of recovered spar. The potash content of four analyzed samples of the no. 1 perthite was 11.92, 12.80, 13.90, and 12.23 percent, respectively (theoretical maximum, 16.9), and the last of these contained 3.51 percent soda (Pegau, 1932, p. 86). The intermediate zone, which is rich in graphic granite, yields no. 2 potash feldspar, as well as a mixed perthite-plagioclase product that is somewhat diluted with quartz. The core of the deposit appears to plunge very gently east-northeast; it was encountered at deeper levels as mining progressed. Much feldspar-bearing pegmatite appears to remain in the deposit beyond the present mine workings.

YOUNG MINE

The Young mine is on the south side of a hill a mile south of Moneta (location 47, pl. 13). It was opened about 1923 by a Mr. Young and was later operated for several years by the Seaboard Feldspar Co. Three large open-cuts were excavated on the hill slope. The main, or middle, cut was cleaned out during the summer of 1944 by Morgan Nance, of Moneta, who was mining the deposit when it was visited in June 1945.

The main cut is 200 ft long, 20 to 80 ft wide, and 70 ft deep at its east end. It exposes a large pegmatite dike that strikes N. 60° E. and dips very steeply south-southeast in thinly foliated amphibole schist. The country rock, which is much weathered near the surface, strikes east-northeast to northeast and dips steeply south-southeast to southeast. The deposit is about 40 ft in maximum thickness but tapers out at the southwest end of the main pit. This appears to be the outcrop of its keel, which plunges 25° to 30° ENE.

The fine-grained border zone of the deposit is $\frac{1}{16}$ to 1 in. thick and consists of plagioclase, quartz, and mica. The well-defined wall zone is a medium-grained aggre-

gate of plagioclase and quartz with minor perthite. It is 1 to 6 ft thick, with an average of about 3 ft. Its inner part contains scattered large masses of perthite, some of which are euhedral. The wall zone grades inward into a very coarse grained perthite-quartz intermediate zone, and it in turn grades into a core of massive quartz with abundant irregular to euhedral perthite crystals. Much of the perthite in the outer part of the core and the adjacent inner part of the intermediate zone contains intergrown quartz, which commonly occurs as long, thin tablets, rather than as spindles or rods. Accessory minerals include spessartite, which is most abundant in the wall zone, pyrite and pyrrhotite, which generally occur along fractures in quartz, and minor rutile.

Muscovite is most abundant in the inner part of the wall zone, where it is associated with both plagioclase and potash feldspar. It occurs as long strips, as aggregates of small books in quartz, and as well-formed crystals as much as 4 in. in diameter. It is dark brown, and most of it is clear. Some books contain irregular green primary vegetable stains and curdy brown spots. Much of the mica is very lumpy and badly ruled, and some crystals contain intergrown biotite and inclusions of garnet.

The core yields nearly all the no. 1 feldspar produced from the deposit. It has been mined from its outcrop east-northeastward down its plunge and is underlain by the graphic granite-rich part of the intermediate zone. The microcline in the core is coarsely perthitic and light gray to pale apple green. Nance estimates that about 8 tons of waste is handled per ton of no. 1 spar produced from the core and that 5 or 6 tons of waste is handled per ton of no. 2 spar.

A second open pit, 75 ft long, 20 to 45 ft wide, and 55 ft in maximum depth, lies northwest of the main quarry. It exposes three pegmatite dikes that are 12 to 16 ft thick. They strike east-northeast and dip very steeply. Feldspar of good grade is said to have been produced from this opening as late as 1933. A third, somewhat smaller pit is southeast of the main opening. It appears to have lain idle for many years, and the walls are much slumped. The pegmatite dike is large and probably trends east-northeast to northeast. It contains abundant coarse perthite, graphic granite, and kaolinized plagioclase.

BARN CLAY MINE

The Barn Clay mine (location 47, pl. 26), about half a mile southwest of the Young mine and 1½ miles by road south of Moneta, was opened in the spring of 1945. A cut was excavated in soft kaolinized pegmatite on an eastward-facing hillside. The deposit appears to be large and contains many coarse masses of partly weathered perthite. Several shipments of feldspar had been made when it was visited in June 1945.

OTHER DEPOSITS

The following descriptions were in part abstracted from the report of Pegau (1932):

Ivy prospect.—The Ivy deposit, 1½ miles northwest of Rode station on the Norfolk and Western Railway and about 3 airline miles north-northeast of Forest (location 34, pl. 13), was prospected many years ago for kaolin and muscovite. Several cuts and shallow shafts expose two parallel dikes that strike N. 60° E. and are about 200 ft apart. The northwest dike is 15 ft wide and the southeast dike 25 ft wide. Nearly all the mica is of poor quality.

Radford prospect.—The Radford prospect is in the bottom of a valley 1 mile west of Rode station and 2 airline miles northeast of Forest (location 35, pl. 13). The pegmatite dike is 10 ft wide and strikes N. 50° E. Where exposed it consists chiefly of kaolinized feldspar with fragments of quartz and small, clay-stained books of mica.

Everett prospect.—The Everett prospect, on the northeast side of a small stream 2½ airline miles west of Forest (location 36, pl. 13), is an open-cut 150 ft long, 30 ft wide, and 60 ft deep. Several carloads of kaolin were shipped from the deposit for the pottery trade, and a little scrap mica was recovered as a by-product. The dike is 15 ft or more thick and trends north-northeast, but the trend swings to N. 85° E. at the northeast end of the cut. The deposit consists chiefly of kaolinized feldspar, interstitial quartz, small books of mica, and accessory spessartite.

Harris prospects.—The Harris prospects are on both sides of a small stream about 4 airline miles west-southwest of Forest (location 37, pl. 13). They are at least half a mile apart, apparently on different dikes. The east dike is about 75 ft wide and is rich in very coarse, partly kaolinized perthite. Plagioclase is present along and near the walls. The west dike is 25 ft wide, and it also contains coarse perthite. Little mica is present in either deposit.

Other feldspar-bearing pegmatite bodies are exposed in the areas northeast and southwest of the prospects.

Bells mines.—The Bells mines are east of the Otter River (location 38, pl. 13) and about a mile south of Bells. Several pegmatite bodies on the property were prospected for feldspar during World War I, and shipments are said to have been made from time to time. Extensive work was done in five dikes during 1928 by the Clinchfield Sand and Feldspar Co. Most of the dikes strike N. 50° E. and dip steeply southeast. They are 5 to 50 ft wide and are rich in coarse perthite. Muscovite, biotite, and garnet are minor constituents. Some of the perthite was analyzed by John H. Yoe, who reported 12.07 percent potash and 1.80 percent soda (Pegau, 1932, p. 88).

A small dike that crops out on the riverbank was prospected by means of several pits, and in 1931 and

1932 it was mined through two shafts about 25 ft apart. Several carloads of feldspar are reported to have been shipped. A dike 100 ft wide crops out 20 ft to the southeast and can be traced for a considerable distance northeastward along the strike. It contains many large tabular inclusions of wall rock along its southwest contact. A 15-ft dike is exposed 150 ft to the southeast, and a 40-ft dike that is richer in muscovite than the other deposits crops out 300 ft to the southeast. It yielded two carloads of scrap mica during the summer of 1928. A fifth dike, 100 ft southeast of the mica-bearing deposit, is 25 ft wide and finer-grained than the others.

A feldspar deposit a quarter of a mile southeast of the riverbank workings was mined for about 2 years by the Seaboard Feldspar Co. A pit 150 ft long, 25 ft wide, and 50 ft deep exposes a 50 ft dike that strikes N. 50° E. and dips steeply southeast. Large quantities of good feldspar are said to have been obtained, but the deposit appears to be exhausted.

