

Mica Deposits of the Southeastern Piedmont

Part 5. Shelby-Hickory District
North Carolina

Part 6. Outlying Deposits in North Carolina

GEOLOGICAL SURVEY PROFESSIONAL PAPER 248-D



Mica Deposits of the Southeastern Piedmont

Part 5. Shelby-Hickory District
North Carolina

Part 6. Outlying Deposits in North Carolina

By WALLACE R. GRIFFITTS and JERRY C. OLSON

GEOLOGICAL SURVEY PROFESSIONAL PAPER 248-D

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



UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1953

UNITED STATES DEPARTMENT OF THE INTERIOR

Douglas McKay, *Secretary*

GEOLOGICAL SURVEY

W. E. Wrather, *Director*

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C.

CONTENTS

	Page		Page
Part 5. Shelby-Hickory district, N. C.....	203	Part 5. Shelby-Hickory district—Continued	
Abstract.....	203	Descriptions of deposits—Continued	
Introduction: Field work and acknowledgments.....	203	Burke and Catawba Counties—Continued	
Geography of the district.....	204	Abernathy Water mine.....	232
Geology of the district.....	204	Abernathy Long Cut (Hickory) mine.....	232
Rock formations.....	204	Other mines and prospects.....	233
Metamorphic rocks.....	204	Catawba, Cleveland, and Lincoln Counties:	
Igneous rocks.....	206	Fallston area.	
Structure.....	208	Tallant prospect.....	233
Mica-bearing pegmatites.....	209	A. F. Hoyle mine.....	233
Distribution and occurrence.....	209	Jake Hoyle prospect.....	235
General structural features.....	209	Bonnet Split (Big Hill) mine.....	235
Size and shape.....	209	Cooke mine.....	235
Attitude.....	210	Indian Graveyard mine.....	235
Relation to country rock.....	211	Indiantown (Mull) mine.....	236
Internal structure.....	213	Randall (Norman) mine.....	236
Mineralogical features and paragenesis.....	216	Woodrow prospects.....	236
Wall-rock alteration.....	218	Bumgarner mine.....	236
Origin.....	220	Mitchem deposit.....	236
Tin- and spodumene-bearing pegmatites.....	221	Marvin King prospects.....	236
Distribution and occurrence.....	221	Shorty prospect.....	237
Mineralogical and structural features.....	221	Archie Norman (W. H. Thompson, Wyatt)	
Origin.....	222	mines.....	237
Other pegmatites.....	222	M. H. Gantt mine.....	238
Economic aspects of the pegmatite minerals.....	223	Ira London prospect.....	238
Mica.....	223	B. T. Gantt prospect.....	238
Feldspar and kaolin.....	223	Griggs mines.....	238
Beryl.....	224	Wright prospect.....	239
Tin and spodumene.....	224	Royster mine.....	239
Monazite.....	224	Fallston prospect.....	239
Graphite, corundum, and sillimanite.....	224	Mauney Carpenter mine.....	239
Other minerals.....	225	Lem Hamrick mine.....	239
Mining.....	225	Pink Leatherman mine.....	239
History.....	225	Shull (John Dillinger) mines.....	240
Mine workings and mining methods.....	225	Hull (Rock Cut) mine.....	240
Production.....	225	Hallman mine.....	240
Future of the district.....	225	Shidal prospect.....	240
Descriptions of deposits.....	226	W. T. Foster (W. A. Thompson) mines.....	240
Iredell County: Iredell area.....	226	Biggerstaff (Deadman) mine.....	242
Alexander County: Hiddenite area.....	227	Wehunt prospect.....	243
O. F. Patterson mine.....	227	Plato Houser mine.....	243
Gwaltney prospects.....	227	Plato Houser No. 2 mine.....	245
Dagenhart mine.....	227	Bess mine.....	245
Other prospects.....	227	J. B. Peeler mine.....	245
Caldwell County: Oak Hill area.....	228	Beam prospect.....	245
McGee mine.....	228	W. L. C. Foster prospect.....	245
Other mines and prospects.....	228	Lincoln mine.....	245
Catawba County: Conover area.....	229	Carl Harrelson prospect.....	246
Sigmon mine.....	229	Doris Eaker mine.....	246
Drum mine.....	230	Jack Baxter (Tom Baxter) mine.....	246
Other mines and prospects.....	230	Jack Baxter prospect.....	247
Burke and Catawba Counties: Burke Chapel		Baxter East prospect.....	247
area.....	231	Other mines and prospects.....	247
Noah Young mine.....	231	Gaston County: Cherryville area.....	249
Floyd Brittan mine.....	231	Claude Beam prospect.....	249
Reed mine.....	231	Big Bess (M. M. Carpenter, M. S. Bess)	
		mine.....	249

Part 5. Shelby-Hickory district—Continued	Page	Part 5. Shelby-Hickory district—Continued	Page
Descriptions of deposits—Continued		Description of deposits—Continued	
Gaston County: Cherryville area—Continued		Cleveland County: Shelby area—Continued	
E. R. Self (Old Neale) mine.....	251	Webb mine.....	269
Huskins mine.....	253	G. B. McSwain mine.....	270
S. E. Peeler prospect.....	255	Mill Race mine.....	271
Cleveland County: Kings Mountain area.....	255	J. T. Martin prospects.....	271
Scism prospect.....	255	J. F. Green mine.....	272
Bun Patterson (Old Carroll) mine.....	255	Old Plantation mine.....	272
Rice mine.....	256	Anthony prospects.....	272
Herndon mine.....	256	Lail prospect.....	273
Other prospects.....	256	Other mines and prospects.....	273
Cleveland County: Polkville area.....	256	Western Alexander County.....	275
Gettys No. 1 mine.....	256	Central and southern Catawba County.....	275
Gettys No. 2 mine.....	257	Moose mine.....	275
Wallace mine.....	257	Other mines and prospects.....	275
Peeler No. 1 mine.....	258	Eastern Cleveland County.....	276
Peeler No. 2 mine.....	258	J. L. Foster prospect.....	276
Fred Falls prospect.....	258	Sweezy mine.....	276
Cleveland County: Shelby area.....	258	J. North Smith prospects.....	276
Powell (Sugar Barrel) mine.....	258	W. H. Fortenberry prospect.....	276
Jim Blanton prospect.....	259	Other mines and prospects.....	276
Williamson mine.....	259	Northwestern Cleveiaand County.....	277
McIntyre mine.....	259	Clyde Warlick mine.....	277
Bowen mine.....	259	Mull mine.....	277
Harris mine.....	259	Ledford mine.....	277
Horne prospect.....	260	Hastings mine.....	277
Bowen Southeast prospect.....	260	L. R. Elliot mine.....	278
Mary Gold mine.....	260	Lattimore mine.....	278
Plato Scism prospect.....	260	T. C. Stroud prospects.....	278
S. S. Mauney (M. M. Mauney, Homestead)	260	Clippard prospect.....	278
mine.....	260	Eastern Rutherford County.....	278
Bailey Mauney mine.....	260	Lax Stroud mine.....	278
D. H. Spangler prospects.....	261	Dycus mine.....	278
Campbell mine.....	261	Maurice mine.....	279
Weathers mine.....	261	Other mines and prospects.....	281
Cliff Blanton mine.....	261	References cited.....	281
Cabaniss-Story (Cabaniss Three Sisters)	262	Part 6. Outlying deposits in North Carolina.....	283
mines.....	262	Abstract.....	283
T. N. Spangler (Reuben Spangler) pros-	263	Introduction.....	283
pects.....	263	Warren, Franklin, and Wake Counties: Northeastern	
Eli Glover mine.....	263	Piedmont area.....	283
Walter Davis mine.....	263	Geography.....	283
Metcalf mine.....	263	Geology.....	283
Blanton prospect.....	263	Pegmatites.....	284
Cabaniss prospect.....	263	Mining and production.....	285
Putman mines.....	263	Descriptions of deposits.....	285
Charles Cornwell prospect.....	264	Caswell County: Milton area.....	286
W. H. Wellman prospects.....	264	General features.....	286
Martin mine.....	264	Pegmatites.....	286
Alma Cabaniss mine.....	266	Descriptions of deposits.....	286
Chrysolite mine.....	266	J. G. Slaughter prospect.....	286
Tom Cabaniss mine.....	266	O. W. Barker prospect.....	286
Rudasill prospect.....	266	Yarboro No. 1 (Old Milton) mine.....	237
Pleaz Bridges mine.....	266	Other mines and prospects.....	287
Coleman Blanton mine.....	267	Yadkin, Wilkes, Caldwell, Catawba, Burke, McDow-	
Joe E. Humphries mine.....	267	ell, Rutherford, and Polk Counties: Western	
Vess Cooke prospect.....	267	Piedmont area.....	287
Frank Cornwall (Old J. S. Blanton) mine.....	267	General features.....	287
C. Robert Blanton mine.....	268	Descriptions of deposits.....	288
Philbeck mine.....	268	Isinglass Hill mine.....	288
Niagara mine.....	268	Kay mine.....	288
Hunt mine.....	269	Other mines and prospects.....	288
Jones mine.....	269	References cited.....	290
F. G. McGinnis mine.....	269	Index.....	291
W. H. Humphries prospect.....	269		

ILLUSTRATIONS

	Page
PLATE 18. Index map of western North Carolina showing the location of mica deposits in the North Carolina Piedmont.	In pocket
19. Index map of the southern part of the Shelby-Hickory district.....	In pocket
20. Geologic map and sections of the Drum mine, Catawba County.....	In pocket
21. Geologic map and sections of the Archie Norman mines, Cleveland County.....	In pocket
22. Geologic map, plan, and section of the W. T. Foster mines, Lincoln County.....	In pocket
23. Geologic maps and sections of the Big Bess mine, Gaston County.....	In pocket
24. Geologic map, plans, and sections of the Cliff Blanton mine, Cleveland County.....	In pocket
FIGURE 77. Geologic sketch map of the Shelby-Hickory district and vicinity.....	205
78. Index map of part of Caswell County, showing location of mica deposits and granite and diorite bodies.....	210
79. Trends of pegmatite bodies in the Shelby-Hickory district.....	211
80. Distortion and rupture of country rock, Shelby-Hickory district.....	212
81. Poles of country-rock foliation southeastern part of the Shelby area.....	213
82. Geologic reconnaissance map of the Fallston area.....	213
83. Geologic reconnaissance map of the Cherryville area.....	214
84. Muscovite crystals from a vug, Foster No. 7 mine, Lincoln county.....	217
85. Paragenesis diagrams of four common types of pegmatite in the Shelby district.....	219
86. Pegmatite-wall rock relations, Shelby-Hickory district.....	220
87. Geologic map and sections of the Sigmon mine, Catawba County.....	229
88. Sketch map of the Reed mine, Burke County.....	231
89. Sketch map and section of the Abernathy Water mine, Catawba County.....	232
90. Geologic map and sections of the A. F. Hoyle mine, Cleveland County.....	234
91. Geologic sketch map of the Biggerstaff mine, Lincoln County.....	243
92. Geologic map and sections of the Plato Houser mine, Lincoln County.....	244
93. Geologic map of the Jack Baxter mine, Lincoln County.....	246
94. Plan of workings, Big Bess mine, Gaston County.....	250
95. Geologic map of the E. R. Self mine, Gaston County.....	252
96. Geologic map and sections of the Huskins mine, Gaston County.....	254
97. Geologic map and sections of the Gettys No. 1 mine, Cleveland County.....	257
98. Geologic map, plan, and sections of the Martin mine, Cleveland County.....	265
99. Geologic map and plan of the Frank Cornwall mine, Cleveland County.....	267
100. Geologic map and sections of the G. B. McSwain mine, Cleveland County.....	270
101. Sketch map and plan of the Moose mine, Catawba County.....	275
102. Geologic map and plan of the Dycus mine, Rutherford County.....	280
103. Index map of Warren and Franklin Counties.....	284

MICA DEPOSITS OF THE SOUTHEASTERN PIEDMONT

PART 5. SHELBY-HICKORY DISTRICT, NORTH CAROLINA

BY WALLACE R. GRIFFITTS and JERRY C. OLSON

ABSTRACT

The Shelby-Hickory district is the most productive mica district in the southeastern Piedmont. A belt of quartzite, conglomerate, and marble occurs on its eastern edge. The district itself is underlain by micaceous and hornblende schists and gneisses and by two granites of different age and appearance. The regional trend of the foliation of the gneiss and schist is northeast, and the regional dip is southeast. The fold axes in these rocks plunge south or southwest. Faults of small displacement that formed before the pegmatite are common, but faults younger than the pegmatite are rare.

Mica-bearing pegmatite bodies are abundant in 10 areas. The bodies in the southern half of the district are somewhat smaller than those farther north but have accounted for most of the mica production. In the western part of the district the pegmatite bodies strike north, and in the central part they strike east. In the eastern part they strike northeast but range more widely than in the other parts of the district. Most of the bodies that have been profitably mined range from 5 to 15 ft in thickness and from 30 to 525 ft in length.

All the pegmatite bodies cross the foliation of the enclosing rocks. The parallelism of dikes over large areas indicates that they formed in widespread parallel fractures. The pegmatites were localized near bodies of competent rock, especially granite, and appear to be genetically related to a granite that occurs in the eastern part of the district. Zones in the pegmatites are well developed; wall zones are of plagioclase-quartz pegmatite, cores are of massive quartz, and intermediate zones are commonly rich in perthite. Muscovite is common with plagioclase, especially in the wall zones. Accessory minerals include biotite, beryl, tourmaline, garnet, apatite, sulfides, carbonates, chlorite, and gold. The schist wall rocks of several pegmatites have been recrystallized, but alteration is slight except in deposits in granite in the eastern part of the district.

The mica in the Shelby-Hickory district is predominantly clear and red brown. A little is green or stained. Most of the mica occurs in the wall zones and is flat or slightly reeved. Herringbone and "A" mica are most common in the eastern part of the district. In several deposits the mica is concentrated in a shoot that plunges steeply.

Perthite-rich intermediate zones might be a valuable source of potash feldspar, but many of the deposits in the southern part of the district are small. The deposits of kaolin in the pegmatites are small, but large amounts are contained in weathered granite. Tin- and spodumene-bearing pegmatites occur in a narrow belt along the eastern edge of the district. They are strikingly different from the mica-bearing pegmatite in internal

structure, texture, and composition. Many have been sheared during consolidation. Other types of pegmatite, containing rutile, gem spodumene, graphite, or quartz crystals, occur in the northern part of the district.

The total mica production of the Shelby-Hickory district may have amounted to several million pounds. During World War II a total of 63,481 lb was obtained; one-fourth of this was no. 1 quality, and one-half was no. 2 superior.

INTRODUCTION: FIELD WORK AND ACKNOWLEDGMENTS

The Shelby-Hickory mica district is the most productive in the Piedmont province and the third most productive in the Southeastern States. It was examined and studied prior to World War I by D. B. Sterrett, who described several mines and prospects (Sterrett, 1923, pp. 188-194, 220-224). Recent investigations by the Geological Survey were begun early in 1943, when W. C. Stoll and J. J. Norton mapped the Martin mine, J. J. Norton, J. J. Page, and E. Wm. Heinrich mapped the Foster mines, and J. C. Olson examined 80 mines and prospects. Investigations were carried on intermittently at several of the more productive mines during the fall of 1943, the spring of 1944, and the summer of 1945 by J. M. Parker III, V. C. Fryklund, Jr., J. C. Olson, and R. H. Jahns. W. R. Griffiths and J. C. Olson spent 4 months in the district during the fall of 1944 and the spring of 1945. Twenty deposits were mapped, and 130 others were examined. Information concerning still others was obtained from the published record (Sterrett, 1923) and from unpublished reports in the files of the Colonial Mica Corp.

Much information concerning the history of the mines and the extent of the inaccessible workings was obtained from the reports of field engineers of the Colonial Mica Corporation. D. J. Smith, C. S. Burleson, G. C. McGimsey, and Paul Henline, of that organization, were very helpful during the course of the investigations, and all mine owners and operators cooperated wholeheartedly. R. L. Rudasill, F. B. Hendricks, and H. L. Kennedy contributed helpful data

on mines operated or examined by them and gave friendly assistance to the geologists on many occasions. J. B. Mertie, Jr., of the Geological Survey, investigated the monazite deposits in the district during the summer of 1945 and supplied much information about bed-rock geology and the heavy-mineral content of several rocks.

The area immediately north of the Big Bess mine, Gaston County, was diamond-drilled by the U. S. Bureau of Mines during the summer of 1945. L. A. Dahners, Jr., the engineer in charge, made every effort to coordinate this work with the results of the geologic studies.

GEOGRAPHY OF THE DISTRICT

The Shelby-Hickory district embraces 800 sq mi in Cleveland, Rutherford, Gaston, Lincoln, Burke, Catawba, Caldwell, Alexander, and Iredell Counties, N. C. Six groups of mines and many scattered deposits occur in a portion roughly triangular, that includes most of Cleveland County and small parts of the adjoining counties (pl. 18). This part of the district is 75 miles long in a northeast-southwest direction and is about 25 miles in maximum width. Shelby lies about 5 miles south of the center of the triangle. A second portion, which contains fewer mines and in general has been less productive of mica, extends from eastern Caldwell County eastward and southeastward to north-central Catawba County and northward to northwestern Iredell County. Hickory is in the southern part of this portion, which includes four well-defined groups of mines and many scattered deposits. The northern portion is separated from the southern one by a belt several miles wide in which few deposits are known. These two main divisions are grouped into one district because of the marked similarity of their deposits.

Paved State and Federal highways pass through or alongside all the groups of deposits in the southern part of the district except the one in southwestern Catawba and southeastern Burke Counties, which is crossed by gravel and dirt roads. The deposits in Catawba, Alexander, and Iredell Counties are likewise easily accessible, but those in eastern Caldwell and northeastern Rutherford Counties are in country of high relief and are accessible only over unsurfaced roads and trails. Gravel roads pass within a mile of most of the outlying deposits. A branch line of the Southern Railway crosses the district from Rutherfordton to Shelby, and main lines extend through Kings Mountain and Hickory. A line of the Seaboard Airline Railway is parallel to the Southern Railway branch between Rutherfordton and Shelby and from Shelby extends northeastward through Cherryville. The main line of

the Carolina, Clinchfield, and Ohio Railway serves the western part of the district.

The district includes part of a low rolling plain that rises from an altitude of about 850 ft at the town of Kings Mountain to about 1,100 ft in Caldwell County, where it adjoins outlying spurs of the Blue Ridge. A few monadnocks that rise above the general level of the plain are prominent parts of the landscape. The Pinnacle, near Kings Mountain, is the highest, with an altitude of 1,705 ft. The central and southern parts of the district are drained by tributaries of the Board River, which flows eastward to a point southwest of Shelby and southward into South Carolina. The largest tributary, the First Broad River, rises in the rough country in northern Rutherford and Cleveland Counties. The Catawba River, which flows eastward across the area north of Hickory, drains the northern part of the district.

The rocks in the district have been thoroughly weathered to appreciable depths. Pegmatite and granite are altered to aggregates of white or iron-stained kaolin, friable microcline, quartz, and mica. Fresh plagioclase is exposed in pegmatite at only six mines. Gabbro and the metamorphic rocks are weathered to buff, red-brown, or dark-brown masses of quartz, mica, clay, and hydrous oxides of iron and manganese. Unweathered rocks, generally moderately fine grained and poor in mica, are exposed in a few road cuts and creek beds.