Otter Hill (American Asbestos Co.) mine.—The Otter Hill mine (location 40, pl. 13) is on the northwest side of a small northeast-flowing tributary of the Otter River, 2¾ airline miles east-northeast of Otter Hill and a similar distance south-southwest of Bells. The pegmatite body is a nearly vertical sill that strikes N. 30° E. in weathered hornblende schist or schistose gabbro. It was worked many years ago by the American Asbestos Co., first in an open-cut 30 ft long and 20 ft deep that was driven northwestward into the hillside about 30 ft above the creek and later by means of a 30-ft shaft from the end of the cut. Subsequently five prospect pits were dug southwest of the cut.

The sill is 20 to 30 ft thick. Its east half is rich in kaolinized feldspar, but its west half contains more quartz and mica. Some of the quartz occurs as irregular masses and as small sheets or lenses parallel with the pegmatite walls. At least one wall-rock inclusion is reported. Spessarite occurs as flattened inclusions in muscovite, as scattered crystals, and as large, coarsely crystalline aggregates in feldspathic pegmatite. Some of the book mica is large, but most is strongly marked by "A" structure. Some large sheets are said to have been obtained from flat parts of the books.

Hottinger mine.—The Hottinger mine is several hundred yards southwest of the Little Otter River, (location 39, pl. 13), about 7 miles by road east of Bedford and 1.8 airline miles north-northwest of Otter Hill. It is on the John Mitchell property and was opened in 1929 by the Seaboard Feldspar Co. The main opening is a cut 450 ft long, 20 to 50 ft wide, and about 60 ft in maximum depth. The vertical pegmatite dike strikes N. 27° E. and is 35 to 50 ft thick. It consists chiefly of white to very pale green perthite, kaolinized plagioclase, milky to smoky quartz, and scattered muscovite and biotite. Accessory minerals

include garnet and pyrite. Most of the biotite occurs as thin, broad sheets in fracture planes. The muscovite is a clear brown, but nearly all the books are badly warped and broken. The largest feldspar masses are 3 ft in diameter, and much high-grade material is said to have been shipped from the deposit.

Patterson prospect.—The Patterson prospect is several hundred yards northwest of the Hottinger mine (location 39, pl. 13), on the opposite side of a small stream. An open-cut that was excavated across a low ridge exposes a large feldspar-rich pegmatite dike. The deposit strikes north-northeast and is about 125 ft wide. It contains much coarse perthite kaolinized plagioclase, and quartz, with minor muscovite, biotite, and garnet.

Thurman mine.—The Thurman mine, 4¼ airline miles south-southwest of Otter Hill and 5¼ miles east-northeast of Moneta (location 41, pl. 13), was worked many years ago for feldspar. The large pegmatite body strikes northeast and dips steeply in hornblende schist. The country rock is rich in biotite along the pegmatite contacts. The deposit consists chiefly of coarse perthite with subordinate quartz, thoroughly kaolinized plagioclase, and muscovite.

Miller mine.—The Miller deposit is about 2,000 ft east-northeast of the Young mine and 0.8 airline mile south-southeast of Moneta (location 46, pl. 13). Several carloads of feldspar are said to have been obtained in an open-cut about 1924. The thick pegmatite dike, which strikes N. 60° E. in hornblende schist, is rich in coarse perthite and contains scattered small books of brown mica.

Hales Ford prospects.—The Hales Ford prospects, at the southwest end of the Otter River-Moneta area, are on the northeast side of the Roanoke River 3.6 airline miles southwest of Moneta (location 49, pl. 13). A feldspar deposit that crops out in the river a short distance east of Hales Ford bridge also is exposed in the road, where it appears to consist of three dikes 10, 50, and 60 ft wide. Quartz is very abundant, and some of it contains large, blocky masses of perthite. Most of the exposed feldspar, however, is much finer grained and would be difficult to recover commercially. The deposit contains scattered books of cinnamon-brown muscovite and abundant clusters of spessartite grains.

Nance mine.—The Nance mine, near Morgan Church and half a mile north of Moneta, has been worked intermittently for feldspar since about 1923. The deposit strikes east-northeast and dips steeply in hornblende-rich schist. Coarse perthite is abundant in the inner parts of the pegmatite, and kaolinized plagioclase is present along and near the walls. Scattered books of brown mica occur with the plagioclase.

Three hundred yards southwest of the main open-cut is a prospect opening that exposes mica-bearing pegmatite. It was worked in 1934 and in the spring

of 1944. The mica is brown to cinnamon brown and occurs near the walls of the deposit. Some of the books would yield trimmed sheets 3 in. in diameter.

Nance prospect.—The Nance prospect is $1\frac{3}{4}$ airline miles east of Moneta (location 44, pl. 13). A partly slumped open-cut exposes coarse perthite-rich pegmatite. Small flakes of brown mica are present in the dump.

The reports on the following two prospects are based upon data of the Colonial Mica Corporation:

Morgan prospect.—The Morgan prospect is northeast of the Virginian Railway tracks and 1.6 airline miles east-northeast of Moneta (location 43, pl. 13). The large pegmatite body strikes east-northeast to north-east in hornblende-biotite schist. Coarse, partly kaolinized perthite is exposed in a slumped prospect cut.

Woolridge prospects.—The Woolridge prospects (location 44, pl. 13) are south of a tributary to Goose Creek and 1.3 airline miles east of Moneta. They consist of several cuts and pits that expose pegmatite dikes 20 to 35 ft in outcrop breadth. The deposits strike east-northeast and dip steeply southeast to vertical in thinly foliated hornblende gneiss. The pegmatite minerals include coarse, flesh-colored to pale-green perthite, kaolinized plagioclase, quartz, and a little muscovite and garnet.

PITTSYLVANIA COUNTY: PITTSYLVANIA AREA

GENERAL FEATURES

The irregular Pittsylvania area lies south of the Roanoke River in northern Pittsylvania County (pl. 13). It is 12 miles wide from east to west and 10 miles long, and its northeast corner lies southwest of Alta-vista. It is characterized by rather rough topography, and altitudes range from less than 600 ft along the Roanoke River to more than 1,000 ft on the higher mountain summits. The southeastern part of the area is drained by tributaries of the Bannister River, and the rest by northward flowing tributaries of the Roanoke River. The chief routes of travel are U. S. Highway 29 and the main line of the Southern Railway. The area is served by few secondary routes, and some of the deposits can be reached by trail only.

Most of the bedrock consists of dark-gray biotite gneiss and schist that contain many metacrysts of feldspar. Lenses of marble and sill-like layers of hornblende gneiss are reported to occur in some localities. The foliation in these crystalline rocks trends northeast and dips steeply.

PEGMATITES

The pegmatite bodies are dikes that range in thickness from 5 ft or less to at least 40 ft. A few concordant bodies occur in the southern part of the area, but most of the bodies are very distinctly cross-cutting. They trend northwest to west and generally dip very steeply.

The chief pegmatite minerals are perthite, plagioclase, quartz, and muscovite. Accessory species include garnet, tourmaline, and sulfides. Most of the muscovite is yellowish green to brownish olive and is heavily stained with iron oxides. A few deposits contain books of clear, light yellowish olive mica. Flat, flat-A, and wedge-A books occur in the area, and the largest trimmed sheets are recovered from flat-A material. A substantial output of electric sheet mica has been obtained from the Sycamore mine, but the production from the entire area has not been large. Moreover, little clear mica could be recovered from future operations. Several carloads of feldspar are said to have been shipped from time to time, and some deposits may well merit further attention as sources of feldspar.

DESCRIPTIONS OF DEPOSITS

SYCAMORE (ROACH) MINE

The Sycamore mine is three-quarters of a mile east of Sycamore (location 52, pl. 13) and is owned by Ruth Whitehead and D. H. Whitehead. It has been operated by Robert Roach intermittently since 1905, and substantial quantities of electric-grade mica are said to have been produced. The pegmatite dike trends N. 25° to 30° W. in quartz-mica schist, which trends north-east and dips about 30° SE. The country rock is locally much contorted.

The pegmatite is composed of plagioclase, quartz, and mica. Granular quartz and small mica books are abundant along the walls. A discontinuous quartz core is indicated by large blocks of milky to gray massive quartz in the dumps. No large mica books were seen in place, but a few fragments as much as 8 in. in diameter and several 3-by-4 in. books are present in the dumps. The mica is heavily stained with iron oxides and is slightly clay-stained. Most is free splitting and flat, but some is slightly reeved. Trimmed sheets as large as 14 by 14 in. are reported to have been recovered during the mining.

BROOMFIELD PROSPECTS

A mica deposit on the Broomfield property, 4 miles west of Sycamore (location 55, pl. 13), was prospected in January 1945 by W. F. Stein, of Lynch. The pegmatite dike is at least 25 ft thick and contains much partly weathered perthite in blocks 2 to 5 ft in diameter. Scattered between the perthite blocks are pockets of yellowish olive "A" mica, much of which is badly hair-cracked. Some is also specked. The books range from 1 by 1 to 6 by 8 in. in size, and the largest recoverable trimmed sheets are about 3 in. in diameter.

According to Pegau (1932, pp. 80-81), there are seven older prospects on the same property. They are in a belt a quarter of a mile long that trends N. 80° W. The dumps from pits 5 to 25 ft deep are rich in white to pink kaolin, and they contain reeved and broken

books of mica. Few of the books are more than 5 in. in diameter.

OTHER DEPOSITS

The descriptions of the following two prospects were abstracted from Pegau's report (1932):

Farmer prospect.—The Farmer prospect, 1 mile north of Motley and $3\frac{3}{4}$ airline miles southwest of Altavista (location 50, pl. 13), is 300 yd west of U. S. Highway 29. The deposit is exposed in several pits and open-cuts, one of which is 40 ft deep. Two carloads of feldspar are said to have been shipped. The pegmatite dike is 40 ft wide and is traceable for a distance of 300 yd along its east-northeast strike. It consists of coarse, light-gray to buff-colored perthite, quartz, kaolinized plagioclase, and scattered books of muscovite. Chemical analysis shows that the feldspar is about one-fourth albite.

Motley prospect.—A thoroughly kaolinized pegmatite dike is exposed in an open-cut southeast of the Southern Railway tracks and about half a mile south of Motley (location 51, pl. 13). It strikes N. 50° E., dips 45° SE., and is 45 to 50 ft wide. It pinches out along the strike in both directions from the cut. The schistose country rock strikes N. 60° W. and dips 60° NNE. It contains many stringers and small pods of pegmatitic material. The exposed pegmatite consists of kaolinized feldspar, some unweathered perthite, quartz, and scattered small books of mica.

The following description was abstracted from Sterrett's report (1923):

George Easley mine.—The George Easley mine, 5 miles south-southwest of Chatham (location 58, pl. 13), was opened between 1900 and 1905 and was again operated about 1910. The workings include a 40-ft shaft and two open-cuts that are connected with each other and with the shaft by a 60-ft tunnel and irregular stopes. All are caved. The country rock is garnetiferous mica schist and gneiss that is much contorted near the pegmatite contacts. The foliation trends northeast to east-northeast, with a variable southeasterly dip. The pegmatite body is essentially concordant but cuts across the country-rock structure in detail. It is more than 8 ft thick.

The deposit contains partly kaolinized feldspar, quartz, and bunches of small flat-A and wedge-A muscovite books. Some flat books of fair size also are scattered through the pegmatite. Clay-stained, slightly reeved mica sheets as much as 8 in. in diameter are present in the dumps. The mica is light yellowish green and part of it is slightly specked. Much of it is free splitting, but the proportion of recoverable sheet material is low.

The information in the following reports was obtained mainly from the Colonial Mica Corporation:

Irby mine.—A mine on the Luther Irby property, near Virginia Highway 671 and about 2 miles southeast

of Sycamore (location 53, pl. 13), was worked to a depth of 50 ft by a Mr. Pugh in 1927. The pegmatite dike contains a quartz core and a kaolinized feldspathic wall zone. Heavily stained and reeved mica is reported to be abundant. Some yields 4-by-6-in. sheets.

Lee Shelhorse prospect.—The Shelhorse prospect, near the Irby mine (location 53, pl. 13), consists of several small pits and cuts. Broken and reeved books of heavily stained mica are present in the dumps.

Pickrel mine.—A mine on the M. M. Pickrel property, in a wooded area 0.2 mile south of Virginia Highway 643 and 1.5 miles west of Sycamore (location 54, pl. 13), was worked in 1934. The openings include a 40-ft shaft and several pits. The pegmatite dike is said to strike north to N. 15° E. and dip 25° to 35° W. Flat-A books of stained mica are abundant along the margins of a quartz core.

Mica is reported from seven other localities on the Pickrel property, but clear books are present in only one of the deposits.

J. P. Pullen prospect.—The Pullen prospect, near the west bank of the Pigg River and 1 mile north-northeast of Sandy Level (location 56, pl. 13), consists of several shallow pits and cuts. Fragments of heavily stained mica are present in the dumps.

Murphy deposit.—A pegmatite dike crops out on the property of F. L. Murphy, about 2.5 miles east-northeast of Gretna (location 57, pl. 13). It strikes N. 35° E. in mica schist and is $1\frac{1}{2}$ to 10 ft thick and at least 300 ft long. A thin quartz core is fringed with "A" books of clear, pale yellowish-olive mica. Both perthite and plagioclase are present in the pegmatite that flanks the core.

FRANKLIN COUNTY: CHESTNUT MOUNTAIN AREA

GENERAL FEATURES

Several mica mines and prospects in southeastern Franklin County are grouped in a small area on Chestnut Mountain between Chestnut Creek and Snow Creek. The area is 11 airline miles southeast of Rocky Mount and is served by Virginia Highway 619 and a few secondary roads. It is drained chiefly by small eastward-flowing tributaries of Snow Creek. The topography is rugged, with altitudes ranging from 1,000 to more than 1,500 ft.

PEGMATITES

The pegmatite bodies occur in deeply weathered quartz-mica schist in which a well-developed foliation strikes northeast and dips steeply. An irregular mass of the Leatherwood granite of Jonas, an intrusive rock that is quartz dioritic in composition, lies east of the Chestnut Mountain area (fig. 73). Some of the pegmatite bodies, like those in and near the Center Ridge mine, are concordant, but most are dikes that trend east-southeast and dip steeply south. They are 2 to 30 ft wide, with an average of about 12 ft, and many can

be traced for 600 ft or more along their strike. The country rock adjacent to most of these deposits contains abundant black tourmaline.

Most of the pegmatites are medium- to coarse-grained aggregates of plagioclase, perthite, quartz, and book mica, with accessory garnet, tourmaline, biotite, and beryl. Some contain rich concentrations of mica, most of which is heavily stained with iron oxides. The mica ranges from light brown through greenish olive to green. Most of the greenish books are stained, and many of the brown ones are marred by inclusions of tourmaline. Large sheets can be recovered from the mica in some deposits, whereas others contain shoots of closely spaced small books. Some of the shoots, like those at the Center Ridge mine, might well be worked for scrap.

Most of the large-scale mining in the area was done many years ago, and the total production may well have amounted to several hundred thousand pounds of selected mine-run mica. Work was done in 1942 by the U. S. Mica Manufacturing Co., and since that time lessees and other small-scale operators have carried on operations.

DESCRIPTIONS OF DEPOSITS

CENTER RIDGE MINE

The Center Ridge mine is about 21 miles north of Martinsville and can be reached from that town over U. S. Highway 108, Virginia Highway 619, and a 3-mile dirt road (location 71, pl. 13). It has been worked intermittently since about 1935 and was last leased by A. L. Nelson, of the Nelson Mica Corp. The workings, which are on a steep south slope, comprise five pits and appended irregular drifts and inclines (pl. 17). Pit 1, the main opening, is 30 ft deep and gives access to two short drifts that extend eastward along one of a series of mica-bearing pegmatite bodies. From the east end of pit 2, which is 12 ft deep, an incline extends down the dip of another pegmatite body. Pit 3, farther east, is 10 ft deep and connects with two short drifts that extend eastward.