GEOLOGY OF THE DISTRICT

ROCK FORMATIONS

METAMORPHIC ROCKS

The eastern edge of the district is approximately marked by a narrow belt of quartzite, conglomerate, phyllite, and marble of possible Cambrian age (Keith and Sterrett, 1931, p. 5). These rocks are succeeded farther east by belts of hornblende schist injected by Bessemer granite, Battleground schist, and finally the main body of Bessemer granite. All appear to contain few pegmatite deposits, but they may have exerted an indirect influence in the localization of the main pegmatite areas.

Most of the pegmatite district is underlain by granitic igneous rocks and by metasedimentary rocks of high-rank metamorphism (fig. 77). The most widespread rocks are the mica schists and gneisses mapped as Carolina gneiss by Keith and Sterrett (1931), but several rock types are included in this unit. The principal one is well-foliated schist that contains muscovite, biotite, quartz, feldspar, sillimanite, garnet, and graphite. In most places biotite is far more abundant than muscovite, but locally the reverse is true. Feldspar and quartz are widespread, and constitute 30 to 80 percent of the

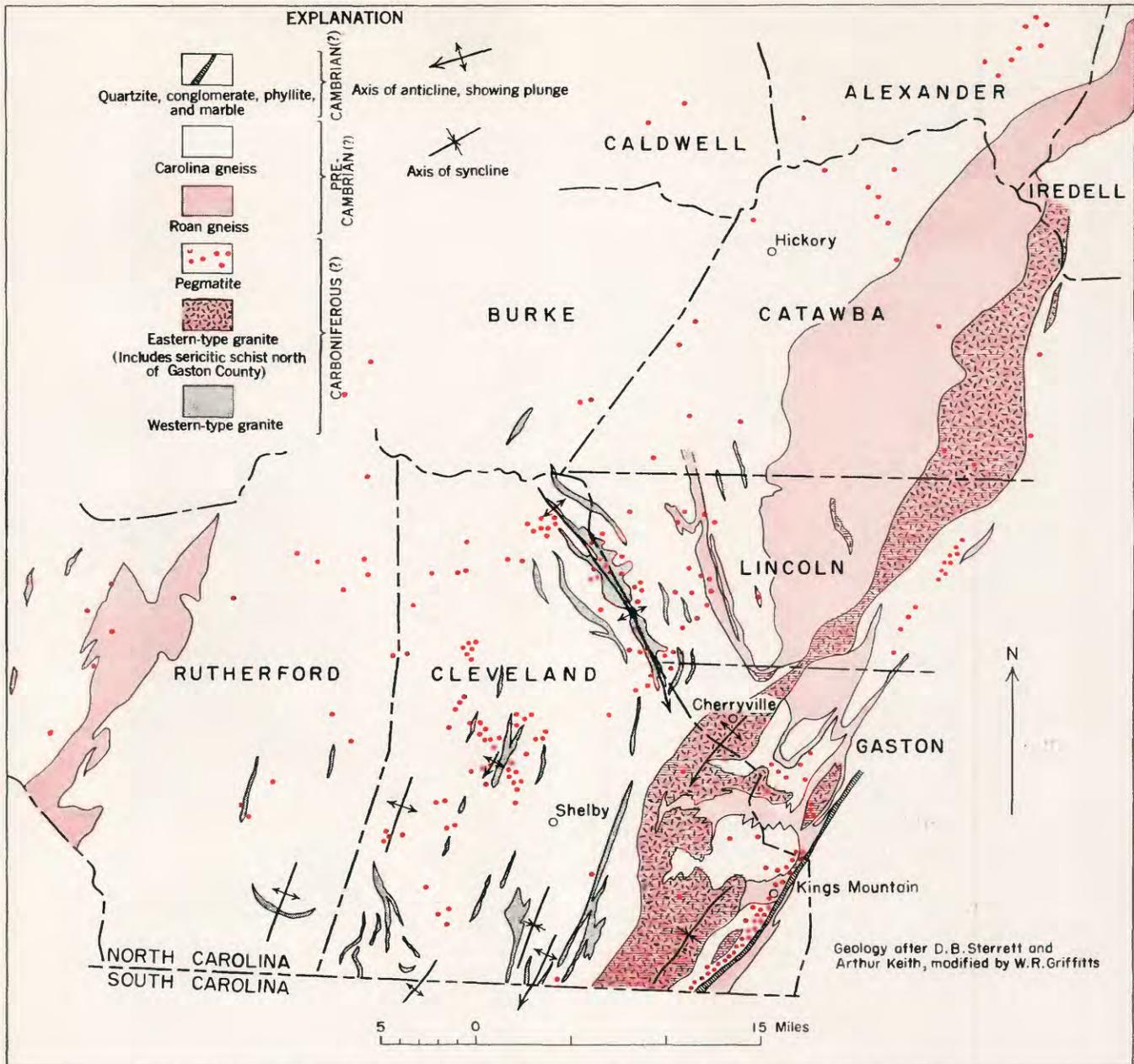


FIGURE 77.—Geologic sketch map of the Shelby district and vicinity, North Carolina

rock. Sillimanite is locally abundant, either as feltlike aggregates in mica schist or in layers or lenses of quartz-sillimanite rocks, and it commonly constitutes 10 percent or more of the rock. Sillimanite-rich schist about $11\frac{1}{2}$ miles S. 60° W. of Belwood contains a few prisms of bronze-colored corundum $\frac{1}{2}$ to $1\frac{1}{2}$ in. long. Shiny black flakes of graphite occur sparsely in most of the district but are widespread in central Cleveland County, southeastern Burke County, and south-central Catawba County. Tourmaline is locally an accessory mineral, chiefly in grains $\frac{1}{8}$ to $\frac{1}{4}$ in. across.

A distinctly layered feldspathic biotite gneiss is exposed in road cuts at the west edge of Shelby, and it is

the wall rock at the A. F. Hoyle mine, $1\frac{3}{4}$ miles west of Toluca. It contains abundant green hornblende, brown biotite, and andesine, with smaller quantities of quartz, calcite, epidote, zircon, and apatite. Most of the mineral grains are less than $\frac{1}{20}$ in. across, but some layers are composed largely of feldspar and quartz in $\frac{1}{10}$ -in. grains. A fine-grained feldspathic rock that lies within the Carolina gneiss is exposed in the Shelby quarry and elsewhere in southern Cleveland County. It shows little foliation but contains some disseminated biotite flakes with parallel orientation. The rock consists of plagioclase, quartz, biotite, and accessory zircon, sphene, and calcite. Its contacts with

the younger granite are sharp, but its extent, attitude, and relations to older rocks are not known. It may be a quartz diorite or a metamorphosed sandy sediment.

Beds of dolomitic marble, 1 to 20 ft thick, are inter-layered with the mica schist at several places east and south of the Shelby district, but this rock is not known within the district itself. All the marble beds lie parallel with the foliation of the enclosing rock. (Keith and Sterrett, 1931, p. 3.)

Through most of the district hornblende schist and gneiss, termed "Roan gneiss" by Keith and Sterrett (1931, pp. 3-4), occur only as thin layers in the micaceous schists and gneisses, but one broad belt extends northeastward from the Cherryville area, in Gaston and Cleveland Counties, through central Lincoln and eastern Catawba Counties. A smaller belt appears to lie along the western edge of the district, in Rutherford County. Hornblendic rocks are exposed in the workings at both the E. R. Self and Huskins mines. The rock at the Huskins mine is well foliated and is composed largely of moderately fine grained hornblende, with small quantities of feldspar and local garnet. Most of the Roan gneiss may represent a series of volcanic flows, sills, and sediments; much of that in Lincoln County, however, is coarser-grained and may be of intrusive origin.

The Battleground schist, which crops out on Kings Mountain near the east edge of the district, is in large part an even-grained phyllite. Small grains of magnetite are common, and some members of the formation contain pebbles, boulders, or angular fragments of igneous rocks. Some massive rock layers contain partly altered crystals of feldspar in a fine-grained matrix of sericite and biotite and may well be remnants of ancient lava flows. In general the schist appears to consist of interlayered sediments, tuffs, volcanic breccias, and perhaps lava flows. Primary structures are better preserved in it than in the other metamorphic rocks, owing to less severe recrystallization and deformation. The "manganese lead" member of the formation is a layer of phyllite that contains much disseminated spessartite, in part altered to manganese oxides.

The micaceous rocks of the Carolina gneiss are thought to represent metamorphosed shale and sandy shale. Much of the hornblende schist is fine-grained and has a high hornblende and a low feldspar content. The schist may have originally been a sedimentary rock, possibly locally rich in volcanic material. After comparing the sequence of strata in the hornblendic and micaceous rocks of Gaston County with that of the marble, phyllite, and schist of the supposed Cambrian strata farther southeast, Kesler (1944, pp. 775-781) points out that the term "Carolina gneiss" has been

applied to metamorphosed shaly rocks wherever encountered in this area and like the term "Roan gneiss," has lithologic but not correlative value. It is evident that, although both "Carolina gneiss" and "Roan gneiss" are useful terms that indicate a general lithologic type, the rocks of each may range widely in age and differ greatly in origin.

IGNEOUS ROCKS

Several bodies of peridotite and one of pyroxenite are exposed in the northern part of the Gaffney quadrangle (Keith & Sterrett, 1931). Much of the original olivine and pyroxene have been altered to talc, serpentine, and chlorite. An apparently complex series of mafic rocks at the Old Plantation mine ranges from peridotite through hypersthene and olivine gabbro to hornblende gabbro. Many of the olivine grains are doubly rimmed, showing partial alteration to pyroxene, followed by partial alteration of the pyroxene to hornblende. The feldspar of the olivine gabbro has been replaced by roughly spherical aggregates of other minerals. Some of the alteration may have been the result of reaction between differentiates of the same original magma, although some probably accompanied the emplacement of the neighboring body of granite.

Gabbro is exposed at the Old Plantation mine, alongside North Carolina Highway 18 several miles north of Fallston, and probably in central Lincoln County. It is a massive to moderately foliated dark-gray rock composed of red-brown hornblende, labradorite, biotite, and olivine. Inclusions of this rock in both types of granite in the district are enriched in biotite.

Granite underlies much of eastern Cleveland County and central Gaston County, and sills as much as 2,000 feet thick are common in central and western Cleveland and Lincoln Counties (fig. 77). All the granite west of the belt of Cambrian rocks evidently was mapped as one unit by Keith and Sterrett, who correlated it with the Whiteside granite of southwestern North Carolina (Keith and Sterrett, 1931, p. 6). It was considered by them to be the result of igneous intrusion, although Kesler (1944, p. 759) believes that some is the result of metasomatic alteration of fine-grained mica schist by emanations from neighboring masses of granitic magma.

Recent study has shown that at least three different rocks have been included in the Whiteside granite in the Shelby district. J. B. Mertie, Jr. (oral communication, 1945), found that the granite sills in western Lincoln, central and western Cleveland, eastern Rutherford, and southern Burke Counties differ in mineralogy and structure from the large mass near Cherryville. The former is referred to in this report as the "west-

ern"-type granite, because the known bodies are in the western and central parts of the district—for example, a few miles northwest of Shelby and in western Lincoln County. The latter is termed the "eastern"-type granite, owing to its extensive development in the eastern part of the district, especially near Cherryville. The rock exposed in the Shelby quarry is dissimilar in several respects to both the other granites. The relative ages of the granites are not known with certainty, but the western-type granite is much more strongly foliated than the other two and hence may be older.

The western-type granite is actually a quartz monzonite and consists chiefly of microcline, orthoclase, calcic oligoclase, quartz, biotite, muscovite, and garnet. Muscovite is subordinate to biotite in all the material examined. Garnet is common and locally is abundant. Monazite, zircon, and apatite are widespread accessory minerals, and calcite occurs sporadically. In most places the feldspar and quartz grains are about $\frac{1}{20}$ in. across, but some of the garnet grains are $\frac{1}{10}$ in. in diameter. Most of the biotite flakes are mere specks, which occur in clusters between the light mineral grains and also are scattered individually through the rock. In some places biotite constitutes 20 percent of the rock and occurs in fine-grained layers wrapped around subhedral feldspar grains. In general, the biotite content appears to vary inversely with the garnet content of the granite.

Some small masses of western-type granite consist largely of quartz and feldspar. Such rock, which contains 20 to 80 percent quartz, commonly contains large garnet crystals or a few tiny flakes of biotite as well. Myrmekitic intergrowths of quartz and oligoclase are common, and a little muscovite is intergrown with microcline, oligoclase, and quartz. The degree of foliation ranges widely and to some extent is related to the mineral composition of the rock. The quartz-rich types generally are more strongly foliated than the biotite-rich varieties, as the quartz tends to occur in plates and spindles oriented parallel with the walls of the granite sills and with the foliation of the country rock.

Irregular masses and dikes of a coarse-grained rock are exposed at the G. B. McSwain mine and in road cuts west of Toluca. This rock consists of the same minerals as the western-type granite, with which it is associated, but the minerals occur in grains as much as $1\frac{1}{2}$ in. in diameter. Some aggregates of garnet grains are as much as 2 in. across. This pegmatitic phase of the western-type granite also forms northward- to north-eastward-trending dikes in the schist.

Bodies of western-type granite are a few inches to at least 2,000 ft thick and as much as several miles long (figs. 77 and 82). Their contacts, where exposed, appear

to be approximately conformable with the foliation of the enclosing metamorphic rocks. At the A. F. Hoyle mine blocks of feldspathic gneiss, apparently unaltered by the magma, are included in the granite. The wall-rock itself is little altered where it is feldspathic, but where it is micaceous or highly sillimanitic it is commonly much altered, and the different alteration types are described under "Wall-rock alteration." The occurrence of unaltered and unoriented gneiss inclusions in the granite, and the locally discordant contacts, suggest that the bulk of western-type granite was formed by mechanical igneous intrusion, rather than by wholesale replacement of the country rock. The sharpness of the contacts with the highly altered schist is noteworthy, suggesting that even in these permeable rocks the amount of replacement may have been slight as compared with the amount of material mechanically intruded.

Unweathered eastern-type granite was rarely observed during the present investigation; hence few details are known concerning its composition. It is a medium-grained, massive to poorly foliated rock composed largely of feldspar, quartz, and muscovite. Like all other granitic rocks in the Southeastern States that have been described, it probably contains oligoclase or andesine as the dominant feldspar. It contains few accessory minerals, although zircon in small amounts is widespread. Biotite and muscovite both are common, biotite especially so near inclusions of hornblende rocks, the assimilation of which probably contaminated the adjacent granite magma. Keith and Sterrett (1931) report that many hornblende inclusions in the region south of Cherryville have been partly altered to biotite schist and that the surrounding granite is enriched in biotite. Many micaceous inclusions have been partly digested by the granite to yield mica-rich streaks and layers in otherwise normal granite.

The eastern-type granite, like the western, appears to have been emplaced with sufficient force to push aside the foliation planes of the schists. The eastern type granite also stopped large blocks of the less schistose rocks. The concentration of biotite near partly assimilated bodies of hornblende gneiss, together with the low biotite content of most of the eastern-type granite, suggests that assimilation played only a minor role during intrusion of the rock.

The granite in the Shelby quarry is a medium- to coarse-grained aggregate of feldspar, quartz, muscovite, biotite, and garnet. Most of the feldspar is gray plagioclase and microcline, but some salmon-colored perthite grains as much as 4 in. long occur with a little tourmaline as irregular masses. Much of the biotite occurs in clusters, whereas the muscovite is scattered through the rock. Garnet is locally abundant, gener-

ally in nearly horizontal streaks or layers. Zircon is a minor accessory mineral, but no monazite appears to be present. Most of the quartz is in small grains interstitial to feldspar, but some forms lenses as much as 6 in. thick and as much as 3 ft. long. The granite in the upper part of the Shelby quarry contains many tabular inclusions, 10 feet or more long, of fine-grained feldspathic gneiss. The gneiss is similar to the country rock and does not appear to have been altered by the granitic magma.

Small dikes of granite in Cleveland and Rutherford Counties characteristically occur with mica-bearing pegmatite or lie in structures identical to those that controlled the emplacement of the pegmatites. They are well exposed at the Frank Cornwall and Dycus mines and near the Bowen mine, where they are composed of feldspar, quartz, and muscovite. Microcline appears to constitute about half the feldspar, which occurs as grains about a quarter of an inch across. The mica and quartz grains are smaller. Zircon is the chief accessory constituent, and monazite is not present. The granite probably represents the magma from which the nearby pegmatite was derived, and it must have been formed only a short time before consolidation of the pegmatite. Both are localized in the same structures, and there is little evidence of chilling of the pegmatite along contacts with the granite.

The intensity of rock alteration near the granite bodies varies greatly with different types of granite and wall rock. The fine-grained gneiss adjacent to the granite in the Shelby quarry has been little altered, perhaps because of its mineralogic similarity to the granite itself. The eastern-type granite apparently has little effect upon nearby mica schist or gneiss, but in places the granite itself is somewhat enriched in mica or unusually coarse in grain near its walls. Hornblende rocks are characteristically altered to mica schist near the granite bodies, but detailed studies of mineral alteration near such bodies have not been made, owing to the thorough weathering of the rocks.

The intrusion of the western-type granite was accompanied by much greater wall-rock alteration than that of the eastern type. Peridotite was locally altered to an actinolite-rich rock, and the hornblende of gabbros and amphibole schists was converted to biotite within a few inches of the contacts with granite. Feldspathic mica gneiss appears to have undergone little or no alteration, whereas the more permeable mica schist was greatly affected. Microcline, orthoclase, quartz, and monazite were developed in the schist, and garnet, sillimanite, biotite, and graphite were recrystallized with marked coarsening of texture. The most characteristic and easily recognized additions are metacrysts of potash feldspar, some of which are large single

crystals with chatoyant luster. Others are small augen with a little quartz and muscovite, ranging in width from $\frac{1}{10}$ to 2 in. They are sparsely to densely distributed through the rock.

Pink garnet forms lenses that in places are half an inch across and locally constitute 25 percent or more of the rock. Rock exposed in a creek bed north of the Metcalf mine is so rich in garnet that it is lavender. Quartz forms grains and irregular layers as much as an inch thick. Sterrett (1911) reports that monazite is associated with each of the other minerals but is most abundant in feldspar-rich rock and least abundant in sillimanite-rich rock. Biotite and graphite, probably original constituents of the schist, are present in flakes as much as a quarter of an inch broad.

STRUCTURE

The regional trend of the foliation in the metamorphic rocks and the trend of the major rock units in this part of the Piedmont are northeast. The regional dip is southeast. Variations and reversals of dip indicate broad folds that affect the attitudes of both the foliation and the rock units, and small areas of contorted rock are present locally. Two of the most conspicuous broad folds extend along the western boundary of Lincoln County and across northwestern Gaston County, respectively (fig. 77). The axis of the Lincoln County Fold tends northwest and appears to plunge gently southeast, and this structure may have been important in localizing some of the pegmatite deposits. The fold in Gaston County appears to be a broad dome across a marked bulge in the main eastern-type granite mass at Cherryville. The western and southern flanks of the dome are complex series of interlayered granite sills and metamorphic rocks, with many granite dikes. The main granite body may plunge south or southwest (Keith and Sterrett, 1931, p. 6).

A third large arch in the country rock lies west of the largest group of mines northwest of Shelby and near the Rutherford County line. It trends northeast and passes through the town of Lattimore, N. C. The foliation of the schist is somewhat contorted near its crest, either as a result of flowage during folding or because of later deformation superimposed upon the anticlinal structure. The axes of several other folds are shown in figure 77. Most of them are known to plunge south or southeast, but small folds in limestone at the Kings Mountain gold mine, 2 miles south of Kings Mountain and a short distance east of the Shelby district, plunge gently northeast (Keith and Sterrett, 1931, p. 8). All the linear structures whose attitudes have been determined, except those east of the Cambrian rocks, thus plunge in a southerly direction, and the plunge of the folds at the Kings Mountain mine may

not represent the typical attitude of structures in the eastern area. Most of the folds trend northeast; the northwestward-trending arch in western Lincoln County is the largest known exception.