The country rock is a micaceous schist in which a well-developed foliation strikes north and dips about 45° E. A thoroughly weathered sill of hornblende gneiss or schistose hornblende gabbro is exposed in pit 2. Most of the pegmatite bodies are irregular sills and concordant lenses. Six of these concordant bodies are exposed in pit 1, where they range in thickness from a few inches to 11 ft. Most of the pegmatites are less than 200 ft long, and some are less than 20 ft.

The deposits are nearly uniform aggregates of kaolinized feldspar, interstitial quartz, and muscovite, but a few irregular pods and lenses of massive quartz are present. Tourmaline is a rather widespread accessory mineral, and small beryl crystals occur in the dump from pit 1. Most of the largest mica books are concentrated in the inner parts of the pegmatite bodies,

although mica of scrap grade is scattered irregularly throughout the bodies.

The quality and size of the mica books vary greatly from sill to sill. Much of the mica exposed in pit 1 is small, soft, buckled, heavily specked, and marred by abundant inclusions of tourmaline. Some clear mica is exposed in pit 2, but most of the books are small and heavily specked and contain tourmaline inclusions. It is reported that some large mica books of good quality were mined in this pit. The best mica observed in pit 3 is cinnamon brown, flat, free splitting, and only lightly mineral-specked. Most books are small, and they are sparsely scattered through the pegmatite. Some of the books are ruled, and some contain inclusions of tourmaline. Nearly all the mica obtained during the mining operations was sold as scrap.

OTHER DEPOSITS

The following reports are based primarily upon information obtained from the Colonial Mica Corporation:

Chitwood mine.—The Chitwood mine, owned by C. E. Plybon, can be reached over a mile of dirt road that forks from Virginia Highway 619 at the top of Chestnut Mountain (location 71, pl. 13). The workings include two inclines, 30 and 80 ft long, and an irregular stope that extends 30 ft southwest and 15 ft northeast from the longer incline. These old openings were cleaned out in 1942 by S. Almon, of Rocky Mount.

The pegmatite body strikes N. 55°–60° E. and dips 55°–80° SSE. in mica gneiss. It is 1½ to 7 ft thick and at least 150 yd long. Many irregular apophyses extend into the country rock. The deposit contains muscovite, quartz, kaolinized feldspar, and tourmaline. Mica books are abundant, chiefly in pockety concentrations. The mica is hard and flat, and most is clear. The mine-run books yield a moderately high proportion of trimmed sheets, some of which are as large as 3 by 4 in.

Chimney mine.—The Chimney mine is near a scrap-mica mill half a mile west-southwest of Virginia Highway 619 and 3.4 miles northwest of Virginia Highway 108 (location 71, pl. 13). It is owned by W. E. Woody and was last worked by the Security Development Co. An incline was driven 80 ft down the dip of the deposit, and the mica-bearing pegmatite on both sides was stoped.

The pegmatite body strikes N. 60° W. and dips 55° NNE. in chloritic mica schist. It is 4 ft thick and at least 50 ft long. Mica is scattered through the deposit. Some books are 10 in. in diameter and would yield 2- by 3-in. trimmed sheets. Most of the mica is stained, and nearly all has been processed as scrap.

Plant mine.—The Plant mine, on the southeast side of Chestnut Mountain and 1.5 miles by road west-southwest of Virginia Highway 619 (location 71, pl. 13), is

owned by the Central Mica Co. and was last operated in 1942 by the U. S. Mica Manufacturing Corp. Several 50- to 200-ft drifts extend in both directions from a 200-ft incline that slopes 65° NE. The country rock is quartz-mica schist with well-developed foliation that strikes N. 10°–40° E. and dips 60° E. to SE. The pegmatite dike strikes N. 60° W. and dips 68° NNE. Mica occurs along the margins of a quartz core 1½ ft thick. The books average less than an inch in diameter, but a very few are as much as 10 in. in diameter. All are heavily stained.

The deposit consists of thoroughly kaolinized feldspar, quartz, muscovite, and accessory tourmaline and garnet. Mica occurs as scattered books and appears to constitute more than 10 percent of the rock. Most of the books are small, with only a few as much as 4 in. in diameter. Some are reeved. A few books are clear and very pale green, but most contain abundant trigonal latticelike intergrowths of iron oxides.

Rocky Mount mine.—The Rocky Mount mine, about half a mile northeast of the Cooper mine (location 71, pl. 13), consists of numerous cuts, shafts, and tunnels. The largest cut is 60 ft long, 12 ft wide, and 20 ft deep. It is reported that 100,000 lb of mica was taken from it and that some of this mica yielded 6-by-6-in. trimmed sheets. The deposit strikes N. 65° W. and is 15 to 20 ft thick. It consists of kaolinized feldspar, quartz, muscovite, tourmaline, and garnet. Nearly all the mica is moderately to heavily stained.

Klondike mine.—The Klondike mine, about a quarter of a mile north of the Center Ridge mine (location 71, pl. 13), is on the property of Lena W. Vines, of Roanoke. It is on Fork Mountain, 2½ miles west-southwest of Virginia Highway 619, and was operated in 1940 by S. Almon, of Rocky Mount. An open-cut 100 ft long, 40 ft wide, and 30 ft in maximum depth exposes four closely spaced parallel pegmatite dikes. They are exceptionally rich in heavily stained muscovite. Some of the mica books are large.

Scrap mica has been produced also from the Patterson mine, which is a short distance south of the Center Ridge workings. The deposit is rich in kaolinized feldspar and small books of heavily stained mica.

The description of the following mine is based in large part on Pegau's report (1932):

Franklin (Cooper) mine.—A mine west of the main road on the Hudson Cooper property, 2 miles northwest of Virginia Highway 632 and 2 miles southwest of Virginia Highway 619 (location 71, pl. 13), was leased to the U. S. Mica Manufacturing Co. in 1942. Mica was obtained in four inclines and an open-cut 60 ft long. The older workings include at least ten shafts, irregular stopes and connecting tunnels, and slumped pits in a belt about 600 ft long. Some are reported to extend to depths of 135 ft. The mine is said to have been opened

by the aborigines and to have yielded nearly 500 tons of mica since that time.

The country rock is a chloritoid-bearing quartz-mica schist in which the foliation strikes N. 45° E. and dips 65° SE. The main pegmatite body strikes N. 75° to 80° W. and dips southward at angles of 25° to 60°. It may be as much as 100 ft thick. Several thinner pegmatite dikes nearby have similar attitudes.

HENRY AND PITTSYLVANIA COUNTIES: AXTON AREA

GENERAL FEATURES

A well-defined area of mica-bearing pegmatites in eastern Henry and southwestern Pittsylvania Counties extends about 12 miles east and 8 miles north from Axton, on the Danville and Western Railroad (pl. 13). The western part of this area lies along a major drainage divide and is moderately rugged. The eastern part is more rolling country, with altitudes of less than 600 ft along the principal stream courses and 750 ft or more in the interstream areas. In general the area drains to the east, along tributaries of the Sandy River. Most of the mica deposits can be reached over U. S. Highway 58 and gravel or sand-clay secondary routes.

PEGMATITES

Nearly all the pegmatite bodies occur in an irregular, eastward-trending belt of mica schist with minor inter-layered hornblende schist and gneiss. North of this belt is a large mass of the Leatherwood granite of Jonas, and to the south is a smaller, irregular mass of hornblende gneiss and gabbro (fig. 73). Much of the mica schist and gneiss is garnetiferous, and some kyanite-rich layers are present. Sills, pods, and thin stringers of hornblende-chlorite metapyroxenite are known in several places.

Most of the pegmatite deposits are in an area about a mile east-northeast of Axton, "apparently around the border of an unexposed granite boss" (Pegau, 1932, p. 75). Nearly all are dikes that range in thickness from less than a foot to as much as 40 ft. They trend north-northeast to northeast in the western half of the area, but in the eastern half the trends are westerly and west-northwesterly. Most of the pegmatites in the eastern part of the area, therefore, are strongly discordant. Their dips range from 30° to 90° and ordinarily are very steep. In general, those which are sills dip more gently.