Fractures that formed before the pegmatite are widespread, but deformation after pegmatite emplacement has been slight. A fold in the country rock at the Griggs mine passes upward into a small reverse fault that offsets the pegmatite dike, and joints and minor faults are common in the Big Bass deposit in Gaston County, the Cliff Blanton mine in Cleveland County, and the Sigmon mine in Catawba County. Many joints cut the hornblende schist at the east end of the E. R. Self open-cut but persist for only a few inches into the adjoining mica schist. Large thrust faults have been mapped along the eastern edge of the district (Keith and Sterrett, 1931) but these were not examined during the present study. The movement along the faults probably antedates pegmatite formation in the Cherryville area and in eastern Cleveland County, as the book mica in most of these deposits is not markedly deformed.

MICA-BEARING PEGMATITES

DISTRIBUTION AND OCCURRENCE

The Shelby-Hickory district can be subdivided along a barren belt near its middle (pl. 18). The southern part, which contains the largest number of deposits and has accounted for most of the mica production, contains six major groups of deposits (pl. 19):

1. The *Burke Chapel area*, in southeastern Burke and southwestern Catawba Counties, contains at least 11 deposits. Most are near Burke Chapel.

2. The *Fallston area*, which comprises parts of Lincoln and Cleveland Counties, contains 50 known deposits. Production from these has been large.

3. The *Cherryville area* is 3 to 5 miles southeast of Cherryville, in Gaston County. It contains 9 developed deposits, as well as several not yet explored, and has accounted for a large part of the production from the district.

4. The *Kings Mountain area* extends about 5 miles northwest and 5 miles southwest from Kings Mountain. It includes 10 deposits.

5. The *Shelby area*, 1½ to 8 miles northwest of Shelby, includes at least 65 deposits. It is one of the most productive areas.

6. The *Polkville area*, 1 mile east of Polkville in Cleveland County, contains 8 deposits.

The northern division of the district comprises four groups of pegmatites:

1. The *Northwestern Iredell County area*, at the north end of the district, contains six known deposits.

2. The *Hiddenite area* extends southwest from Hid-

denite to Payne's store, in central Alexander County. It includes at least nine deposits.

3. The *Oak Hill area* lies between Brushy Mountain and Granite Falls, in Caldwell County. A total of 11 deposits are known, and most occur within 4 miles of Oak Hill.

4. The *Conover area*, in north-central Catawba County, extends about 5 miles south from the Catawba River nearly to Conover. It is 2 to 5 miles west of North Carolina Highway 16. At least seven deposits are included within its limits.

During the recent investigations most attention was given to the deposits in the southern part of the district. Several mines and prospects in the Conover and Hiddenite areas were studied, but only one in the Oak Hill area was examined and none in the Northwestern Iredell County area were visited. Most of the following discussion is therefore based upon information from the more southerly pegmatites.

GENERAL STRUCTURAL FEATURES

SIZE AND SHAPE

The pegmatite dikes in all areas of the Shelby-Hickory district range in thickness from a few inches to at least 140 ft. Few are known to measure less than 2 ft, and most of those that have been profitably mined range from 5 to about 15 ft. The total lengths of only a few deposits are known. Among the shortest are the lenses at the G. B. McSwain mine, which are less than 30 ft long. The longest known dike, at the Cabaniss-Story mine, is discontinuously exposed for 525 ft. In general, small lenses are most common in the southern part of the Shelby area and in the Kings Mountain area, whereas relatively long tabular bodies and flat lenses are common in the northern part of the Shelby area and in the Fallston area. The dikes in the Burke Chapel area appear to be thicker than those farther south in the district, but few are sufficiently well exposed to permit the determination of shapes or lengths.

The persistence of the dikes with depth varies greatly, but this variation is to some extent systematic with respect to the position of the pegmatite within the district. In the southwestern part of the district, where the deposits are relatively short lenses, none has been proved to extend to a depth of more than 60 ft. Some dikes and lenses in other parts of the district also may bottom at shallow depth. The Campbell deposit, in the central part of the Shelby area, pinched out abruptly at the 25-ft level in the northeastern mine workings, and the dike at the M. H. Gantt mine bottomed at a depth of about 35 ft.

The pegmatite lenses thin gradually along their strike from the broadest parts of the outcrops, both at the surface and at depth. In contrast, most of the long

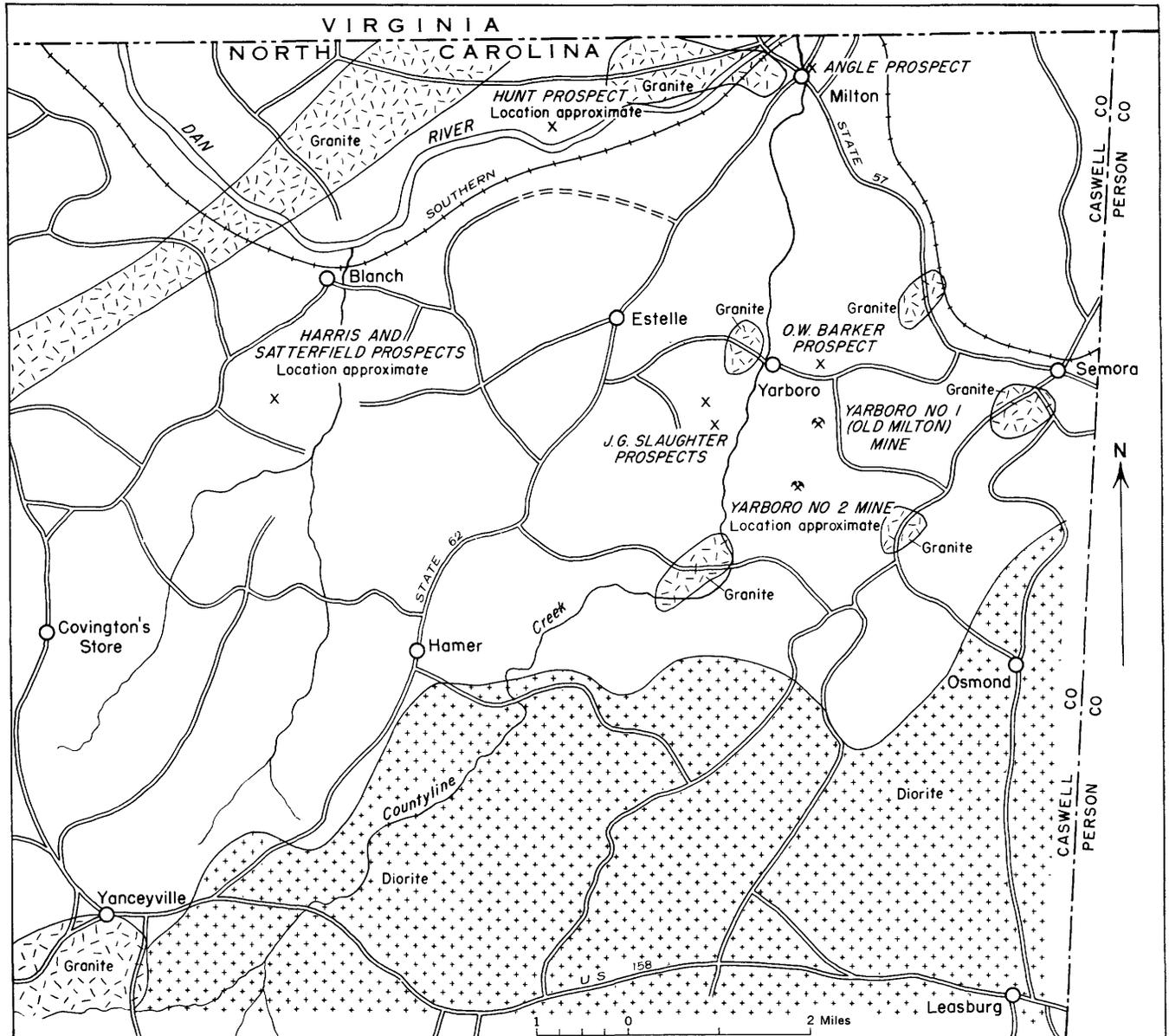


FIGURE 78.—Index map of part of Caswell County, N. C., showing location of mica deposits and granite and diorite bodies. (See p. 286.)

dikes are less symmetrical and in general plunge steeply. The crest of the Abernathy Water deposit, for example, is broad and round, whereas the tapering keel is sharply terminated. The southern Cliff Blanton dike also thins gradually toward its keel, but a pegmatite layer about 3 ft thick continues crestward above its thickest part and beyond an abrupt thinning that is due to a sharp bend in the footwall. The footwalls of several dikes, notably those at the Cliff Blanton and Toy B. Webb mines, are undulatory, whereas the hanging walls are straight. The reverse relation was nowhere observed.

ATTITUDE

The dikes in most of the Shelby area and all but the northwestern part of the Fallston area strike nearly

east (fig. 79). Those along the western edge of the Shelby area, those in the Polkville area, and those scattered elsewhere near the Rutherford County-Cleveland County line strike north to northeast. The dikes at the northwest end of the Fallston area range widely in strike. A similar disposition of eastward-trending bodies on the east side of the district and northward-trending ones on the west side is apparent in the northern areas. As the zone of shift in strike lies within the large group of mines in Cleveland County, its position there can be determined accurately. It is not abrupt in detail, but is a northeastward-trending belt about half a mile wide; its position is indicated in figure 79. The southern part of this belt may nearly coincide with the contorted zone along the crest of the arch near the

county line. The strike of the deposits along the eastern edge of the district, in the Kings Mountain and Cherryville areas, swings toward the northeast.

Many dikes, like that at the Biggerstaff mine, are broadly curved, but several others bend sharply. The J. B. Peeler dike, for example, bends abruptly from a strike of N. 40° E. to one that is nearly west. In a similar but less abrupt bend the Sigmon dike swings from N. 20° E. to N. 60° E.

The dip of most deposits in the district is 75° to vertical. The Big Bess, Dycus, Sigmon, and Dagenhart dikes are the only known exceptions. The Big Bess is nearly horizontal in most of the open-cut but dips more steeply at the outcrop and very steeply in the lowermost mine workings. Several of the pegmatite lenses in the district appear to have nearly level keels, but those in and near the Polkville area show clear evidence of plunge. Among the long dikes, in contrast, those at the Abernathy Water and southern Cliff Blanton workings plunge steeply south-southwest and east, respectively.

RELATION TO COUNTRY ROCK

All the bodies of pegmatite that were examined clearly transect the foliation of the country rock; hence they probably were emplaced along fractures. The fractures themselves resulted from widespread tectonic forces rather than from forcible intrusion of pegmatite magma, as indicated by their occurrence in regular patterns over broad areas, by the displacement of the country rock along them, and indirectly by the regular outlines of most dikes. The country rock is visibly bent near the pegmatite in several mine workings. Figure 80A shows the drag of the country rock near a granite dike of the type commonly associated with pegmatite. The warping indicates that the rock along the north wall of the dike moved downward with respect to that along the south wall.

The attitude of the country-rock foliation at 10 points distant from known pegmatite and at 13 points adjacent to pegmatite is plotted in figure 81, which summarizes all such information available in the southeastern part of the Shelby area. The foliation near most of the deposits dips in a more southerly direction than that in the intervening areas, presumably as the result of drag caused by a relative downward or westward movement of the rock adjacent to the south walls of the dikes. The wall-rock foliation at the Rudasill and Charles Cornwell mines is bent in the opposite direction, probably indicating the reverse direction of movement. Similar variations may well occur in the remainder of the Shelby area and in the Fallston area, but they cannot be as easily shown because of the general irregularity of the foliation in those areas. Drag

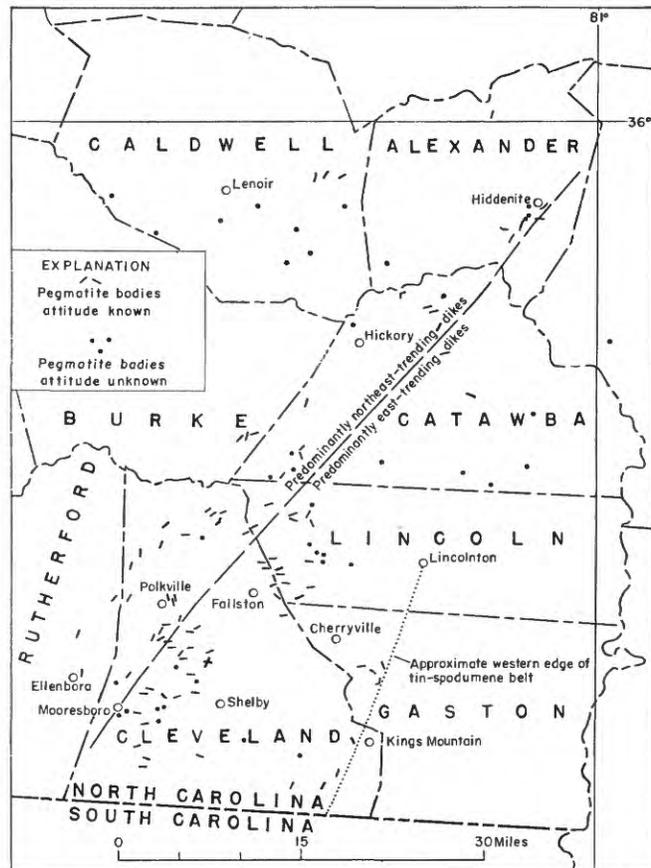


FIGURE 79.—Map of the Shelby-Hickory district, North Carolina, showing the trends of pegmatite bodies.

along the west walls of the northward-trending Powell and Gettys No. 1 dikes indicates depression with respect to the east walls. The foliation is not greatly warped near the Biggerstaff deposit, but displacement along a fracture predating the pegmatite is shown by the dissimilarity of the wall rocks on opposite sides of the pegmatite.

The structures that guided emplacement of the pegmatite at the Archie mine are evident in the badly fractured granite exposed in the west end of the open-cut. The western-type granite was shattered rather than cut by a sharp fracture like the regular ones that are common in the schist and gneiss. Some of the granite blocks are slightly warped and rotated (pl. 44B). Part of the E. R. Self pegmatite was emplaced in metamorphic rocks and along the contact between them and eastern-type granite, but most lies within the granite. Apophyses with ragged, scalloped contacts are common, and many inclusions of granite occur within the main pegmatite body. Metacrysts of muscovite, biotite, and feldspar are abundant in the granite within a few feet of the pegmatite contact but do not appear to be present farther away. The northeastern, or largest, dike thins markedly where it passes from granite into

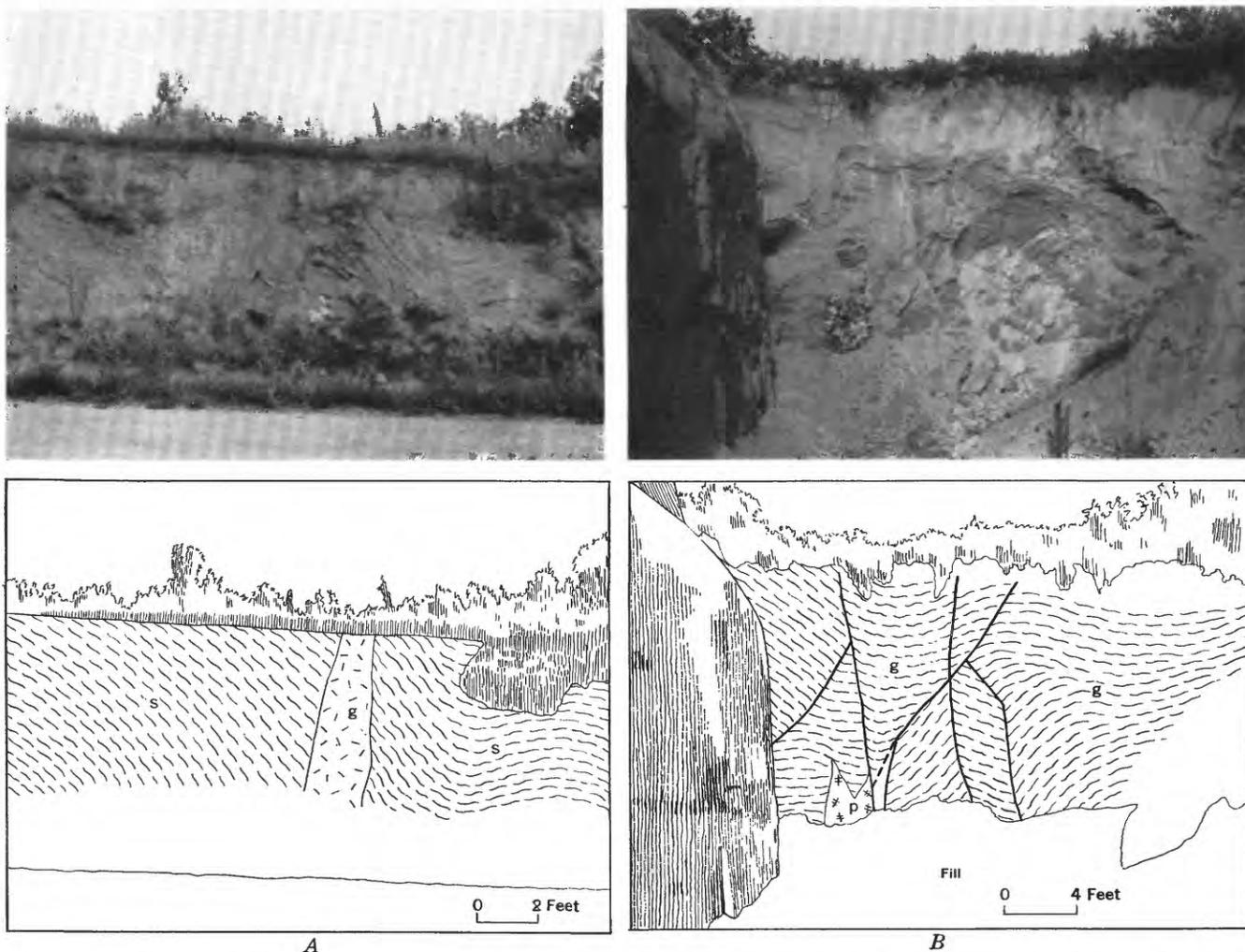


FIGURE 80.—Distortion and rupture of country rock, Shelby-Hickory district. *A*, Drag of schist near granite dike, road cut east of Bowen mine, Cleveland County: *s*, mica schist; *g*, granite showing foliation. *B*, Western-type granite above pegmatite dike, showing fracturing and folding of foliation, west end of Archie open-cut, Cleveland County: *p*, mica-bearing pegmatite; *g*, western-type granite showing foliation.

schist. These relations within the eastern-type granite are in distinct contrast to the relations of the pegmatites that occur in the western-type granite and in schist and gneiss.

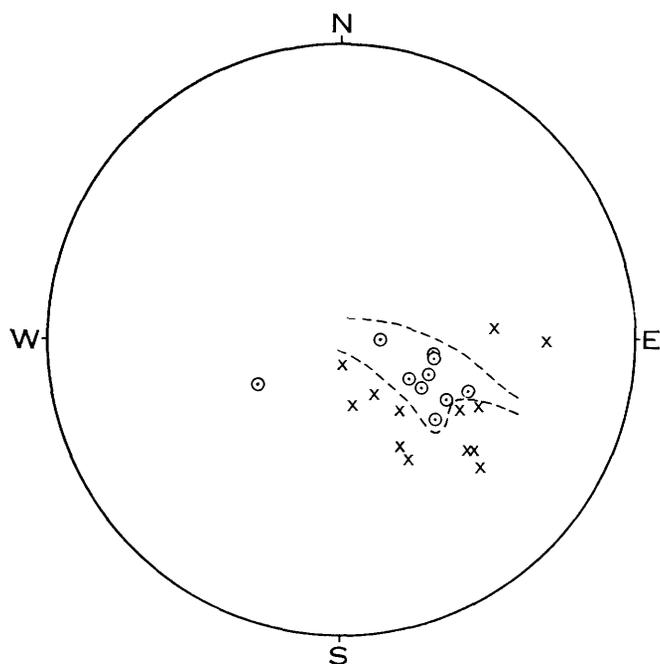
Many of the pegmatite deposits in the largest groups are closely associated with large granite masses. This is best shown in the Fallston area (fig. 82), in which most of the pegmatites occur within a mile of the east side of a broad, irregular body of western-type granite. Apparently they lie above the granite and along the flank of a large fold in the metamorphic rocks. Similarly, other pegmatites occur near the margin of a mass of hornblende gneiss about 2 miles farther east.

The deposits in the Shelby and Burke Chapel areas also occur near large sills of western-type granite and appear to be most abundant east of them. In the Cherryville area (fig. 83) most of the mica-bearing pegmatites are along the southeast side of a large bulge in the belt of eastern-type granite. The mica-bearing

pegmatites of the Kings Mountain area lie near the east side of the same granite belt several miles farther south. The presence of the granite is not the sole factor governing the occurrence of the pegmatite, as large sills of western-type granite west and south of the Shelby-Hickory district apparently are not accompanied by mica-bearing pegmatites similar to those that have been mined.

The two largest groups of deposits in the district, in the Shelby and Fallston areas, are near the intersection of the large granite sills with the zone that separates the northward-trending from the eastward-trending pegmatite dikes. Smaller groups of deposits occur along masses of hornblende gneiss (fig. 82) and along other sills of western-type granite. In general the pegmatites are concentrated near contacts between structurally competent rocks and rocks that are markedly less competent.

The structural control of pegmatites by the eastern-



EXPLANATION

x
Pole of foliation, measured at a point
near pegmatite dike

o
Pole of foliation, measured at a point
distant from pegmatite dikes

FIGURE 81.—Poles of country-rock foliation at 10 points distant from and 13 points adjacent to pegmatite dikes in the southeastern part of the Shelby area, North Carolina: x, point near pegmatite dike; o, point distant from pegmatite dikes.

type granite is much less obvious than that exerted by the western-type granite. Most of the pegmatites occur east of the granite bulge near Cherryville, to be sure, but in the Kings Mountain area the deposits are distributed across most of the granite mass, a distance of several miles. The pegmatite deposits in the eastern part of the district trend northeast, but individual strikes range much more widely than in the other areas. Available data do not indicate whether the position of the pegmatites with respect to the eastern-type granite has appreciably influenced their structural features or composition.

INTERNAL STRUCTURE

Zones are generally well developed in the Shelby-Hickory pegmatites, few of which lack quartz cores. Probably half the pegmatites contain both intermediate and wall zones in addition to the cores and border zones. The thick middle parts of many pegmatite bodies have been mined, leaving only the thin peripheral parts. This tends to obscure the relations of the zones, especially in those dikes that contain one or more discontinuous units. No zoning statistics can be given, owing

to the incomplete exposures of most deposits, but nine general types are recognizable in the district, as shown in the table below. Muscovite is present in many of the zones, especially those that contain plagioclase. The border zones are typically thin, discontinuous selvages of plagioclase-quartz pegmatite, with or without muscovite.

The long dikes most commonly show zoning of the first two types; typical examples are the Cliff Blanton and Cabaniss-Story pegmatites. The simple dikes at the Plato Houser No. 1 mine contain zones of the second type only. In contrast, the bulbous Drum pegmatite contains a discontinuous quartz core, a discontinuous beryl-bearing quartz-perthite-plagioclase-muscovite inner intermediate zone, a thick, plagioclase-rich

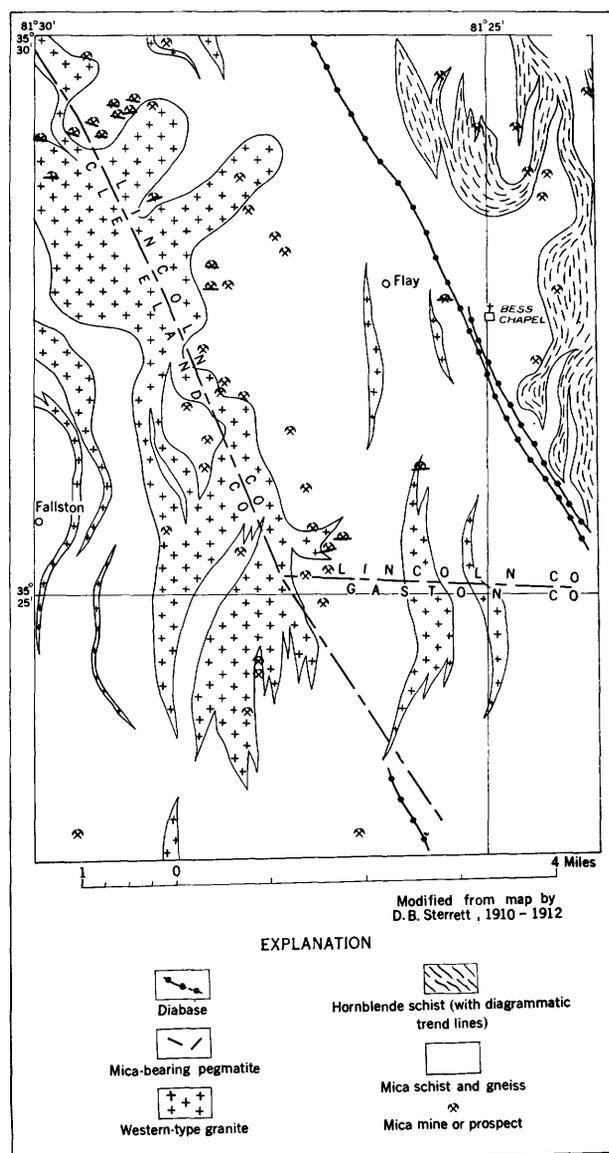


FIGURE 82.—Geologic reconnaissance map of the Fallston area, Lincoln and Cleveland Counties. After Keith and Sterrett.

outer intermediate zone, a plagioclase-quartz-muscovite wall zone, and a thin plagioclase-quartz border zone. The plagioclase-quartz-muscovite unit might be subdivided into a thin, discontinuous wall zone that contains sheet mica and an outer intermediate zone characterized by scrap mica. In the short, lenslike pegmatites the first eight types of zoning are known to occur.

Zoning types recognizable in the Shelby-Hickory district

[Border zones are present in all nine types; these zones are typically thin, discontinuous selvages of plagioclase-quartz pegmatites, with or without muscovite]

Type No.	Border zone	Wall zone	Intermediate zone	Core
1	Present	Plagioclase-quartz	Blocky perthite	Quartz.
2	do	do	(1)	Do.
3	do	Plagioclase-perthite-quartz.	(1)	Perthite-plagioclase-quartz.
4	do	do	Perthite-plagioclase-quartz.	Quartz.
5	do	Medium-grained plagioclase-quartz.	Coarse-grained plagioclase.	Do.
6	do	Quartz-muscovite	(1)	Do.
7	do	Plagioclase-perthite-quartz.	(1)	Do.
8	do	(2)	(1)	Plagioclase perthite-quartz.
9	do	Plagioclase-quartz.	Outer: Plagioclase-perthite-quartz-muscovite. Middle: Plagioclase-perthite-quartz. Inner: Blocky perthite.	Quartz.

¹ No intermediate zone.
² No wall zone.

Zoning of types 3, 4, and 5 is interesting in that two zones are composed of essentially the same minerals but are distinguished on the basis of different textures and mineral proportions. The pegmatites that contain plagioclase and perthite in both the wall and intermediate zones are vuggy in their inner parts and show evidence of late-stage corrosion of the feldspars and formation of secondary muscovite. They also appear to contain less quartz than most other deposits in the district. The A. F. Hoyle and Bowen pegmatites are of this type. In the Niagara dike the wall zone is medium-grained plagioclase-quartz pegmatite that contains flat books of cinnamon-brown muscovite. The intermediate zone, which is very coarse grained, is composed largely of plagioclase and yellowish-green reeved mica, with minor quartz. The contacts between these units are sharp, even above the upper edge of the quartz core.

The other types of zoning are not common. Several are known to occur only in one deposit or in a small group of deposits. Zone sequences of types 6, 7, and 8, for example, occur at the Albert Wright prospect, the Sigmon mine, and the G. B. McSwain mines, respectively. Zoning of type 9 is well exposed at the Dycus mine, and the zoning in the W. T. Foster No. 1 pegmatite is somewhat similar.

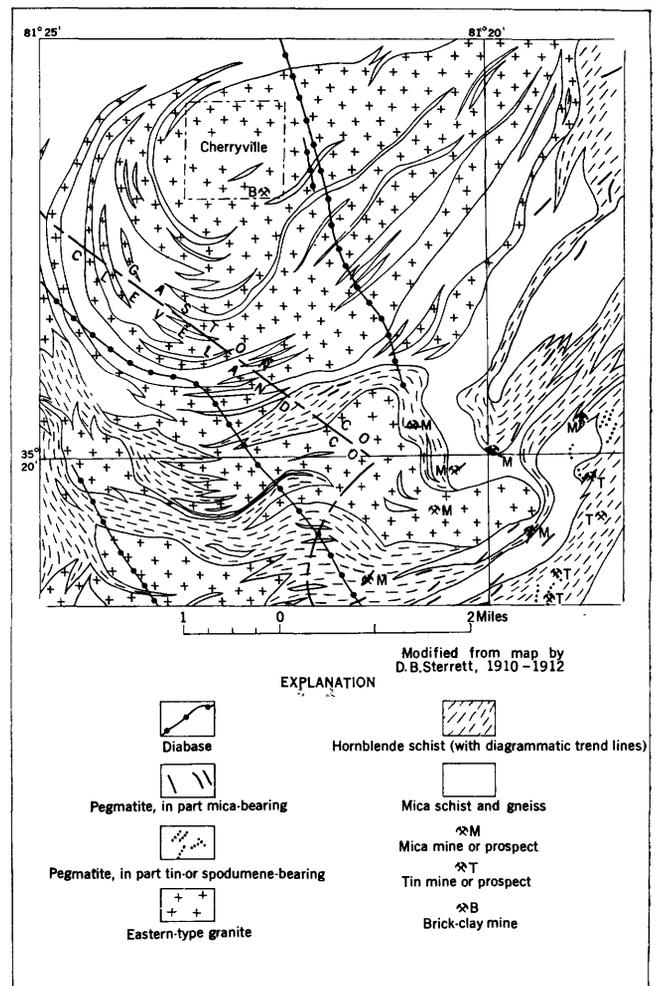


FIGURE 83.—Geologic reconnaissance map of the Cherryville area, Gaston County. After Keith and Sterrett.

Several features are common to most of the pegmatites, regardless of the type of zoning present. The grain size and perthite content increase inward from the walls, and the proportion of quartz appears to be lower in the intermediate zones than in the wall zones or the cores. The border zones are thin, discontinuous, and in most places inconspicuous. Some consist of a layer a fraction of an inch thick of granular smoky quartz, with or without small flakes of mica. Others are feldspathic and contain small books of mica or spindles or layers of quartz oriented normal to the contact. Quartz-rich border zones may be somewhat more common in the long dikes than in the lenses, whereas the most feldspathic border zones probably are most common in the smaller lenses. The quartz-rich border zones probably are more common than the feldspathic ones in the district as a whole. With few exceptions the contacts between zones are sharpest near the middle of the pegmatite bodies. The transition between adjacent zones generally takes place within a

distance of a few inches, and many contacts are of knife-edge sharpness.

Even the unzoned deposits are not homogeneous. The G. B. McSwain pegmatite, for example, consists almost entirely of plagioclase-perthite-quartz pegmatite, but most of the perthite occurs in nearly horizontal layers, less than 1 ft thick, that are separated by perthite-poor-plagioclase-quartz pegmatite. Similar variations occur within individual zones in other pegmatites. In the wall zones of the southern Cliff Blanton and Plato Houser No. 1 dikes mica is concentrated in layers that are separated by layers of barren plagioclase-quartz pegmatite several feet thick. The layers in the Plato Houser deposit are reported to be nearly horizontal, whereas those in the Cliff Blanton deposit are said to dip eastward, parallel to the plunge of the mica shoot and the plunge of the crest of the dike. The mica content of most zones varies greatly from place to place. Sparsely scattered books of mica in some wall zones are in sharp contrast to adjacent well-defined mica shoots in which the book mica constitutes as much as 7 or 8 percent of the rock.

The contrast in composition between adjacent zones also varies along the strike or down the dip of the pegmatites. Many contacts between pegmatite zones are sharp alongside the quartz cores, but beyond the ends of the cores or between core segments the contacts become diffused and the position of the inner zone involved is composed of the minerals of the inner and outer zones. The pegmatite in these "telescoped" units is granitic or is porphyritic with perthite phenocrysts in a plagioclase-quartz groundmass. In the Big Bess pegmatite (fig. 19, ch. A of this series) this is clearly shown.

The wall and intermediate zones of the Big Bess deposit are sharply bounded and contrast markedly in composition in the thin, essentially flat-lying part of the dike, which contains no core segments. The rock in the more steeply dipping upper part of the dike is rather homogeneous plagioclase-perthite-quartz pegmatite with some muscovite and moderate quantities of biotite. In the lower and thicker steeply dipping part of the pegmatite the feldspathic rock is a coarse, granitoid aggregate of plagioclase, perthite, quartz, and muscovite. It contains the same minerals as both the plagioclase-quartz-muscovite wall zone and the blocky perthite-plagioclase perthite-quartz intermediate zone exposed in other parts of the dike and probably can be interpreted as a combination of these two units. This part of the deposit also contains one of the few quartz core segments encountered during the mining operations.

The thickness and continuity of zones varies greatly from one pegmatite to another, as well as within a given

pegmatite. Most wall zones are fairly continuous, and many can be traced through the entire exposed lengths of pegmatite bodies. The intermediate zones, however, are much less regular and continuous. That at the Niagara mine, for example, swells to occupy the entire central part of the dike above the edge of the core. In contrast, some thin intermediate zones rich in blocky perthite, like those at the Cliff Blanton mine, are represented only by a row of isolated crystals. Other intermediate zones commonly appear as lenses, pods, or hoodlike masses.

Cores vary greatly in their continuity. The core of the southeastern dike at the Huskins mine, for example, appears to persist for at least 150 ft along the strike, whereas in the northwestern dike, about 80 ft away, the known core segments have a total length of less than 50 ft, although the dike is exposed for a strike length of 150 ft. The core may be present only at the crest and keel of this dike. The cores in the Foster No. 1, Mill Race, Albert Wright, and Niagara dikes thicken downward, with concomitant thinning of the wall zones and whatever intermediate zones are present. In the bottoms of several mines the core occupies the entire thickness of the dike. Such downward swelling of the innermost unit is fairly common in the southern part of the Shelby area, where it may occur near the keels of the lenses. At the J. F. Green mine the quartz core crosses the wall zone and appears to transect the north wall of the dike a short distance beneath the surface. Apophyses of quartz from the core of the Hallman dike extend nearly to the wall and probably are fracture-filling features.

The texture of the polymineralic pegmatite units is granitoid, some units are coarsely porphyritic. Many of the biminerals consist of large crystals of feldspar individually surrounded by massive quartz. Few of the pegmatites are conspicuously foliated, although clear or milky quartz in some cores is traversed by thin parallel white layers that may represent healed fractures. The quartz in the southeastern Huskins dike is fine-grained and sugary, owing partly, perhaps, to extensive granulation.

Thin films of green muscovite are abundant in many feldspar crystals and appear to have been formed by fracture-controlled replacement. Evidence of larger bodies of replacement origin has been found only at the Old Plantation and Big Bess mines. At the latter locality large, cauliflowerlike aggregates of coarse cleavelandite blades project into the quartz core. Cleavelandite aggregates on the dump of the Old Plantation mine appear to have been taken from the interior of the dike, but little else is known of their occurrence.

MINERALOGICAL FEATURES AND PARAGENESIS

The essential minerals of the pegmatites in the Shelby-Hickory district are quartz, plagioclase, microcline, muscovite, and biotite. Widespread accessory minerals are tourmaline, beryl, garnet, and apatite. Autunite occurs at one deposit; and carbonates, with associated sulfides, zeolites, and chlorite, are known to be present in three. Thorough weathering has removed all but the most stable minerals from the exposed parts of most deposits. None of the pegmatites in the district is truly granitic in composition. The range in composition is from quartz monzonite to quartz diorite, and in only a few dikes does microcline constitute more than half the total feldspar content.

Quartz occurs in most dikes in massive, nearly monomineralic cores, as well as in small grains interstitial to larger grains of feldspar in other units. Most of the quartz in the cores is white or gray, a little is clear, slightly smoky, or milky. Some masses appear structureless but actually are composed of grains $\frac{1}{4}$ to about 4 in. in diameter. The core of the southeastern Huskins dike, however, contains quartz grains less than $\frac{1}{10}$ in. across. Thin white layers that cross the transparent or translucent quartz may represent healed fractures. The interstitial quartz of border, wall, and intermediate zones is white, gray, or smoky. Smoky quartz is more abundant in the wall zones, where it is associated with muscovite, than it is in the cores. A little quartz occurs with books and flakes of muscovite in masses of burr rock.

Plagioclase is as widespread as quartz and probably is more abundant. The ordinary plagioclase in the few exposures of unweathered pegmatite ranges in composition from Ab_{82} to Ab_{88} , the cleavelandite in the Big Bess dike from Ab_{93} to Ab_{97} . Most of the oligoclase occurs as 1- to 4-in. grains and is associated with quartz and mica in the wall zones. It occurs in blocky masses nearly a foot across in the intermediate zones of a few deposits, where it is commonly associated with perthite. A little plagioclase in the core of the Sigmon dike and a layer $\frac{1}{8}$ in. or less thick separating blocks of perthite from massive quartz in the middle of the Dycus pegmatite may represent late plagioclase, possibly of replacement origin.

Oligoclase is intergrown with round quartz grains in some wall zones, but not in a graphic pattern. Rectangular blocks of plagioclase project into the granite country rock from the hanging wall of the E. R. Self dike, and other blocks nearby are completely surrounded by granite. In most pegmatities in the district the plagioclase is weathered to depths of 10 to 80 ft, and only at the A. F. Hoyle mine was fresh plagioclase exposed at the outcrop.

Microcline is widespread. Its typical occurrence, in intermediate zones, is as blocky perthitic crystals 5 in. or more across. It generally is associated with subordinate quantities of quartz and, in some deposits, with plagioclase. In a few deposits, such as those at the Sigmon, A. F. Hoyle, and Dycus mines, it constitutes 20 to 70 percent of plagioclase-perthite-quartz wall or intermediate zones.