The pegmatite minerals include perthitic microcline, plagioclase, quartz, muscovite, biotite, tourmaline, garnet, and sulfides. Coarse-grained potash feldspar is abundant in many of the deposits. Most of the plagioclase is kaolinized to depths of 30 ft or more. The quartz occurs as well-defined cores, as interstitial material in feldspathic pegmatites, in late crosscutting veins, and as scattered sill-like lenses within the pegmatite bodies. Some of these lenses lie near the crests or

keels of quartz cores and may be interpreted as small core segments. In distribution, size, and occurrence they resemble closely the quartz plates and segments that are so common in many of the Alabama pegmatites. Most of the dikes are distinctly zoned, but some are merely medium- to coarse-grained aggregates of feldspar, quartz, and mica which increase in grain size inward from the walls but are not otherwise systematically zoned.

The mica is brown, brownish olive, and yellowish to greenish olive. Most of the olive-colored mica is heavily stained with iron oxides. Some very large books have been obtained during the mining, but the bulk of the production has been small-size, scrap-quality material. A moderate production of stained sheet mica is reported from operations dating back to the period 1890-1920.

DESCRIPTIONS OF DEPOSITS

The descriptions of the following deposits are based in part upon data presented by Pegau (1932):

Tyler mine.—The Tyler mine, on the east side of Sandy Ridge $7\frac{1}{2}$ airline miles east of Axton (location 59, pl. 13), consists of a 60-ft shaft and an appended drift. The pegmatite dike strikes N. 70° W. and is 3 ft thick at the eastern end of the drift. It is rich in thoroughly kaolinized plagioclase and is said to have yielded 3 carloads of mica, most of which was scrap.

Will Rogers mine.—The Will Rogers mine is at the side of a road $5\frac{1}{2}$ airline miles east-northeast of Axton (location 60, pl. 13). The pegmatite dike strikes east-northeast and is exposed in two slumped cuts. Small flakes of clay-stained mica are present in the dumps.

Dalton prospects.—The Dalton prospects are on both sides of a road $4\frac{1}{2}$ airline miles S. 75° E. of Axton (location 61, pl. 13). They were worked by the Vicama Mica Co., but little mica is said to have been found. One of the dikes is 25 ft thick and consists chiefly of perthite.

Vicama mine.—A mine on the west side of Georgia Branch, 3.3 airline miles S. 75° E. of Axton (location 62, pl. 13), was opened in 1922 by H. C. Fields, of Martinsville, who later sold the deposit to the Vicama Mica Co. The pegmatite dike is 40 ft thick and strikes N. 40° W. in biotite schist. It appears to be very nearly continuous. Most of the mine workings are on the bank of the branch and near the southeast end of the deposit. They include several 50-ft shafts and irregular tunnels and stopes along a strike distance of 200 ft. Several pits and cuts are 300 to 400 ft farther west. The deposit consists of coarse, blocky perthite, thoroughly kaolinized plagioclase, abundant book mica, and accessory garnet, tourmaline, and zoisite. It is said to have yielded 20 carloads of scrap mica, 15 tons of punch and sheet mica, and 3 carloads of feldspar during the early operations.

Martin mine.—The Martin mine is about a quarter of a mile east of Green's store and 3 airline miles east-southeast of Axton (location 63, pl. 13). It was operated by the Vicama Mica Co. in 1922, and its output is said to have included 25 tons of mica. As exposed in an open-cut 20 ft long and 25 ft deep, the deposit is 10 ft thick and strikes N. 50° W. A quartz core 3 ft thick is flanked by a thoroughly kaolinized wall zone that contains scattered books of mica and irregular fragments of quartz. Coarse mica books are concentrated along the margins of the core.

The descriptions of the following four deposits are based upon the data of Sterrett (1923).

Harston (Hairston) mine.—The Harston mine is west of Mountain Valley Road and 3 airline miles north of Axton (location 66, pl. 13). The workings comprise a 20-ft shaft with two short drifts, an irregular 35-ft tunnel that extends east-northeast from the shaft, and several small pits (fig. 74). Production from the mine is reported to have amounted to 11,000 lb of mica, from which amount 2,000 lb of sheet material possibly was obtained.

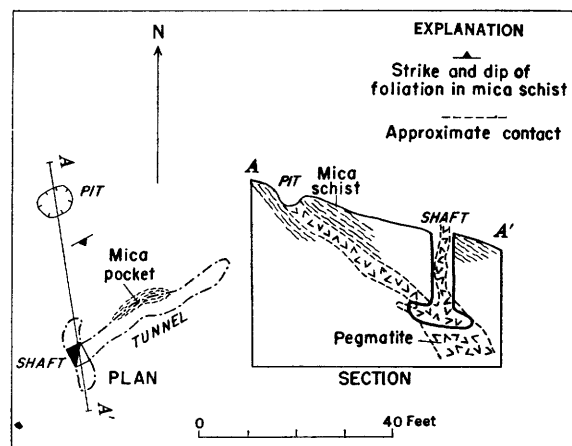


FIGURE 74.—Plan and section of the Harston mine, Henry County, Va. (after Sterrett, 1923, p. 328).

Holland mine.—Mica-bearing pegmatite was prospected and mined at two places on the land of D. S. Holland, $1\frac{3}{4}$ airline miles north-northwest of Axton (location 67, pl. 13). The main workings, on the south side of a small creek, include a flooded 20-ft shaft and two small open-cuts. The country rock is interlayered mica schist and hornblende gneiss. The pegmatite is a fine- to coarse-grained aggregate of kaolinized feldspar, quartz, and mica. The mica is clear and dark yellowish olive. Many of the books are small, but some 4-by-6-in. trimmed sheets were obtained from those mined.

The country rock is mica schist that contains many dikes and concordant stringers of granite and pegmatite. A well-developed foliation strikes N. 60° E. and dips 35° SSE. The schist is rich in crystals and radiating clusters of tourmaline within 2 ft of the pegmatite

contacts. A pegmatite body about 15 ft thick is exposed in the bottom of the shaft. Two branches extend upward, one along the schistosity of the enclosing rock and the other cutting across it (fig. 74).

The pegmatite is a medium- to coarse-grained aggregate of kaolinized plagioclase, abundant partly kaolinized perthite, and quartz, with mica and accessory tourmaline and beryl. Many coarse mica books occur in irregular clusters that are scattered sporadically through the deposit. The books are abundant in the steeply dipping pegmatite branch exposed in the shaft, but the largest output was obtained from the tunnel. One 350-lb crystal is said to have been encountered. The mica is brownish olive and moderately to heavily specked. Many of the crystals are badly cracked, but others yield large sheets.

A mass of decomposed pegmatite 25 ft wide crops out in a road about 250 ft west-southwest of the mine. Some of the books that occur in this rock yield sheets 3 in. in diameter. Small sheets of mica were plowed up in the light-gray sandy soil of a cultivated field about 150 yd to the west.

Lip Willis mine.—The Lip Willis mine is 0.3 mile south-southwest of the Harston mine and 2.7 airline miles north of Axton (location 66, pl. 13). The workings include an 18-ft shaft, a short tunnel, and three pits to the northeast. They expose the pegmatite body over a strike length of about 75 ft. The country rock is garnetiferous mica schist.

The pegmatite contains partly decomposed perthite, thoroughly kaolinized plagioclase, interstitial quartz, and mica. A core of massive quartz ranges in thickness from 2 ft in the shaft to about 6 ft at points southwest of the shaft. Some large books of mica are said to have been mined, but only small fragments are present in the dumps. The mica is dark yellowish olive, and some is slightly specked. Most of the pieces are free splitting, but some are warped, reeved, and locky.

Turner mine.—The Turner mine is on a hilltop about a third of a mile east of Axton (location 69, pl. 13). The workings include several shafts, pits, and elongate cuts in a row about 300 ft long. One of the shafts is reported to have been 40 ft deep. According to C. S. Turner, the owner, about 10,000 lb of mica was removed from a long cut about 1905. This material yielded 500 lb of trimmed sheets, the largest of which measured 6 by 8 in.