The microcline is characteristically friable near the surface, owing to partial kaolinization, but even in the most thoroughly weathered pegmatites the softened material is distinctly gritty and contains recognizable grains or shards of microcline. The microcline in the Sigmon and other dikes is all apparently fresh, although much of the adjacent plagioclase is weathered to soft, smooth kaolin.

Muscovite is almost invariably associated with plagioclase and quartz. In some deposits it is accompanied by biotite and in a few by perthite. Book muscovite has been reported to occur without plagioclase only at the Albert Wright prospect, where it is associated solely with quartz. The largest and flattest mica books occur in medium-grained plagioclase-quartz pegmatite. Some broad but thin books, most of which are reeved, occur with coarse-grained plagioclase in quartz-poor pegmatite. A few deposits, notably that at the Lincoln mine, contain books of "A" mica that project into massive quartz cores. Within the feldspathic pegmatite, mica generally occurs with small, irregular masses of light smoky or white quartz or is embedded in plagioclase. Several deposits contain vugs lined with mica crystals or nearly filled with aggregates of well-formed crystals (fig. 84). Many porous crystals of feldspar contain tiny flakes of mica, both in the pores and embedded in the feldspar. Some contain layers of mica that conform with the cleavage directions.

Most of the muscovite in the district is pinkish buff and cinnamon brown. The rest, which is brownish olive to green, generally occurs in masses of quartz or coarse-grained pegmatite. Some of the mica crystals in vugs are color-zoned, with alternating light- and dark-brown bands.

Sericite forms compact greenish-yellow masses in the Bowen pegmatite and thin films along cleavage planes in the feldspar of several other deposits.

Biotite, like muscovite, occurs chiefly in medium-grained plagioclase-quartz pegmatite, but in several deposits it is in plagioclase-perthite-quartz pegmatite. It is distributed throughout the district but is abundant in few pegmatites. In all deposits it is associated with muscovite, and in places the two micas are intergrown.

Tourmaline, a minor constituent of pegmatites in all parts of the district, occurs in or near cores of massive quartz, although small quantities occur with a wide

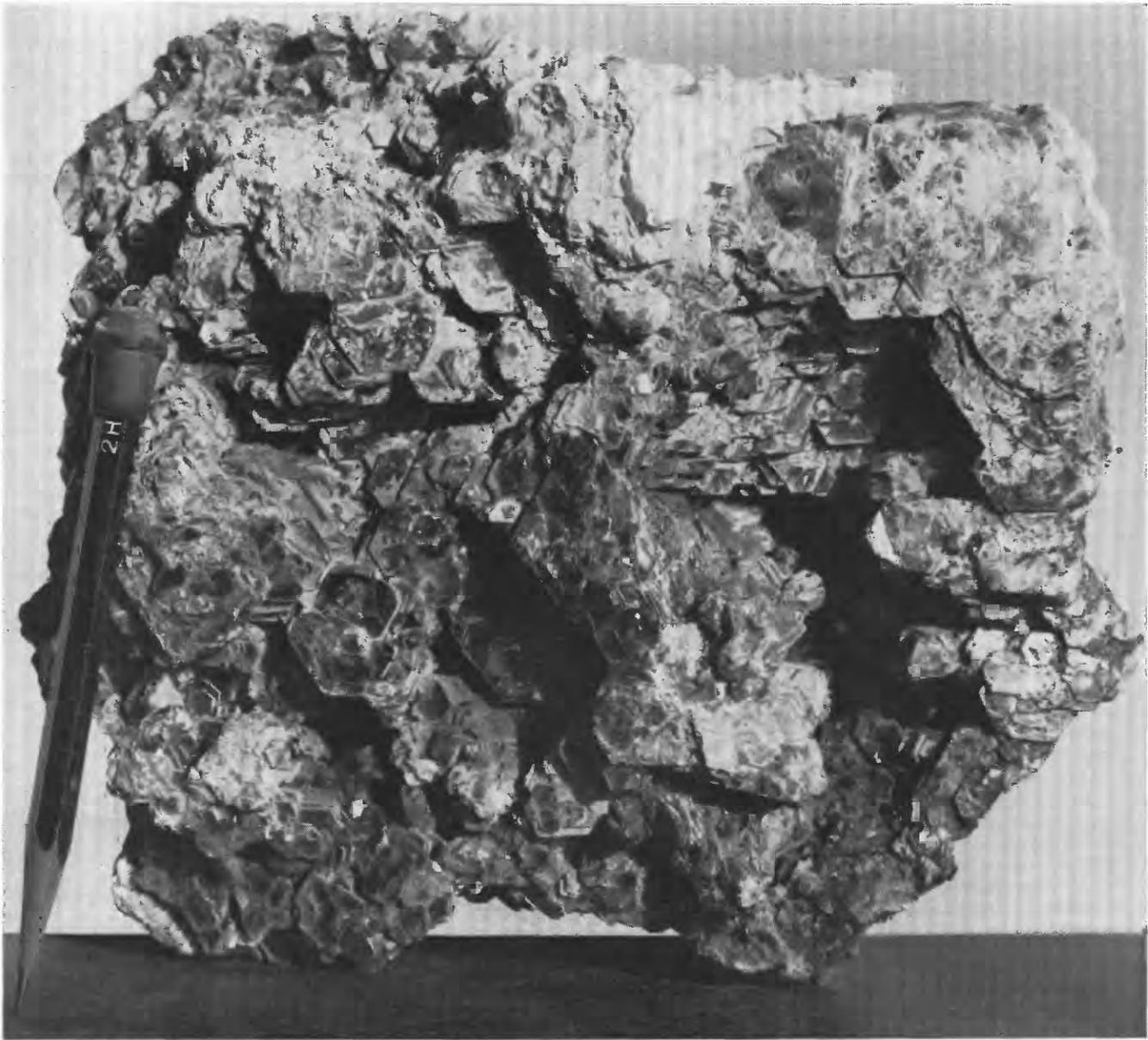


FIGURE 84.—Muscovite crystals from a vug at the Foster No. 7 mine, Lincoln County.

variety of minerals elsewhere in the dikes. A few mica books contain long, prismatic tourmaline crystals (see fig. 40, chapter A of this series).

Beryl, like tourmaline, is a widespread minor constituent of the pegmatites. In most deposits it is embedded in blocky perthite or massive quartz near the edges of cores. In the southeastern Huskins dike it occurs in plagioclase-quartz pegmatite, probably a part of the wall zone. Crystals 10 in. or more in diameter are present in the Big Bess and Drum deposits. Most of the beryl is light green, although that from the Huskins mine is nearly colorless and some from the Drum mine is yellow. The base of one crystal from the Drum deposit is covered with cones of beryl about one-eighth inch long.

Apatite occurs at the Sigmon, Big Bess, A. F. Hoyle, and Mill Race mines, and it may well be present in unexposed, unweathered parts of other deposits. It is closely associated with mica and garnet. Some occurs as inclusions in biotite at the Sigmon mine. Fine-grained green apatite is conspicuous in the border zone of the Big Bess pegmatite, where it is associated with fine-grained muscovite, feldspar, and quartz.

Garnet is less common in the Shelby-Hickory district than in the other mica districts of North Carolina. Inclusions of it occur sparingly in both muscovite and biotite, as well as in plagioclase. The enclosing rock generally is medium-grained plagioclase-quartz pegmatite. The mineral is the manganese-rich variety spessartite, and its former presence in weathered de-

posits is indicated by black stains and round masses of manganese oxides. Garnet is the chief constituent of a fracture filling that crosses the feldspathic pegmatite at the A. F. Hoyle mine.

Carbonate minerals are present in several unweathered pegmatites. Elongate scalenohedrons of calcite occur in fractures in the massive quartz of the Mill Race pegmatite, where it is associated with a little pyrite. Dolomite and calcite occur in the Bowen pegmatite as anhedral masses in feldspar and as anhedral masses and equant crystals in vugs. Some masses penetrate crystals of perthite. Several of the larger masses contain small books of light-green mica and needles of black tourmaline.

Sulfide minerals occur in the Mill Race, Bowen, Martin, and A. F. Hoyle pegmatites. In the first two it is associated with a carbonate, and in the Bowen mine it occurs with chlorite as well. A more complex assemblage is found at the A. F. Hoyle mine, where fractures are filled by aggregates of iron sulfide, calcite, garnet, and a zeolite.

Autunite forms crusts on and near apatite in the A. F. Hoyle pegmatite. J. B. Mertie, Jr., found a trace of gold in weathered pegmatite on the dump of the King mine, as well as sand-sized grains of magnetite or ilmenite in several other pegmatites. Monazite appears to be absent from the mica-bearing pegmatites, although it is abundant in the granitic wall rocks of some deposits.

The order in which minerals were deposited can be determined where veins of one mineral cross other minerals. It can also be determined by the occurrence of some minerals in phenocrysts, by inclusions of one mineral in another, and by the layering of minerals deposited in vugs. Wherever conditions have permitted a determination of the order in which zones were formed, those that lie nearer the walls have been found to be older than those that lie closer to the center of the pegmatite body, although there are irregularities in many deposits, as indicated by the telescoping of zones.

Minerals began to crystallize in about the same order in all the deposits of the Shelby-Hickory district, regardless of the type of zoning. Plagioclase (chiefly oligoclase), quartz, and muscovite formed in the initial stages of pegmatite consolidation. Microcline began to crystallize later, and finally quartz formed in large amounts. The order in which the crystallization of each mineral was completed and the relation between the time when the earlier minerals ceased to form and the time when the later minerals started to form vary widely, not only between deposits but in different parts of the same deposit.

The order in which the essential minerals of four of the commoner types of deposits were formed is indicated

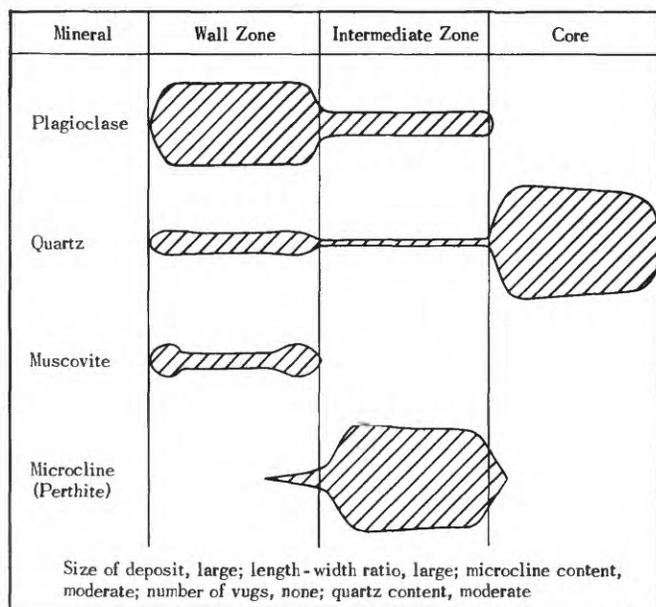
graphically in figure 85. The most striking feature of the paragenesis as illustrated by these diagrams is that all types of deposits started to crystallize in the same manner. The composition of the pegmatite as a whole, especially the silica and potash content, greatly affected the course of crystallization in the later stages, but not in the earlier stages. In some unzoned deposits the plagioclase, quartz, and muscovite formed throughout the time of pegmatite consolidation. The main irregularity in this initial stage of pegmatite consolidation was the formation of perthite along with the other minerals in some pegmatites. Another feature of the paragenesis is the sharp changes in the material deposited, even where the minerals are essentially the same in both zones.

In several pegmatite bodies certain minerals were deposited at a distinctly later stage than the others. Some, like those in the A. F. Hoyle pegmatite, were deposited in veins that cut the older minerals. Others, like those in the Bowen pegmatite, were deposited in openings between the older minerals. The cleavelandite of the Old Plantation and Big Bess pegmatites may have replaced the quartz of the core, or it may have formed radiating aggregates along the walls of an opening that was filled with the fluid from which the quartz later was deposited. Among the accessory minerals the carbonates, sulfides, and zeolites generally formed late, after the main silicate minerals. Tourmaline and beryl appear to have formed most abundantly rather late, during the crystallization of the innermost parts of the intermediate zones and the outer parts of the cores.

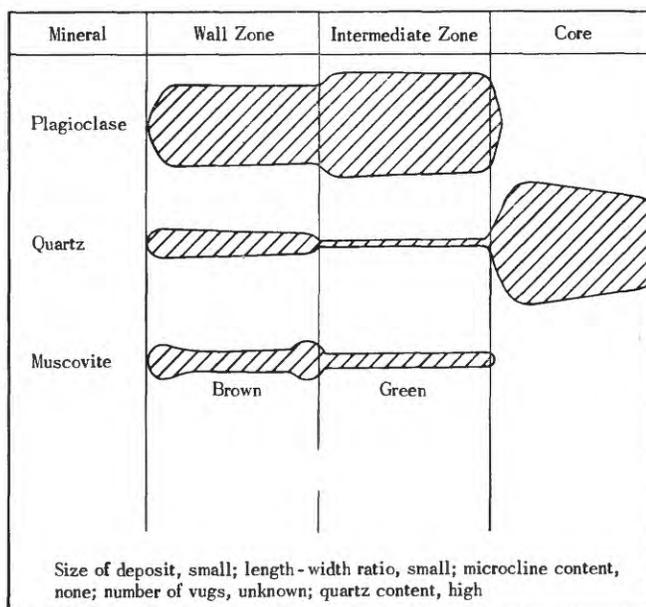
WALL-ROCK ALTERATION

The Shelby-Hickory pegmatites occur in mica schist and gneiss, hornblende schist, pyroxenite, and both western- and eastern-type granite. Wall-rock alteration of all but the eastern-type granite is limited to a layer not more than 2 ft thick alongside the pegmatite.

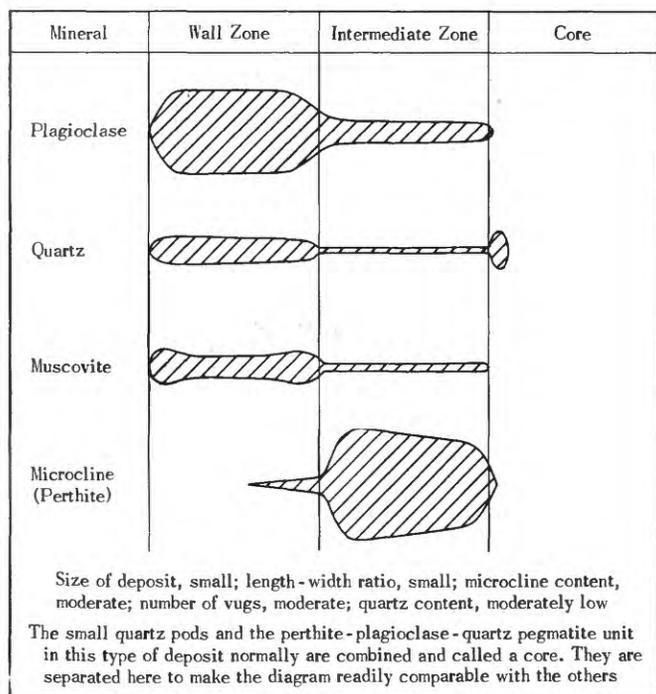
Alteration of the micaceous rocks in most places comprises a coarsening of the mica flakes and the introduction of quartz. No other minerals appear to have been added. The maximum amount of alteration in this rock type is evident at the Mill Race mine, where the mica schist between apophyses of pegmatite contains plates of muscovite as much as 4 in. long and 1½ in. wide. Silicification rarely extends farther than an inch into the country rock, although locally it appears more extensive, owing to the occurrence of an adjacent quartz-mica border zone in the pegmatite. The two materials differ mainly in mica content and in orientation of the mica flakes. Those in the country rock are parallel to the general schist foliation, whereas those in the pegmatite are parallel or normal to the contact or are not systematically oriented.



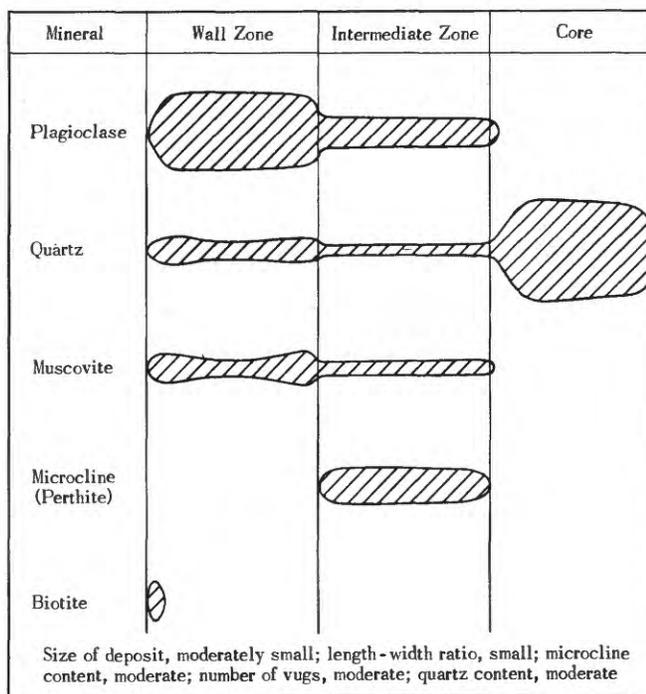
A



B



C



D

FIGURE 85.—Paragenesis diagrams of four common types of pegmatite in the Shelby-Hickory district.

Hornblende in the wall rock has been converted to biotite within a few inches of the Huskins pegmatite; this kind of alteration appears to be typical of the amphibole schists and gneisses. In the peridotite and pyroxenite near the Old Plantation mine, actinolite and chlorite are abundant.

Western-type granite is little altered by the pegmatite at the Archie, Kind, and M. H. Gantt mines. However, the eastern-type granite is much altered near the pegma-

tite at the E. R. Self mine. Large metacrysts of feldspar, probably plagioclase, were formed along the hanging walls of both the southeast and northwest dikes (fig. 86 B). Metacrysts of muscovite as much as 8 in. long and biotite as much as 2 in. long are abundant along the hanging wall of the northwest dike. The muscovite and biotite occur in the same rock but do not appear where the feldspar crystals are well developed. Much of the material in these crystals must have been

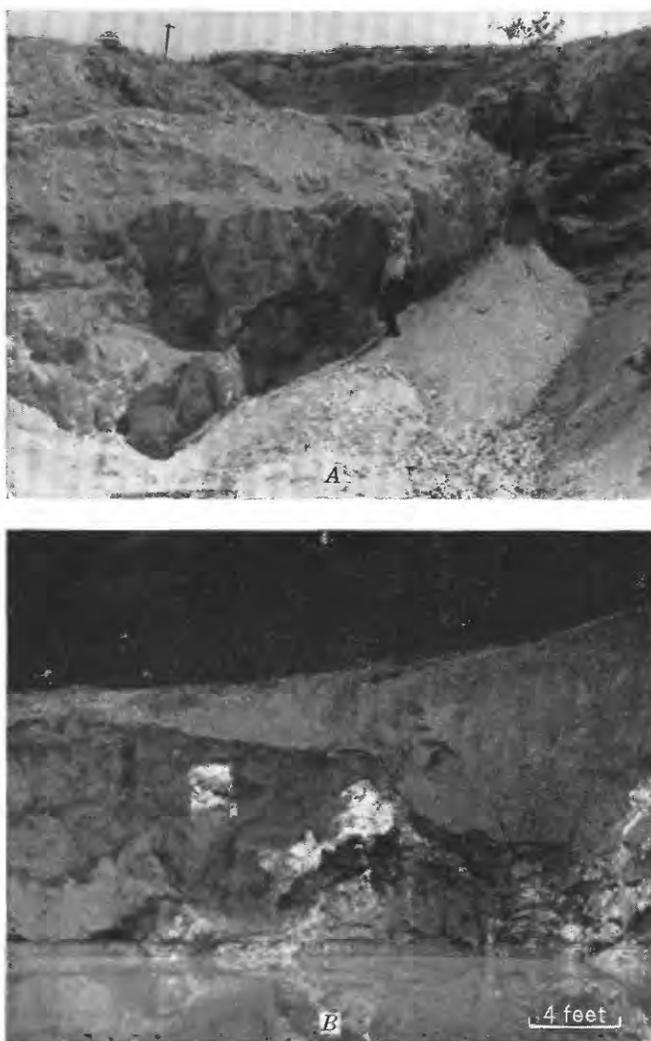


FIGURE 86.—Pegmatite-wall rock relations, Shelby-Hickory district. *A*, Inclusion of quartz-muscovite schist (in front of man) in plagioclase-quartz pegmatite near middle of open-cut, Drum mine, Catawba County. Waste-choked portal of drift is in mica-rich pegmatite adjacent to contact with schist near right margin of picture. *B*, View of northwest end of E. R. Self open-cut, Gaston County, showing irregularity of the pegmatite hanging wall, and feldspar metacrysts in the granite country rock.

introduced from the pegmatite rather than accumulated from minerals already in the granite, as the metacrysts are not associated with concentrations of mica that would result from local concentration of feldspar-making material within the granite. Similar relations occur in the mica-rich part of the altered zone, where the granite near the muscovite metacrysts may well be somewhat richer in fine-grained mica than elsewhere. Moreover, biotite occurs only in the zone of altered rock.

ORIGIN

Monazite-bearing pegmatite forms small, irregular masses in the western-type granite and also is disseminated through certain layers of country-rock schist. Well-defined, feldspar-impregnated layers of schist

several feet thick extend far from known granite masses; hence the hybrid rock is not merely the result of local injection along exposed granite contacts. (See fig. 86*A*.) The irregular shape of many of the small bodies of pegmatite in the granite suggests that the host rock was not wholly consolidated at the time the pegmatite was emplaced. Evidently the pegmatitic solutions were not markedly guided by fractures, but crystallized in irregular pockets in the granite and seeped out into the more permeable layers of the schist country rock. The lack of noteworthy deformation in the pegmatite-impregnated schist may indicate the absence of large faults parallel to the foliation, although joints and faults of small displacement may have rendered some parts of the terrane more permeable than others.

The monazite-bearing western-type granite is clearly related to the monazite-bearing pegmatites, and the age difference of the two rocks probably is not great. The mica-bearing pegmatites, which contain no monazite, are distinctly younger. The term "pegmatite," as used in the rest of this discussion, applies to this mica-bearing rock in contrast to the earlier monazite-bearing pegmatite. The structures that are older than the pegmatite but younger than the western-type granite cross from metamorphic rock into granite without appreciable deflection, although the fractures that guided pegmatite emplacement cut the granite as zones of shattering rather than as single planes. Sufficient time must have elapsed between the intrusion of the granite and the formation of mica-bearing pegmatite to permit regional stresses to develop and cause fracturing of both granite and country rock. The indicated time lapse and the lack of monazite in the pegmatites suggest that they do not represent an end phase of the western-type granite intrusion.

The eastern-type granite at the E. R. Self mine reacted with the mica-bearing pegmatite much more than any other exposed wall-rock material, even though its composition probably was similar to that of the pegmatite. It was penetrated by the pegmatite in a very complex way, and in addition pegmatitic solutions pervaded the granite beyond the irregular contacts. The pegmatite may have been emplaced soon after emplacement of the granite and may well represent a slightly later phase of the same magma.

Although evidence is not entirely conclusive, the age and geographic relations of the mica-bearing pegmatite make it appear likely that this rock is a late differentiate of the same magma that gave rise to the eastern-type granite and that it was guided in its escape from the magma chamber by fractures that formed along and especially east of large bodies of competent rocks. The

sills of western-type granite were the most important of these competent bodies, but the western extensions of the Roan gneiss in Lincoln County, though less effective, controlled the emplacement of a few dikes.

Crystallization in the pegmatites probably began at the walls and proceeded inward toward the centers. Suggestions of comb structure—the open spaces having been filled by later crystallization—occur along the walls and in the inner parts of numerous dikes. Relations between individual mineral masses and, on a larger scale, the tongues of quartz that extend from the cores to the walls of several dikes indicate that the peripheral parts are older than the central parts. This cannot be demonstrated for all the deposits in the district, but the similarity in the occurrence, composition, and internal structure of the dikes and lenses strongly suggests that the same major processes controlled the consolidation of all. The sharpness of zone boundaries suggests an abrupt change at the end of the period of crystallization of one group of minerals and the beginning of the period of crystallization of another. An increase in grain size and in the amount of corrosion in the feldspars, and the appearance of many crystal-lined vugs in the interior zones, suggest that mineralizers or volatile materials played a much more important role in the formation of the younger units. This may have resulted from additions of new material to the pegmatite solutions or, more probably, from a normal increase in mineralizer content during the pegmatites crystallization. The mineralizer content may well have exceeded the saturation point, with consequent separation of water solutions which ultimately collected in the vugs.

The variations in zoning in the Big Bess pegmatite indicate that microcline and plagioclase crystallized simultaneously in the thick, steeply dipping parts of the dike but that little overlap in periods of crystallization occurred in the flat-lying parts. In the thick lower part of the pegmatite crystallization may have proceeded too rapidly to permit segregation into zones, at least until consolidation was nearly complete. The thin quartz core is the only sharply defined zone. The aggregates of coarse cleavelandite along the margins of the core evidently were formed after development of all the zones, as they transect and corrode the minerals that flank them and follow small fractures in the quartz of the core.

Other late units in the pegmatites include prominent, throughgoing fracture fillings, like the garnet-rich "vein" in the A. F. Hoyle deposit, and small-scale fracture-controlled replacement veinlets of albite and fine-grained muscovite. Many of these veinlets are confined to individual crystals of feldspar. Some late solutions removed more material than they deposited, leaving

small masses of sulfide and carbonate minerals and crystals of mica on and within highly corroded, cellular crystals of feldspar.

TIN- AND SPODUMENE-BEARING PEGMATITES

DISTRIBUTION AND OCCURRENCE

A narrow belt with many tin- and spodumene-bearing pegmatite dikes extends from Grover, S. C., 24.5 miles northeastward to Lincolton, N. C. (fig. 79). Most of this area is underlain by mica schist and hornblende schist and gneiss; small parts of it are underlain by the eastern-type granite. The pegmatite dikes, which are tabular and lenticular bodies, have been described by Hess (1940, pp. 942–966), Kesler (1942), and others. They may be as much as 3,250 ft long and 395 ft thick, but most are less than 10 ft thick. Some dikes near Kings Mountain have been proved to continue to depths of 400 ft or more.

The pegmatite dikes were emplaced in steep to vertical fractures. Some may be concordant, but most cut across the country-rock structure. According to Kesler (1942, p. 256), "in areas underlain by almost uniformly competent hornblende-biotite gneisses, pegmatite was emplaced in joints that cut at various angles across the strike of the rocks. . . . The pegmatite bodies . . . [in the Beaverdam Creek area] are straight, tabular, and nearly uniform in thickness; some bend abruptly where prominent joints intersect. . . . In areas where country rocks of contrasting competence alternate in relatively thin layers, most of the pegmatite was emplaced parallel to the strike and dip of the layers." Such an area lies southwest of Kings Mountain.

MINERALOGICAL AND STRUCTURAL FEATURES

Pegmatite minerals listed by Kesler (1942, p. 255) as common or abundant in the tin-spodumene belt are microcline, muscovite, albite (Ab_{95-100}), spodumene, quartz, kaolinite, hydrous mica, and secondary iron, calcium, manganese, and phosphate minerals. The scarce minerals are amblygonite (near montebasite), apatite, beryl (locally common), cassiterite, columbite-tantalite, garnet, plagioclase (Ab_{60-95}), sphalerite, and tourmaline. Cassiterite, though not abundant, is sufficiently widespread to be characteristic of the deposits. The very scarce minerals are chalcopyrite, dufrenite, dumortierite, lithiophyllite, a blue manganese phosphate, molybdenite, diopside, pyrrhotite, stanniferous rutile, sphene, purpurite, and vivianite. A few zeolites encrust fracture surfaces in the pegmatites. Kesler (1942, pp. 257–259) reports that tourmaline, beryl, apatite, cassiterite, columbite-tantalite, and quartz were formed and fractured prior to the introduction of

spodumene and microcline and that medium- and fine-grained albite, quartz, and small quantities of apatite and sulfide minerals crystallized later.

In the Beaverdam Creek area most of the dikes were emplaced in three sets of joints (Kesler, 1942, pl. 40). The two most prominent sets strike north to N. 10° E. and N. 40°–55° E.; a less prominent set strikes N. 40°–60° W. Most of the dikes mapped as spodumene-free in the southern part of the Beaverdam Creek area were emplaced in the northwestward-trending joint set. A few there and most of those in the middle of the area strike northeast. Exploration for spodumene ore by the Solvay Process Co. since the publication of Kesler's report indicates that many of the dikes in the Kings Mountain area strike parallel with, but dip more steeply than, the country-rock structure.

The border zones in the dikes exposed in the Kings Mountain and Cherryville areas are layers of fine-grained feldspar and quartz a few inches to several feet thick. The wall zones, some of which are many feet thick, are characterized by abundant parallel laths of spodumene. These laths are oriented nearly normal to the walls of many thin dikes but tend to curve downward to the west near the centers of some larger dikes. Both the border and the wall zones have been clearly illustrated by Hess (1940, pp. 955–956). The centers of the large dikes south of Kings Mountain are masses of fine- to medium-grained albite, quartz, muscovite, spodumene, and accessory minerals and are strikingly layered parallel with the pegmatite walls.

The hornblende of the wall rock has been locally altered to a bright-brown mica, accompanied by a little white mica and apatite. The brown mica contains 3.52 percent Li_2O , Rb_2O , and Cs_2O and 4.34 percent fluorine (Hess and Stevens, 1937). This alteration has extended along the foliation planes of the metamorphic rocks for distances of as much as a foot from discordant pegmatite contacts. In places along the contacts the micaceous rocks are intergrown with pegmatite.

ORIGIN

Intense fracturing, localized in a narrow belt near the west side of the Cambrian rocks, apparently was followed by the injection of pegmatitic solutions. The earliest pegmatite, consisting chiefly of quartz, feldspar, and spodumene, appears in many dikes to have crystallized as border and wall zones with little or no disturbance. Upward movement of the east walls of the larger dikes led to the introduction of additional solutions, some of which contained partly formed crystals. In some places the movement dragged the east ends of the earlier spodumene crystals of the wall zones upward. As more pegmatitic solutions were added and the move-

ment was repeated, strongly layered masses of fine-grained pegmatite were developed in the centers of the dikes.

The coarse perthite and long spodumene crystals were broken and healed by the later material. Replacement probably occurred along the margins of some mineral grains, but the absence of pseudomorphs and intensively veined crystals suggests that it may not have been important in the development of most of the pegmatite. The general sequence of pegmatite formation which has been outlined corresponds approximately to stages 4–7 of Kesler's more detailed sequence (Kesler, 1942, pp. 257–258).

The pegmatites in the tin-spodumene belt contain a suite of minerals unlike that of the mica-bearing pegmatites to the north and west. Plagioclase and muscovite are common to both pegmatite groups, but their appearance and habit are markedly different. Cassiterite, spodumene, and other minerals that are widespread in the southeastern belt do not occur in the pegmatites that have been worked for sheet mica. The tin- and spodumene-bearing pegmatites are strongly layered and lack large quartz cores, whereas the mica-bearing pegmatites are granitoid and contain large massive quartz units. The two pegmatite groups probably are of different ages, and the much more strongly deformed tin-spodumene deposits may well be the older.

Some of the spodumene-free pegmatites noted by Kesler (1942, pl. 40) in the Beaverdam Creek area appear to be dikes of moderately fine grained granite composed of oligoclase, potash feldspar, quartz, and muscovite. Their emplacement in the same fracture sets as some of the spodumene-bearing pegmatites may indicate a similar age for both. A few thin dikes of granite cut pegmatite in the same area, but the information available at present does not permit certain correlation of these dikes with the other masses of granite.

OTHER PEGMATITES

A few areas in Alexander County contain pegmatites that do not appear to be closely related to the mica-bearing pegmatites or to the pegmatites of the tin-spodumene belt. Several pegmatites near Hiddenite were examined by J. B. Mertie, Jr., as possible sources of quartz crystals but few others were visited during the wartime mica investigations.

The Hiddenite, or Colburn, mine at Hiddenite is the only one in the area that has been extensively worked. The pegmatite, exposed in two large slumped cuts and on the dumps, occurs as lenses less than an inch to more than 10 ft long. These probably trend northeast, parallel to the foliation of the country rock, a fine-grained, light- to medium-gray, garnetiferous and

feldspathic mica schist. Much of the pegmatite is moderately fine grained, and large blocks in the dumps contain few crystals more than 2 in. in diameter. Green spodumene (variety hiddenite), beryl, rutile, muscovite, quartz, cassiterite, pyrite and other sulfide minerals, zeolites, and carbonate minerals occur in small vugs, and a little spodumene appears also to be embedded in the solid pegmatite (Palache, Davidson, and Goranson, 1930). The finest rare-mineral specimens were taken from individual vugs that were separated from the wall rock by less than an inch of pegmatite.

Near the Hiddenite mines are many areas covered by float fragments of quartz, muscovite, beryl, and rutile. Most of the areas are elongate and trend about N. 60° E. Quartz-crystal-bearing pegmatite deposits and quartz veins are reported to be abundant in a northeastward-trending belt that passes through the town of Hiddenite. In this area the float quartz is accompanied by muscovite and locally by tourmaline and rutile. Many of the quartz crystals contain liquid inclusions or are optically twinned and hence are not suitable for the making of oscillator plates. Individual deposits trend N. 60° E., parallel to the trend of the belt as a whole.

Several graphite-bearing pegmatities are reported to occur on the eastern and northern slopes of Barretts Mountain, 5 miles west-southwest of Taylorsville (Pratt, 1902, pp. 71-72). They extend along the mountain in a south-southwestward-trending belt more than 2 miles long. The weathered mica schist and gneiss country rock encloses many concordant pegmatite bodies a few inches to 5 ft thick. They strike a few degrees east of north, dip 30° to 50° W., and pinch and swell markedly. Most of the pegmatite is kaolinized plagioclase feldspar, with interstitial quartz. Graphite is disseminated through the rock and also occurs in nearly pure lumps. The largest of these are about 6 in. across. The proportion of contained graphite in the pegmatites is locally as great as 60 percent, but the average probably is less than 25 percent. At only one place is the country rock reported to contain graphite.

ECONOMIC ASPECTS OF THE PEGMATITES MINERALS

MICA

Most of the mica deposits in the Shelby-Hickory district contain hard, free-splitting books of pinkish-buff to cinnamon-brown muscovite. A few in southern Catawba County contain green mica, but such mica is rare in other parts of the district. Spots and stains are rare in the buff and brown micas but are lightly to moderately developed in the green mica. Inclusions of tourmaline, quartz, garnet, apatite, and biotite are not common. Individual books range in diameter from less than an inch to 2 ft or more. Especially large

books have been mined from the Big Bess, Moose, and Sigmon pegmatites. In general the books are rounded or oval in plan, but a few show rhombic or hexagonal crystal outlines. The E. R. Self deposit contains a large proportion of euhedral mica books, and several other deposits contain vug-filling aggregates of smaller crystals (fig. 84).

Most of the books that occur in the wall zones of the dikes are flat, but many contain thin reeved sheets between thick layers of flat mica. Some contain three or more sets of reeves that radiate out from the center of the book, and the mica generally is locky at the intersection of these reeves. Herringbone and "A" mica appear to be more common in the Cherryville and Kings Mountain areas than in those farther north and west and ordinarily occur along or near quartz cores. Pinholes and hair cracks are very rare, and even fractures are not particularly abundant. Several deposits contain badly ruled or wavy mica, but these imperfections are not common elsewhere in the district. Clay and iron stains are the most widespread defects in Shelby-Hickory mica.

Most of the flat, free-splitting mica occurs in medium-grained plagioclase-quartz pegmatite, regardless of the color of the mica or the zone in which it occurs. The mica is fairly evenly distributed through some zones, but in others it is concentrated in shoots.

In the Plato Houser No. 1 and south Cliff Blanton mines the mica is concentrated in rich shoots that are in the wall zones and form hoods over the crests of quartz cores. The shoot in each pegmatite lies between the end of the core and a point where the dike thins markedly. In both these mica shoots the mica is reported to occur in layers separated by barren pegmatite. The mica in the parts of such shoots that lie along the flanks of cores is commonly somewhat less reddish and more reeved or spotted than that along the crests. Not all the features of these mica concentrations are fully understood, but they are most common in long dikes in which a fairly continuous core ends abruptly at a point 20 to 70 ft from an abrupt constriction of the dike itself. Mica is distributed along most of the strike length of most pegmatite lenses in the southern part of the Shelby area and in the Kings Mountain area, but it is most abundant near the margins of the wall zones. The mica shoots in the Polkville area are nearly as long as the elongate pegmatite lenses. All plunge steeply to the north, but they are not consistently situated with respect to the crests and keels of the pegmatite bodies.

FELDSPAR AND KAOLIN

Large crystals of perthite are abundant in the intermediate zones of many mica deposits. Inasmuch as

few deposits outside the Kings Mountain area have been explored specifically for feldspar, many feldspar-rich shoots not immediately adjacent to mica shoots may remain to be discovered. Most of the lenticular pegmatite deposits contain too little perthite to permit its recovery except as a byproduct of mica mining, but some of the longer dikes might support feldspar operations. The friable condition of much of the perthite and the softness of the enclosing rock would complicate mining and the handling of the product.

The coarse feldspar obtainable from the Shelby-Hickory deposits is very high in potash and low in soda, owing to the kaolinization of the plagioclase. The minable perthite contains kaolin and a little quartz as impurities, but mica, garnet, and other iron-bearing minerals are uncommon or rare in many perthite concentrations. Some feldspar is said to have been mined in the Kings Mountain area, and a little was recovered during World War II as a byproduct of mica mining at the A. F. Hoyle and Floyd Brittan mines. Most of the feldspar produced in the region was obtained as a byproduct of spodumene operations by the Solvay Process Co. near Kings Mountain.

Some metacrysts of potash feldspar in the monazite-bearing gneiss are opalescent and might be of some value as gem material (moonstone).

The plagioclase in the near-surface parts of pegmatite and granite bodies in the district is represented by kaolin, but none has been mined. Several large pegmatite dikes in the western part of the district may contain substantial tonnages of kaolin, but few would support large-scale mining operations. Unless many of the small deposits could be worked simultaneously so as to support a local feldspar mill, it might be necessary to haul the crude product to Spruce Pine for purification, thereby greatly increasing the cost of operations.

Brick clay has been obtained from weathered granite at Cherryville and near Lincolnton. The clay is classed as residual and semiresidual and is said to occur mainly in small valleys. Quartz, mica, and organic material are the chief impurities. Some of the clay is reported to have been satisfactory for brick and tile, but some was not. The large areas underlain by granite saprolite probably contain deposits of clay suitable for brick and tile manufacture.

BERYL

Gem beryl has been mined from the Old Plantation deposit, from the Hiddenite deposits, and at several prospects in eastern Alexander County. The largest production was from the Old Plantation mine prior to 1910.