Pegmatite occurs as thin sills and concordant lenses in decomposed mica schist. The country-rock foliation trends N. 25° E. and dips steeply east-southeast. It is cut by thin dikes of light-gray granite. Mica is scattered throughout the pegmatite bodies. Most is clear and dark yellowish olive, and some is slightly specked. Flat, flat-A, and wedge-A books were obtained during the mining.

The descriptions of the following seven deposits are based upon information obtained from the Colonial Mica Corporation:

Wilson deposit.—Small books of both clear and specked mica are scattered over the ground near a farm road north of Axton. The deposit (location 67, pl. 13) is half a mile northeast of Virginia Highway 616 and about a mile from its intersection with Virginia Highway 647.

Chatin prospect.—The Chatin prospect is about a quarter of a mile west of Mountain Valley Road and 1¼ airline miles north-northwest of Axton (location 67, pl. 13). Partly kaolinized pegmatite is exposed in small open-cuts. It contains abundant clay-stained books of dark yellowish-olive mica. Many are warped and badly broken, and few would yield trimmed sheets of moderate or large size.

Foley prospect.—The Foley prospect is near the head of a small branch 1¾ airline miles northeast of Axton (location 68, pl. 13). Small clay-stained books of clear and spotted mica are present in the dumps from two shallow pits.

MacDonald mine.—The MacDonald mine is on the south bank of a tributary to Tanyard Creek, 3¼ airline miles northeast of Axton (location 65, pl. 13). Partly kaolinized masses of perthite and scattered small books of clay-stained mica are present in the dumps from two small cuts.

Oakley prospects.—Several pits were excavated in 1942 on the property of James T. Oakley, 0.3 mile southeast of a point on Virginia Highway 610 that is half a mile northeast of its intersection with Virginia Highway 57 (location 72, pl. 13). The pegmatite body strikes N. 45° E. and is 1 to 3 ft thick. It contains small books of clear, hard, and flat mica.

Jim Davis prospect.—The Jim Davis prospect is several hundred feet southwest of the Turner mine (location 69, pl. 13), on the eastern outskirts of Axton. Fragments of both clear and specked mica are present in the dumps from several old pits.

Marvin Turner prospect.—The Marvin Turner prospect is 0.3 mile south of U. S. Highway 58 and 1.3 airline miles south-southeast of Axton (location 70, pl. 13). The deposit trends north-northwest in mica schist. It contains kaolinized feldspar, quartz, tourmaline, and scattered small books of yellowish-olive mica. Most of the mica appears to be too small and broken to yield much sheet material.

HENRY COUNTY: PHILPOTT-MARTINSVILLE AREA AND OUTLYING DEPOSITS

GENERAL FEATURES

A poorly defined pegmatite area extends from Martinsville northwestward to the corner of Henry County. Most of the deposits are in a northeastward-trending belt that extends through Philpott. The en-

tire area is moderately rolling to rugged. It is crossed by the Smiths River, by the Roanoke and Winston Salem line of the Norfolk and Western Railway, and by U. S. Highway 220. In addition, many of the deposits are accessible over Virginia Highways 57 and 108, as well as over secondary roads. The area is one of steep, wooded slopes, with a relief of 700 to 800 ft. Drainage is by tributaries of the Smiths River.

PEGMATITES

The pegmatite belt is geologically complex. It extends across at least two irregular masses of the Leatherwood granite of Jonas and two smaller bodies of hornblende gneiss and gabbro (fig. 73). Most of the pegmatite deposits are enclosed by biotite gneiss and schist, which contain layers of hornblende gneiss and kyanite gneiss. The strike of the foliation in these rocks is northeast. Many of the layers in the gneiss are impregnated with feldspar, and large feldspar metacrysts are locally abundant. Many granitic and pegmatitic stringers also have been observed.

The pegmatite bodies in the southeastern part of the area are sills and concordant lenses, whereas most of those in the vicinity of Philpott are markedly discordant dikes. These dikes trend north-northwest to northwest, with moderately steep northeasterly to vertical dips. Those in the vicinity of Martinsville strike northeast, with steep northwesterly dips. Most of the pegmatite consists of plagioclase, perthite, quartz, and muscovite, with accessory biotite, garnet, tourmaline, and vermiculite.

The mica is a clear pinkish buff to cinnamon brown in several deposits, such as the Morrison, Greer, and Merriman, but in others it is greenish and heavily stained by iron oxides. Most of the pegmatites that contain stained mica occur near and northeast of Martinsville and in one small area near the Henry-Franklin County line. "A" structure is abundant in only a few deposits, and the chief defects throughout the area are cracks and ruling. Ruling is so severe in some mica shoots that only small fragments of scrap mica can be recovered. The books in a few deposits, particularly those in the vicinity of Philpott, are marred by inclusions of tourmaline. Books recovered during previous mining operations yielded some large sheets, but most of the output from the area is small-sheet electric material and scrap.

DESCRIPTIONS OF DEPOSITS

C. R. MORRISON (OAK LEVEL) MINE

The Morrison mine is on Virginia Highway 674, at a point 9.5 miles N. 38° W. of Martinsville (location 77, pl. 13). It was worked to a depth of about 40 ft in 1939 by Pat Thomas and was reopened late in 1943 by Edd Martin, who sank an inclined shaft to a vertical depth of 75 ft and drove drifts 25 ft southeast and 42

ft northwest at the 48-ft level (fig. 75). Most of the ground between this level and the surface was then stoped, and most of the waste was left in the mine. Other drifts are said to have been driven from the bottom of the shaft, but these were backfilled during the stoping operations.

The pegmatite dike strikes N. 45° to 55° W. and dips 60° to 75° NE. in decomposed biotite schist. It is exposed for a strike distance of 120 ft, and an outcrop beside the highway N. 55° W. of the shaft indicates a length of at least 190 ft. The deposit is at least 10 ft thick in the workings. Its southwest wall is not exposed but four zones can be distinguished in its northeast part. A 1- to 4-in. border zone of quartz and fine-grained mica flanks a discontinuous wall zone 2 ft in maximum thickness that contains medium-grained plagioclase, granular quartz, and large books of muscovite. The 1- to 4-ft intermediate zone is composed of coarse plagioclase with scattered blocks of perthite, masses of granular quartz 3 to 8 ft long, and small books of mica.

Massive quartz and scattered blocks of perthite form the core of the deposit. This unit is exposed in the southwest wall of the shaft and in the south wall of the drift to the northwest. The plagioclase is kaolinized to a depth of at least 80 ft, whereas the perthite is fresh and unweathered at a depth of 12 ft. Little is known concerning the geology in the lower levels of the mine, but the deposit may plunge eastward at moderate to steep angles. This is suggested by the plunge of a distinct roll in the hanging-wall contact 12 ft northwest of the shaft.

The mica is pinkish buff, and few specks or mineral stains appear to be present. The books within 5 ft of the surface are heavily clay-stained, but at greater depths only the severely cracked or ruled parts of books contain such stains. Some of the books mined in the bottom of the shaft and in the small pit near the shaft are said to have contained abundant inclusions of tourmaline. About 1 percent of the mica mined from the deposit is said to have been recovered as trimmed sheet material. One or more mica shoots may be present along the strike of the deposit beyond the present workings, and further exploration might well be directed toward the pegmatite exposed in the small pit northeast of the shaft.