Common beryl is reported to have been obtained in the L. R. Elliot mine, at the W. M. Carroll prospect near

Kings Mountain (possibly the J. Bun Patterson mine), and elsewhere in the district. During World War II several hundred pounds was obtained from the Drum pegmatite and several dozen pounds of specimen material was recovered from one large crystal in the Big Bess pegmatite. None of the deposits in the district is known to be sufficiently rich in beryl to permit operations for that mineral alone. It might, however, be recovered as a byproduct of mica mining at several deposits, notably some of those in the Hiddenite area.

TIN AND SPODUMENE

Many pegmatites in the tin-spodumene belt have been prospected and worked for cassiterite, but of these only the Ross tin deposit appears to have yielded a substantial production. Most of the lode deposits are small and irregular, and only a very few large placer deposits have been formed from them. According to Kesler (1942, pp. 261-263), the reserves of placer and eluvial cassiterite probably do not amount to more than 150 tons of metallic tin, and the reserves of lode cassiterite above a depth of 50 ft in the most readily workable deposits are not much greater.

Many of the pegmatites in the area south of Kings Mountain contain 15 percent or more spodumene. Some may be several thousand feet long, and diamond drilling has indicated depths of 400 ft or more. The reserves of spodumene in the tin-spodumene belt are exceptionally large, but nearly all the spodumene is in crystals that are too small to be recovered effectively by hand cobbing. During World War II a flotation plant was operated south of Kings Mountain by the Solvay Process Co. for the recovery of spodumene, feldspar, and mica.

MONAZITE

A belt of monazite-bearing placer deposits, once the chief domestic source of that mineral, comprises parts of Cleveland, Rutherford, and Burke Counties. This belt is coextensive with the western-type granite and related pegmatite and hybrid rocks; it extends southwestward to Greenville, S. C. Much monazite remains in the placer deposits, and still more in the granitic source rocks.

GRAPHITE, CORUNDUM, AND SILLIMANITE

Graphite is widespread in the mica schist of the Shelby and Burke Chapel areas and in central Catawba County as well. It also occurs in pegmatite near Taylorsville. The pegmatite deposits and a schist occurrence near Shelby are reported to have been prospected, but no graphite is known to have been shipped from either locality. A little is said to have been produced commercially from deposits 9 miles south and southeast

of Newton, Catawba County. Most of the graphite in the district is classed commercially as amorphous, but the deposit that was prospected near Shelby yielded crystalline material.

The deposits of corundum-bearing rock in the district appear to be small. None has been mined. Some of the mica schists are rich in sillimanite, and it seems likely that part of the rock contains enough of that mineral to be mined profitably. Corundum occurs in the sillimanite schist near Belwood, and the minerals might be mined together.

OTHER MINERALS

Hydrothermal deposits apparently not closely related to the pegmatites occur in a broad belt along the eastern edge of the district. They comprise three general types; one is characterized by abundant magnetite with accessory sulfides, the second by abundant pyrite, and the third by barite, with few other minerals.

Limestone for aggregate and other uses has been quarried in many places between Kings Mountain and Gaffney. The largest current operations are those of the Superior Stone Co., a few miles south of Kings Mountain, and the Campbell Quarry at Gaffney. Much of the rock is dolomitic, but low-magnesium limestone is said to occur also. Many lenses of dolomite marble included in the metamorphic rocks are too small to permit extensive quarrying.

Granite has been quarried on a rather small scale in Shelby and near Toluca.

MINING

HISTORY

Mica mining probably was started in the Shelby-Hickory district prior to 1880. The Jack (Tom) Baxter, Tom Cabaniss, and Putman mines are among those that were worked at a very early date. In general the history of individual mines has been similar to that of most other Piedmont mica operations. Many deposits were opened, worked for a short time, and then abandoned. Some have been reopened many times, but nearly all the mine workings have caved, slumped, and filled with water, and most of the surface openings have been refilled to make the land fit for cultivation. The reopening of many mines has been made difficult by incomplete or inaccurate information concerning the extent and distribution of the former workings.

Mining was moderately active during and shortly after World War I, and several deposits were worked intermittently between 1920 and 1942. Activity during World War II increased markedly, and sheet mica of superior quality was recovered from more than 250 deposits. The number of operations declined after 1944;

during the spring of 1946 the Big Bess and Jack Baxter mines were worked on a large scale, but few others were operated even on a part-time basis.

MINE WORKINGS AND MINING METHODS

Most of the deposits have been worked by means of narrow open-cuts. In general, the deeper workings consist of shafts and long, narrow inclines, drifts, and irregular stopes. Prior to 1942 waste was hauled from the open-cuts by scrapers powered by horses, tractors, or automobiles. Buckets and windlasses were used at most shafts, and few power hoists or pumps were available. During World War II operations were carried on with greater efficiency and to greater depths by the use of gasoline-driven hoists and pumps.

The typical weathered pegmatite can be broken by picks, scrapers, and shovels, but in a few deposits of less weathered pegmatite and hard siliceous country rock blasting is necessary. Several recent operators, including Norman and Cecil, the Herman-Sipe Co., and Hendricks and Kennedy, excavated large open-cuts by means of bulldozers, power shovels, and dragline scrapers. The Big Bess and Drum mines include the largest openings thus made.

PRODUCTION

No record of early mica production from the district is available. It probably was not exceptionally large, owing to the small scale of operations, but it may have amounted to as much as several million pounds. A few mines are reliably reported to have yielded 15,000 to 20,000 lb of sheet mica during their first year or two of operation, but only small amounts were obtained after their initial periods of activity. Many of the smaller mines probably have had a similar history. A few pegmatites were equally rich but much more extensive and were capable of supporting operations for considerable periods.

During World War II a total of 63,481 lb of trimmed punch and sheet mica valued at more than \$325,000 was obtained from deposits in the district. More than 31,000 lb of the total was half-, three-quarter-, and full-trimmed sheet material. Approximately 25 percent of the total was classed as no. 1 quality, 50 percent as no. 2, and 25 percent as no. 2 inferior.

FUTURE OF THE DISTRICT

Many mica deposits in the Shelby-Hickory district are small. Others, like the Big Bess, the Martin, and perhaps the Cliff Blanton, compare in size with the principal deposits of larger and more productive mica districts. The pegmatite in many mica shoots contains a moderately to very high proportion of coarse books, which partly offsets the small size of the deposits.

Few mine openings extend to the bottoms of mica shoots. Most are filled with waste and water and hence cannot be examined. The geology at the bottom of many workings, and even the positions of these workings, are not accurately known. Some mines are described in detail in the following section of this report, but so little is known about others that any attempts to reopen them should begin with the sinking of small test shafts or drill holes to determine the depth of old workings and the continuity of pegmatite beneath them.

Most of the easily discovered pegmatite outcrops in the district have been explored, except, perhaps, in the Cherryville area. Much of the future work will therefore be done in old mines and in deposits that do not form conspicuous outcrops. There must be many pegmatites in the second category, as even thick cores of massive quartz do not necessarily form bold outcrops. This is evident at the Plato Houser No. 1 mine, where the core is covered by several inches of soil and has yielded little float. It seems likely that other deposits in wooded areas and pastures are similarly concealed. Deep plowing in many cultivated fields exposes fragments of quartz, mica, or kaolin from time to time, and any such material found within the known pegmatite areas might well be investigated.

The concentration of mica into rich shoots of small horizontal extent in the northern part of the Shelby area and in the Fallston and Cherryville areas indicates the desirability of thorough surface exploration in advance of extensive underground work. Trenches or pits closely spaced along the strike of the dikes would serve to outline the broad structural features of the deposits and the probable positions of mica shoots. In general the most favorable place for underground exploration in long dikes with fairly continuous quartz cores is at the ends of the cores, especially blunt ends. On the other hand, where the pegmatite proves to be a short lens or where the core tapers gradually at both ends, the mica is most likely to occur along the flanks of the core. The entire strike lengths of the pegmatite lenses in and near the Polkville area should be carefully examined before exploration is abandoned, as the mica in them is concentrated in shoots that in different pegmatites are differently located with respect to the crests and keels.

In a thick deposit that cannot be explored from wall to core in a single opening, attention should be focused on the medium-grained plagioclase-quartz pegmatite. Commonly this type of pegmatite forms the wall zone. Crosscuts might then be driven to determine the position of any coarse-grained plagioclase- or perthite-rich pegmatite near the core. Where the medium-grained plagioclase-quartz pegmatite is found to be barren of

book mica, the coarse-grained plagioclase pegmatite or the plagioclase-perthite-quartz pegmatite, if present, might well be tested. Exploration of coarse-grained perthite-rich material may demonstrate the presence of a minable feldspar deposit but is unlikely to result in the discovery of book mica of good quality.

A thorough program of exploration in the district, followed by systematic mining, probably would result in a moderately small, steady production of sheet mica of excellent quality, both from known deposits and from those not yet discovered. Much perthite could be recovered during the mica mining. Although the amount from each deposit might not be large, it could be stockpiled and the material from several operations sold together in single lots.

DESCRIPTIONS OF DEPOSITS

IREDELL COUNTY: IREDELL AREA

The descriptions of the following deposits, in the Iredell area, Iredell County, are based upon data obtained from the Colonial Mica Corporation:

Marlow prospect.—A little pale reddish-brown mica has been mined on the L. A. Marlow property, 2 miles northwest of New Hope (location 1, pl. 18). A 7-ft pit exposes a pegmatite dike that strikes east.

McLelland prospect.—Mica-bearing pegmatite is exposed on the McLelland property, 2 miles west-southwest of New Hope (location 2, pl. 18). Fragments of pale reddish-brown mica and blocks of quartz are strewn around an old, nearly filled pit. Most of the mica is scrap.

W. A. Campbell prospect.—The Campbell deposit, which is 2 miles south-southwest of New Hope (location 3, pl. 18), was opened in the spring of 1944. The pegmatite contains a little beryl and moderately abundant books of pale reddish-brown mica.

Wade Pharr prospect.—The Pharr deposit, near the Alexander County line 15 miles north-northeast of Statesville, was last worked in 1944 by E. I. Goodnight. The pegmatite dike, which strikes east, contains much coarse feldspar and burr rock. The book mica is pale greenish.

Wade Sloan prospect.—A burr-rock pegmatite on the Wade Sloan property, 3 miles west of North Carolina Highway 115 and 15 miles north-northeast of Statesville, was worked by W. A. Campbell in 1944. Some pale reddish-brown punch and small-sheet mica was recovered from broken, clay-stained books.

Stewart prospect.—A mica deposit on the E. F. Stewart property is 2 miles east of the Clinker Brick Service Station, near U. S. Highway 70 between Statesville and Hickory. The books are badly ruled but yield a little punch and small-sheet material.

Wooten prospect.—Surface mica occurs on the W. P. Wooten property, near the Stewart prospect and west of Statesville. A little shallow trenching has been done.

ALEXANDER COUNTY: HIDDENITE AREA

O. F. PATTERSON MINE

The O. F. Patterson mine, three-quarters of a mile southeast of Hiddenite (location 5, pl. 18), was opened in the spring of 1943 by the owner, Otis F. Patterson. A 22-ft shaft and several drifts are in soft, decomposed pegmatite and mica schist. The deposit strikes N. 50° to 60° E., is said to dip about 45° NW., and is at least 10 ft thick. A discontinuous quartz core 12 to 14 in. thick is flanked by an intermediate zone rich in 1- to 3-in. masses of perthite. The wall zone consists of plagioclase, interstitial quartz, and scattered books of muscovite and biotite. The muscovite is pale cinnamon brown, flat, and very hard, but most of the books are small. A little beryl occurs in the quartz of the core.

A second pegmatite dike, exposed in a small pit about 150 ft west of the main workings, strikes N. 60° E. and is vertical. It is about a foot thick and consists chiefly of kaolinized plagioclase.

GWALTNEY PROSPECTS

A mica deposit on the D. H. Gwaltney property, 2 miles southwest of Hiddenite (location 8, pl. 18), was opened by A. H. De Vier in July 1943. Two pegmatite dikes were explored by means of three 10-ft pits, but only one was exposed when the property was visited in 1945. It strikes N. 10° W., dips very steeply west, and is said to pinch out with depth. The foliation of the enclosing quartz-mica schist strikes N. 20° E. and dips 40° WNW. The deposit is 15 ft thick and contains large books of pinkish-buff to pale cinnamon-brown flat-A mica along the margins of a quartz core. Plagioclase appears to be the dominant mineral in the wall zone. Trimmed sheets of mica as large as 4 by 6 in. were obtained from books recovered during the operations.

DAGENHART MINE

The Dagenhart mine, 3½ miles southwest of Hiddenite (location 9, pl. 18), was worked in 1944 by Ray Jennings and A. H. De Vier, who excavated an open-cut 60 ft. long, 11 to 30 ft wide, and 1 to 8 ft deep. They also drove a drift 30 ft north from the west end of the cut. Both the pegmatite body and the mica schist country rock strike N. 80° E. and dip 45° N. in the open-cut. In the north half of the drift, however, the hanging wall of the sill strikes N. 50° W. and dips 40° NE. The

strike may swing gradually northwestward from the surface downward.

The deposit probably is about 10 ft thick in the cut but thins eastward to 2 or 3 ft in the drift and westward to about a foot at the end of the cut. A 1- to 4-ft core of massive gray quartz is flanked by a plagioclase-rich wall zone. Book mica is abundant beneath the core, and a few books project into or are surrounded by the quartz. All are pinkish buff. Some are reeved and locky, but others are flat and free splitting. Trimmed sheets as large as 4 by 6 in. were recovered during the recent operations.

OTHER PROSPECTS

The data in the following descriptions of prospects in the Hiddenite area, Alexander County, were obtained from the Colonial Mica Corporation:

Mattock prospect.—A pegmatite dike that contains books of light reddish-brown mica is exposed on the J. A. Mattock property in Hiddenite (location 4, pl. 18). It was prospected under lease by Ray Jennings and A. H. De Vier during the fall of 1943.

Payne prospect.—An old beryl prospect on the property of Charles S. Payne, 1 mile south of Hiddenite (location 7, pl. 18), was reopened in 1943 by a Mr. Patterson, who hoped to recover book mica. He sank a 25-ft shaft and drove a 21-ft drift at the 19-ft level. The pegmatite body trends nearly east, dips 70° N., and contains moderate quantities of reddish-brown flat-A mica.

Hammer prospects.—Two pegmatite bodies on the D. W. Hammer property, 6 miles south of Hiddenite, were prospected by A. H. De Vier during the spring and summer of 1943. The No. 1 deposit, south of the barn, was worked to a depth of 17 ft, and the No. 2, north of the Hammer residence, to a depth of 10 ft. Both dikes pinch out downward. The No. 1 is 10 ft thick at the surface, and the No. 2 is 4 ft. Both contain quartz cores and small books of pale reddish-brown flat-A mica. Nearly all the mica in the No. 2 pegmatite was found within the quartz mass.

Blankenship prospect.—In the fall of 1943 Ray Jennings and A. H. De Vier sank a 20-ft shaft and dug several pits on the W. A. Blankenship property, 5 miles south-southeast of Taylorsville (location 10, pl. 18). Both the pegmatite body and the foliation of the mica schist country rock are said to strike N. 20° E., but the dip is not known. The deposit contains a discontinuous core of quartz and clusters of small, reddish brown mica books scattered through a feldspathic wall zone. No large or continuous mass of mica-rich pegmatite was encountered.

CALDWELL COUNTY: OAK HILL AREA

MCGEE MINE

The McGee deposit is on a low ridge 1.3 miles north of North Carolina Highway 90 and $7\frac{1}{2}$ miles east of Lenoir (location 14, pl. 18). An open-cut 10 ft deep was excavated in 1942 by G. C. McGimsey, of Lenoir, and was deepened to 20 ft in 1943 by M. L. McGee, the property owner, and Julius Henline, of Mitchell County. Work was continued through most of 1944, and by the end of that year the cut was 18 ft long, 15 ft wide, and 29 to 34 ft deep.

The country rock, a garnetiferous sillimanite-mica schist, trends east where exposed along the west wall of the pegmatite dike. The deposit consists chiefly of kaolinized feldspar, with an irregular discontinuous core of massive quartz. It probably trends N. 10° E. and is 20 ft or more thick. Quartz float can be traced 75 ft northward from the cut. Mica is concentrated near the margins of the core segments. It is clear, hard, and light cinnamon brown. The flat-A books yield much sheet material, some pieces of which are 6 by 8 in. in size. Neither the bottom nor the ends of the mica-bearing portion of the deposit have been reached.

OTHER MINES AND PROSPECTS

The data on additional mines and prospects in the Oak Hill area, Caldwell County, were obtained from the Colonial Mica Corporation:

Olin McCrary mine.—An old mine on the Olin McCrary property, 8 miles east-northeast of Lenoir (location 13, pl. 18), was reopened in the fall of 1943 by Julius Henline and Lee McKinney. It had been worked in 1908 by Tom English. An old pit and shaft were cleaned out and deepened, and a little greenish mica was obtained from a $2\frac{1}{2}$ -ft pegmatite body that strikes northeast and dips 70° NW. The deposit pinches out at a depth of less than 30 ft. It thins eastward and splits into a series of small lenses that may be conformable with the foliation of the mica schist country rock.

Long prospect.—The Long deposit, about $2\frac{1}{2}$ miles south of Lenoir (location 18, pl. 18) was prospected many years ago and was reopened in the fall of 1943, when L. G. Gouge, of Spruce Pine, sank two shafts near the Cannon residence. Small, apparently concordant pegmatite lenses trend N. 10° W. and dip west in mica schist. They contain a little reddish-brown book mica. The deposit is owned by L. G. Gouge, Robert Gouge, and Herman Long.

Hibriten prospect.—A little prospecting was done many years ago on the side of Hibriten Mountain, $4\frac{1}{2}$

miles from U. S. Highway 321 and 3 miles east-southeast of Lenoir (location 17, pl. 18). The deposit is owned by J. C. Hogan. It contains a little blocky feldspar and small mica books of poor quality.

Land prospect.—A little light reddish-brown mica was obtained in 1944 by W. C. Richards on the Woodrow Land property, $1\frac{1}{2}$ miles northwest of North Carolina Highway 90 and 8 miles east of Lenoir (location 13, pl. 18). The pegmatite body strikes northeast and contains mica books of moderate size.

Dollie Land prospect.—A mica deposit on the property of Mrs. Dollie Land is 2 miles northeast of Oak Hill station on North Carolina Highway 90 and 8 miles east of Lenoir. It was worked in 1944 by W. C. Richards, who obtained small "A" books of pale reddish-brown mica. The mica is concentrated around a quartz mass but is not very abundant.

L. G. McCrary prospect.—A deposit on the L. G. McCrary property, three-quarters of a mile west of the road between Granite Falls and Dudley Shoals (location 29, pl. 18) and 3 miles north-northeast of Granite Falls, was worked to a depth of 20 ft by F. L. Herman in 1942. Mica books as large as 6 by 8 in. were obtained from soft, kaolinized pegmatite.

Miller prospect.—A little prospecting was done in 1944 by Will Clark half a mile east of U. S. Highway 321 and $3\frac{1}{2}$ miles north of Granite Falls (location 20, pl. 18). The deposit is owned by O. V. Miller. It strikes northeast and contains clay-stained books of reddish-brown mica.

Oak Hill prospect.—The Oak Hill deposit is $3\frac{1}{2}$ miles southwest of North Carolina Highway 90 and 8 miles east of Lenoir. It was worked in 1944 by the owner, P. L. Tolbert, who recovered small books of pale reddish-brown mica from two shallow pits.