GREER AND MERRIMAN MINES

The Greer and Merriman mines are in the same pegmatite body, which is approximately 3 airline miles northwest of Bassett (location 78, pl. 13). The old workings of the Greer mine comprised three shallow pits and two short drifts (fig. 76). Pit 1 was deepened, and Edd Martin, of Axton, drove an incline to intersect the footwall of the deposit during 1944 and 1945. The adjacent Merriman mine was operated by E. J. Tyler, of Asheville, N. C., during June 1944. The work-

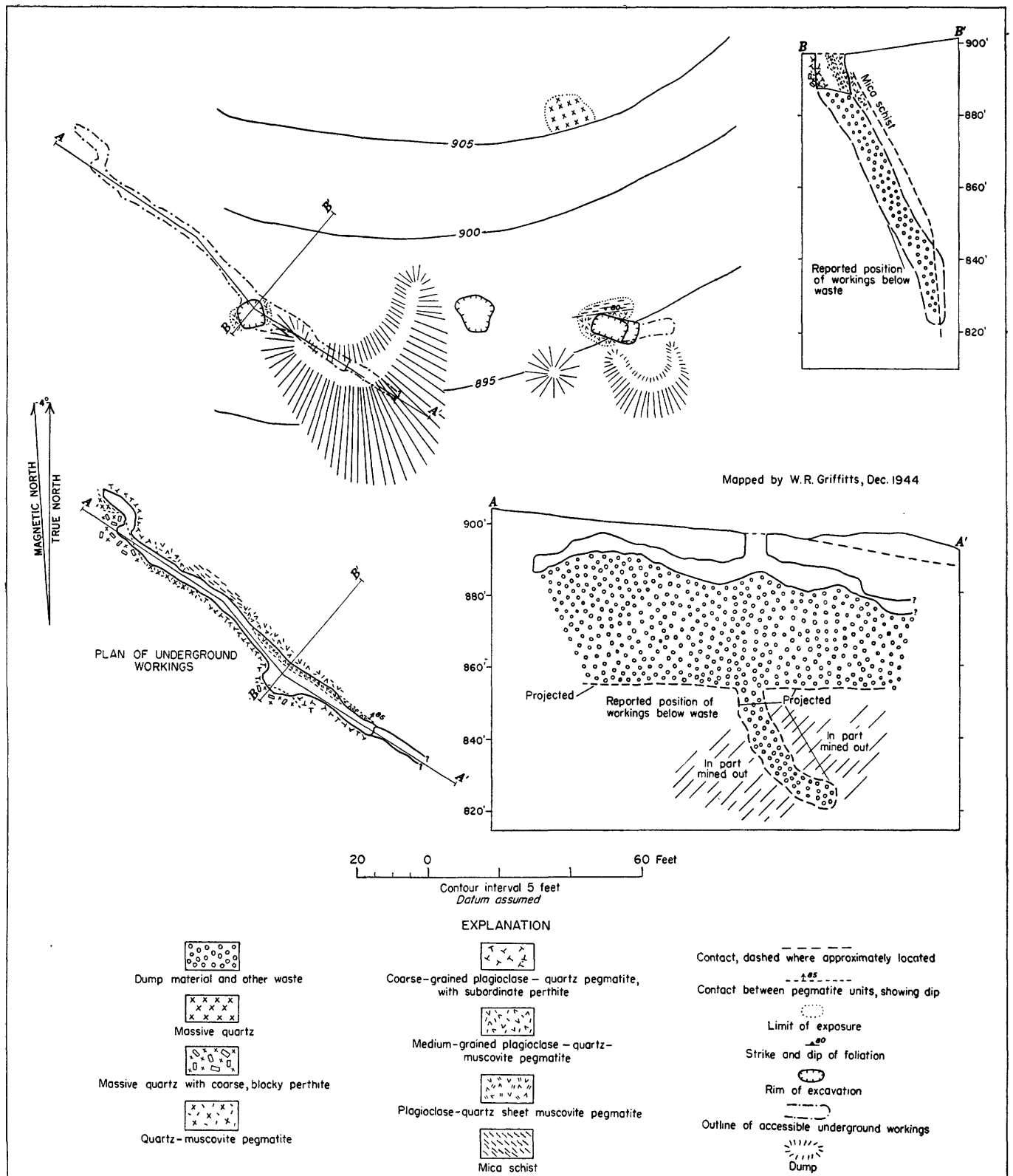


FIGURE 75.—Geologic map, plan, and sections of the C. R. Morrison mine, Henry County, Va.

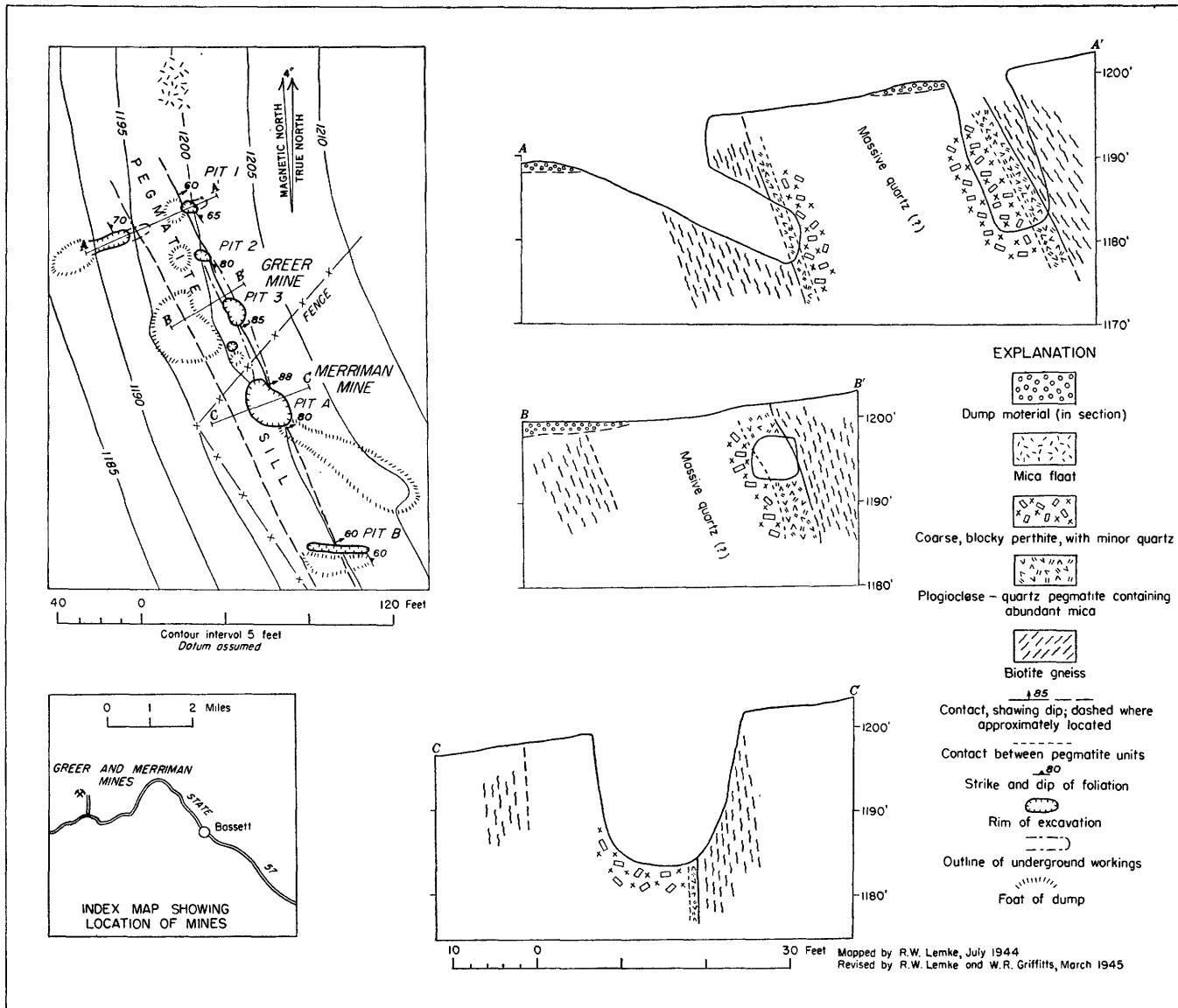


FIGURE 76.—Geologic map and sections of the Greer and Merriman mines, Henry County, Va.

ings comprise two pits. The larger, pit A, is 17 ft deep (fig. 76).

The country rock is gneiss in which layers rich in muscovite and biotite separate thin stringers and pods of quartz and feldspar. The foliation strikes N. 15° – 25° W. and dips 60° – 80° ENE. The concordant pegmatite body is about 30 ft thick. It is irregular in detail, and the hanging wall is vertical in several places. The deposit is at least 200 ft long, and mica float north of pit 1 suggests a much greater length.

The border zone exposed along the footwall of the sill is a fine-grained aggregate of plagioclase and quartz, with accessory tourmaline and apatite. The wall zone is medium-grained plagioclase-quartz-muscovite pegmatite that locally contains as much as 20 percent mica. This unit thins from 4 ft in the middle workings to a foot or less in pit A. Much of the exposed central part of the deposit is coarse perthite-

quartz pegmatite in which plagioclase and large, badly broken books of mica are minor constituents. Sericite-rich veinlets fill cleavage fractures in some of the perthite blocks. The plagioclase and quartz content of this unit increases southward, and in pit A plagioclase is the dominant mineral. Several quartz masses as much as 18 in. thick and 3 ft long also are exposed in this pit. The mica books in this part of the zone are small. Tourmaline is scattered throughout the exposed pegmatite in pit B.

Mica is abundant in the wall zone and moderately abundant in at least the outer part of the perthite-quartz zone. The richest concentrations are exposed in pits 1, 2, and 3. Most of the books are 3 to 8 in. in diameter, and some are as much as 15 in. The mica is cinnamon brown, clear, flat, and free splitting. The principal imperfections are ruling, breaks, severe warping, softness, and clay stains. Some books, particularly those

exposed in the southernmost workings, contain inclusions of tourmaline. The recovery of sheet and punch mica from the mine-run mica ordinarily is very low, owing chiefly to widespread and closely spaced ruling.

WILL EANES PROSPECT

The Eanes prospect, about 1 mile east of the Greer and Merriman mines (location 78, pl. 38), was opened in the summer of 1944 by Edd Martin. After a little mica was obtained from kaolinized feldspathic pegmatite, the pit was filled and the land recultivated.

TERRY MINE

The Terry mine, 4 miles N. 45° E. of Martinsville (location 73, pl. 13), was operated during 1944 and 1945 by a Mr. Adams of that town. The deposit strikes N. 33° E. and dips 70° WNW. at the outcrop. The dip of the western contact decreases to 30° at a depth of 15 ft. The deposit is flanked on the west by coarse-grained, dark-gray biotite granite and on the east by hornblende gneiss and mica gneiss. As exposed 15 ft below the rim of an open-cut, it is about 19 ft thick.

The sequence of pegmatite units from the footwall toward the hanging wall at a depth of 15 ft is as follows:

1. Two ft of plagioclase-quartz pegmatite with 1- to 3-in. books of green "A" mica, apparently not stained.

2. Two ft of coarse, blocky perthite with a fringe of 1- to 2-in. books of green "A" mica along the contact with the plagioclase-quartz unit.

3. Two to four ft of quartz with very abundant strips of biotite as much as 30 in. long and small to moderately large books of heavily stained muscovite. Mica constitutes nearly half this unit.

4. Three to ten feet of massive quartz with blocks of perthite as much as 2 ft in diameter.

5. Three to eight feet of plagioclase-quartz pegmatite with no mica.

The massive quartz unit thins from about 10 ft in the southwest wall of the cut to 3 ft or less in the north wall. The mica-rich zone (unit 3) splits and tapers upward, and the space between the upward-reaching branches is occupied by perthite. The muscovite and biotite are much intergrown. Most of the muscovite is lumpy, heavily stained, badly cracked, and marked by "A" reeves. A few of the books would yield small-sheet material of electric quality. The deposit may offer some promise as a source of feldspar, with scrap and washer-punch mica as byproducts.

OTHER DEPOSITS

The descriptions of the following deposits in Henry County are based mainly upon Colonial Mica Corporation data:

Tuttle prospect.—Several pits were dug during 1944 on the Tuttle property, near Virginia Highway 657 and 1.1 miles east of U. S. Highway 220 (location 74, pl. 13). The pegmatite body strikes N. 60° W. and dips 65°

SSW. A little mica occurs along the margins of a quartz core. Some is clear, but most of the books either are stained or are too badly broken, warped, and ruled to yield trimmed sheets.

Lester prospect.—An old mica prospect on the property of the Lester Lumber Co. lies on a mountainside 2 miles by road from Virginia Highway 57 at Philpott (location 75, pl. 13).

Prillaman deposit.—Scrap mica in three-quarter-inch flakes occurs on the Ruth A. Prillaman property, which adjoins Virginia Highway 674 a quarter of a mile west of Philpott (location 76, pl. 13).

Ben Smith prospect.—A mica prospect was opened in 1944 on the Ben Smith property, east of Virginia Highway 609 and 2 miles north of Fieldale (location 79, pl. 13). The deposit apparently strikes northeast. It contains partly kaolinized feldspar, vermiculite, and small books of clear mica.

Brown prospect.—Mica-bearing pegmatite occurs on the Rives Brown property, 120 yards from Mulberry Street and 0.9 mile from Starling Street in Martinsville (location 80, pl. 13). The mica occurs with quartz and is stained. Some books are 4 in. in diameter.

Morris prospect.—A prospect on the Morris property, near U. S. Highway 220 at South River, was opened in 1943 by Clay A. Cheek. A few small mica books were obtained from a pegmatite body that strikes N. 20° E. and dips gently.

Williams deposit.—Green mica of electric grade occurs on the property of K. E. Williams, three-quarters of a mile from U. S. Highway 58 and 5 miles from Martinsville.

Two outlying deposits in Henry County are known. Their descriptions are based mainly upon Colonial Mica Corporation data.

John L. Cox prospect.—A mica deposit that was opened about 1900 by a Captain McCraw and a Mr. Whitehurst is on the John L. Cox property, east of Virginia Highway 633 and half a mile north of its intersection with Virginia Highway 634. It is 5 miles by road east of Ridgeway (location 81, pl. 13). Clear book mica is scattered through feldspathic pegmatite. Some of the recoverable sheets would measure 3 by 4 in.

Mullins deposit.—Mica-bearing pegmatite occurs on the Mullins property (location 82, pl. 13), about a mile from the S. F. Smith store, near the intersection of Virginia Highways 629 and 695. The mica is greenish and clear but heavily clay-stained. Some "A" books are as much as 4 by 6 in. in size.

PATRICK COUNTY

The descriptions of two deposits in Patrick County have been taken chiefly from data furnished by the Colonial Mica Corporation:

Dunkley deposit.—Mica-bearing pegmatite crops out on the A. G. Dunkley property, which can be reached

over 4 miles of Virginia Highway 8 southward from Stuart (location 83, pl. 13), 2.3 miles of Virginia Highway 103, and 1 mile of dirt road that extends northward. The deposit contains hard, unweathered feldspar, quartz, and small cracked books of stained mica.

Moss prospect.—A mica deposit on the Susie J. Moss property, on a ridge top 1,500 ft south of Virginia Highway 687 and 3 miles west of Virginia Highway 680, was opened in the summer of 1944. Three 6-in. stringers of pegmatite in sericitized schist contain small books of mica.

GRAYSON COUNTY

The data in the following description were obtained from a report by Jonas (1932).

J. C. Pierce prospect.—Kyanite-bearing pegmatite has been prospected on the J. C. Pierce property, 0.3 mile north of West Galax (location 84, pl. 13). Several pinching and swelling pegmatite bodies trend N. 50° E., parallel to the foliation of the enclosing garnetiferous mica-staurolite gneiss. They contain quartz, perthite, muscovite, kyanite, and rutile. The kyanite occurs as broad blades and is most abundant near the

walls of the deposit. Rutile crystals that weigh as much as a pound also are present.

Several similar deposits are exposed nearby. A prospect on the Nichols property, 1.2 miles S. 44° W. of West Galax, contains blue blades of kyanite 18 in. in maximum length.

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