Levi Reid prospect.—A mica deposit 2 miles north of North Carolina Highway 90 and 9 miles east of Lenoir (location 12, pl. 18) was worked in 1944 by Levi Reid, the owner. The pegmatite dike strikes N. 60° E. It contains a quartz core and clay-stained books of pale reddish-brown mica.

Tolbert mine.—The Tolbert deposit is 8 miles east-southeast of Lenoir (location 16, pl. 18). It was worked in 1944 by J. M. Robinson and P. L. Tolbert, who recovered light reddish-brown mica of good quality from two openings. The pegmatite body contains a quartz core.

Travis prospect.—A deposit on the J. S. Travis farm, about 3 miles north of Dudley Shoals (location 15, pl. 18), was worked in 1942 by F. L. German. Books of reddish-brown mica as large as 3 by 3 in. occur along the margins of a quartz core.

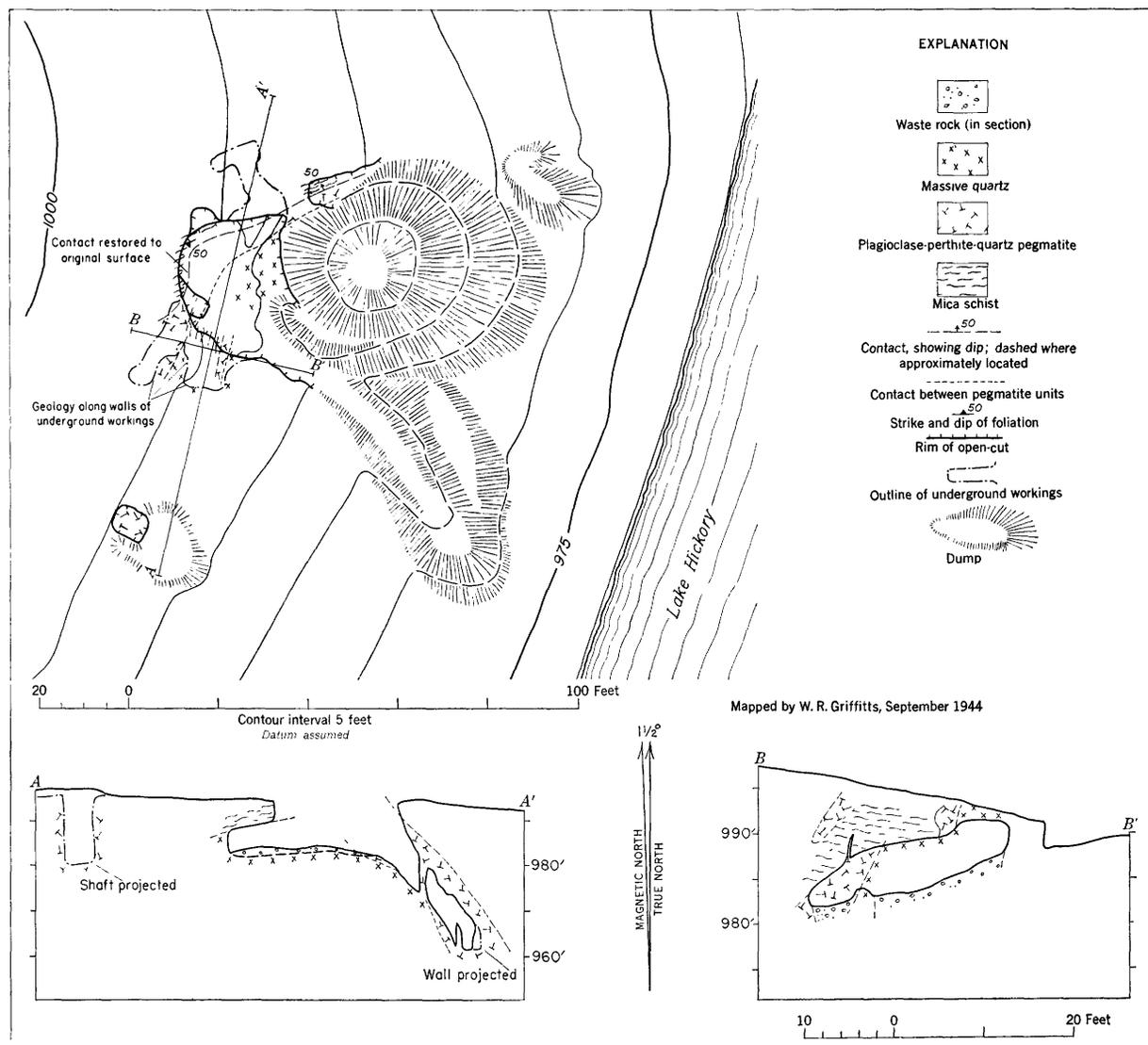


FIGURE 87.—Geologic map and sections of the Sigmon mine, Catawba County.

CATAWBA COUNTY: CONOVER AREA
SIGMON MINE

The Sigmon mine, 5 miles northeast of Hickory, is a short distance northwest of the Catawba River dam and about 80 ft west of the shore of Lake Hickory (location 21, pl. 18). It was opened in February 1944 by the owner, Lee O. Sigmon, of Hickory, who excavated a cut 30 ft long, 20 to 30 ft wide, and 20 ft in maximum depth. An inclined shaft was sunk to a vertical depth of 33 ft from the north end of the cut, and a second shaft, 20 or 25 ft deep, was sunk from a point 40 ft south of the cut and, after the map (fig. 87) was prepared, connected to the southwest corner of the cut by a drift.

The country rock is a feldspathic biotite-muscovite schist with severely contorted foliation. The muscovite occurs as coarse flakes and is most abundant near

the pegmatite contracts. The pegmatite body is poorly exposed, and neither its shape nor its general attitude is known. At the north end of the open-cut its west wall strikes N. 60° E. and dips 50° to 60° NNW., its west wall strikes N. 60° E. and dips 50° to 60° NNW., A broadly arched septum of schist extends 15 ft east from the hanging wall of the dike in the south face of the cut.

A core of massive quartz is partly exposed in the eastern half of the pit, where it is at least 15 ft thick. It seems to be best developed near the bend in the deposit, and blocks of float quartz are abundant east of the workings. Masses of kaolinized plagioclase-muscovite pegmatite are scattered through the core, and it is flanked by a medium- to very coarse-grained plagioclase perthite-quartz wall zone that is 3 to 10 ft thick. Muscovite, biotite, and green apatite occur in quartzose

nodules in the wall zone, and book muscovite also is present in its quartz-poor parts.

The muscovite is light pinkish buff to cinnamon brown, and most is clear. Many of the books are locky; in general, their locky parts are marred by light-brown flecks, whereas the free-splitting parts are clear. Some of the sheets are lightly specked, and many are intergrown with biotite. The cleavages of the two micas tend to be parallel, but a few biotite books contain narrow ribbons of muscovite in which the cleavage planes are nearly normal to those of the host mica. The near-surface muscovite is heavily clay-stained, but most of the books below a depth of about 20 ft are sound. Although some are as much as 2 ft in diameter, they are so severely ruled and haircracked that they yield few sheets larger than 4 by 6 in. About three-fourths of the recovered sheet material has been 1½ by 2 in. or smaller. Mica is moderately abundant in the feldspathic pegmatite in all the workings, and the deposit appears to contain moderate reserves of punch and small-sheet material.

DRUM MINE

The Drum deposit, 4½ miles north-northwest of Conover (location 23, pl. 18), is said to have been discovered about 1917, but little mining was done until 1938. It was worked intermittently during the period 1938–43 by Charles Hollars, of Charlotte, and a Mr. Gouge, of Spruce Pine, who excavated several open-cuts and sank a 60-ft incline. Late in 1943 the Herman-Sipe Co. of Conover, prospected the deposit by means of power-shovel trenches 24 ft deep, and during the following year a large open-cut was excavated by power-shovel methods (pl. 20). Small-scale mining around the walls and bottom of the cut was continued from August 1944 to March 1945.

Most of the country rock is garnetiferous quartz-mica schist and gneiss in which the foliation strikes west to northwest and dips steeply north and south. The mica flakes are distinctly larger near the pegmatite contacts than elsewhere, and many irregular blocks of coarsely recrystallized gneiss are included in the main pegmatite body. Several sill-like masses of light-gray gneissic granite are present in the mine area. The largest is about 90 ft in exposed breadth. Inclusions of granite in pegmatite are exposed in the main cut.

A large, irregular, discordant pegmatite mass was mined in the open-cut for a strike length of at least 275 ft. It consists of two lobes, 35 and 60 ft thick, that are separated by a pegmatite "neck" only 7 ft thick at the surface. The constriction between the lobes may thicken with depth, probably with an outward bulging of the south contact. Fine-grained pegmatite that contains abundant foils of muscovite cuts gneissic

granite at the south wall and near the west end of the cut. Its contacts are sharp, and it appears to fill fractures in the host rock.

The thinner east lobe of the deposit contains much disseminated scrap mica in small fragments. The books probably are most abundant near the walls. A thin quartz core was encountered during the mining, but most of the rock consists of kaolinized feldspar, interstitial quartz, and mica. The thick west lobe of the deposit is zoned in a more complex way. A quartz core 10 to 15 ft thick is flanked by a coarse-grained intermediate zone composed of kaolinized plagioclase and potash feldspar, badly ruled books of "A" mica, and minor quartz and beryl. A second, or outer, intermediate zone is rich in kaolinized blocky plagioclase and contains scattered small books of mica. It coarsens inward from the wall-zone contact. The wall zone, which consists of plagioclase, quartz, and coarse book mica, is best developed south of the quartz core.

The book mica in the deposit is clear and light cinnamon brown, but the proportion of scrap material is high. Many of the books are clay-stained and marred by cracks and ruling. The best sheets are said to have been obtained from the south, or hanging-wall, zone in the deepest part of the mine (section A-A', pl. 20). The footwall of the deposit was not explored at this level during the recent operations. Most of the core-margin mica is severely ruled and marked by "A" reeves and yields little sheet material. The mica in the outer intermediate zone is small and sparsely scattered, and most of that in the eastern bulge of the deposit is too small to yield sheet material. Beryl has been mined from the inner intermediate zone, especially along the east and south margins of the core.

A second pegmatite body is exposed in a prospect shaft and trench 300 ft northwest of the main open-cut. It trends east and is about 6 ft in maximum thickness, but it is very irregular. The book mica is said to be of better quality than that in the main deposit but probably is less abundant. Reserves of mica-bearing pegmatite appear to be small.

OTHER MINES AND PROSPECTS

The data on the following additional mines and prospects in the Conover area were obtained from the Colonial Mica Corporation:

Hefner mine.—In 1940 a Mr. Hefner opened a mica deposit on the L. L. Vinson property, 6 miles northwest of Conover (location 22, pl. 18). The mine was reopened in 1942 and operated until the summer of 1944 by M. L. Swann and Doc Henline. Three 30-ft shafts were sunk, and the intervening pegmatite was mined to depths of 8 to 20 ft. The deposit is at least 5 ft thick

and probably strikes N. 65° E. The mica books are reddish brown and of rather small size.

Smithwick prospect.—A prospect on the L. E. Smithwick property, about 4 miles north-northwest of Conover (location 24, pl. 18), was opened in 1941. The pegmatite contains abundant small books of flat, light reddish-brown mica.

County Home prospect.—Mica-bearing pegmatite occurs on the grounds of the Catawba County Home, 3½ miles north-northwest of Conover (location 25, pl. 18). A 14-ft pit exposes a pegmatite dike that trends N. 25° E. and contains a core of massive quartz. The quartz is fringed by abundant chub-A books of reddish-brown mica, but the proportion of recoverable sheet material is very low.

Bowman mine.—A mica deposit on the Laurence Bowman property, about 1 mile northwest of Conover (location 26, pl. 18), was opened by Charles G. Hollars about 1930. The pegmatite dike is exposed near a branch stream, where it strikes N. 70° E. It contains a thick core of massive quartz and much pale reddish-brown mica in moderately large books. The yield of trimmed sheet material from the books is small.

George Bartlett mine.—A mine on the Everett Drum property, 5 miles northeast of Hickory, was worked by George F. Bartlett from 1940 to 1943. Mica valued at \$5,000 is said to have been recovered. The very thick pegmatite dike consists of kaolinized feldspar, quartz, and flat-A mica.

BURKE AND CATAWBA COUNTIES: BURKE CHAPEL AREA

NOAH YOUNG MINE

A mica deposit on the Noah Young farm, half a mile south of Burke Chapel, Burke County (location 4, pl. 19), was opened about 1900 by Young's father. It was reopened in 1944 by John C. Greene, of Clarissa, who cleaned out some of the old workings and sank a 39-ft shaft. Although pegmatite is exposed in several pits north of the shaft, the attitude of the deposit as a whole is not known. It consists of perthite, kaolinized plagioclase, quartz, and muscovite. No well-defined zones can be distinguished. Many of the books are large, but most are reeved and some are hair-cracked. Flat-A structure is common. The mineral is clear and pinkish buff but somewhat clay-stained.

A small dike of feldspathic pegmatite is exposed in the southwestern pit, where it strikes northeast and dips southeast.

FLOYD BRITTAN MINE

The Floyd Brittan mine, 2.6 miles S. 65° W. of Burke Chapel, Burke County (location 2, pl. 19), consists of an open-cut 56 ft long, 33 ft wide, and 33 ft deep; a

shallow shaft from the bottom of the cut; and a 19-ft shaft 15 ft southwest of the cut. It was operated by Floyd Brittan, the owner, in 1918, 1943, and 1944. The deposit is more than 30 ft thick. Its nearly vertical west wall is exposed at the southwest edge of the cut, where it appears to trend N. 45° E., and several well-defined pegmatite zones are similar in attitude.

The core comprises massive quartz lenses at the surface but thickens and is more continuous with depth. It is flanked by an intermediate zone of blocky perthite. The wall zone consists of plagioclase, interstitial quartz, and scattered coarse book mica. It is distinctly thicker on the east side of the perthite-rich unit than on the west. The mica is pale cinnamon-brown to yellowish-olive, and much is color-zoned. Clay stains are widespread but not serious. A few of the books contain biotite intergrowths.

REED MINE

The Reed mine, near the Brittan mine and Brittan's store in southeastern Burke County (location 3, pl. 19), was worked many years ago by J. E. Burleson. It was reopened during the summer of 1943 by Gete Brittan and in the spring of 1944 by C. H. Foster, of Rutherfordton. The workings comprise six pits and open-cuts, the largest of which is 31 ft deep (fig. 88). Both the deposit and the foliation of the enclosing mica schist strike N. 20° E., and the pegmatite body dips 60° ESE. to vertical. A core of massive quartz 8 ft thick tapers out to the south, and the central part of the deposit in the southern workings consists of exceptionally large blocks of perthite. These may constitute an interme-

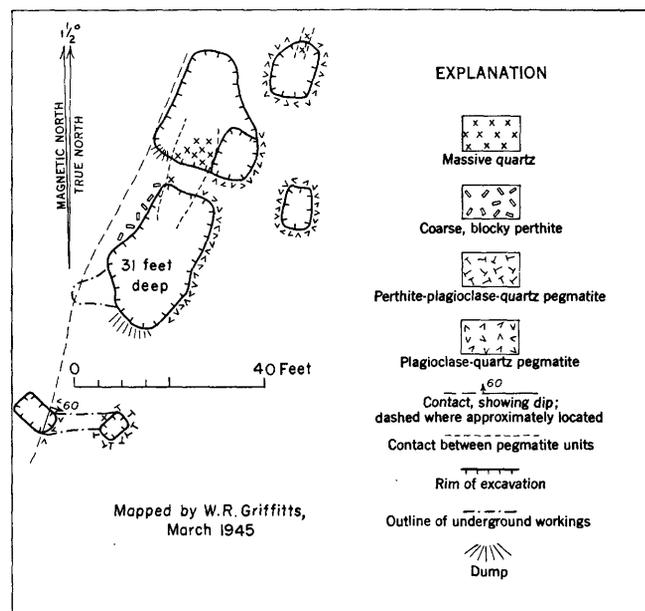


FIGURE 88.—Sketch map of the Reed mine, Burke County.

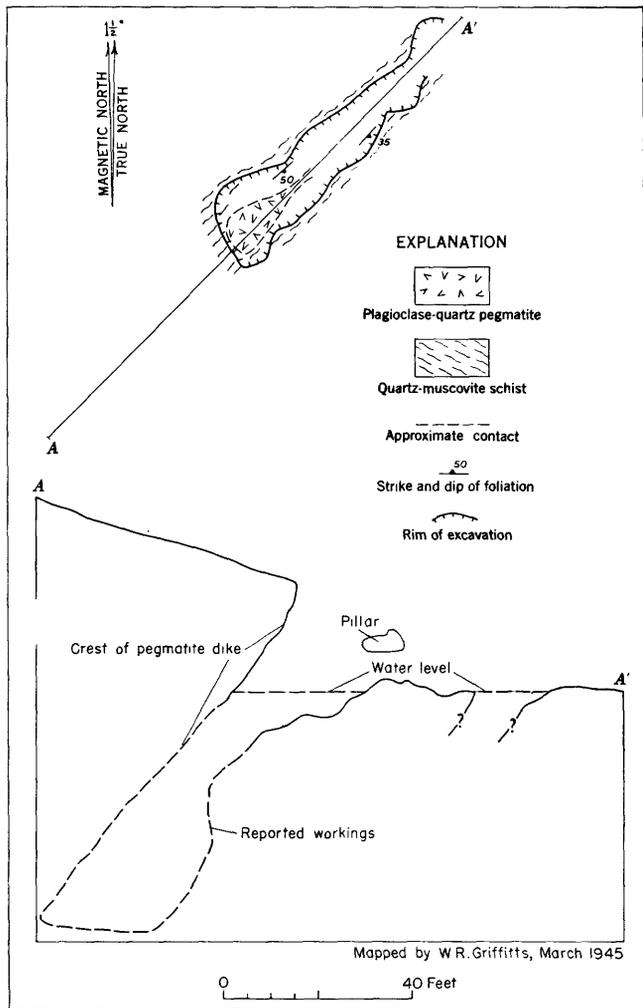


FIGURE 89.—Sketch map and section of the Abernathy Water mine, Catawba County.

diate zone, as the perthitic rock lies west of the south end of the core. A plagioclase-rich wall zone appears to surround the inner units and locally is at least 23 ft thick.

Blocks of quartz in the dumps are fringed with books of yellowish-green flat-A mica. Flat and flat-A books of deep cinnamon-brown and brownish-olive mica are scattered through the plagioclase-rich pegmatite exposed in the deepest cut. Color variations are common within individual books, and many sheets contain nearly colorless streaks parallel to "A" reeves. Much of the mica is badly cracked, and a little is marred by mineral stains. Although the mica content of the deposit is moderately high, the proportion of recoverable sheet material probably is very low.

ABERNATHY WATER MINE

The Abernathy Water mine is 2½ miles by road north of Wray's gin (location 6, pl. 19), which is on North Carolina Highway 10, in Catawba County but

only 2.6 miles northeast of the Burke County line. It was owned in 1943 by Julius Abernathy and was opened about 1895. It was reopened in 1920 by Eli Adkins, subsequent operators including Sam Green, a Mr. Taylor, of Asheville, and a Judge Williams. The workings comprise an open-cut on the southwest side of a valley and two flooded inclined shafts (fig. 89). One shaft, at the southwest end of the cut, is about 90 ft deep, and the other, in the northwest part of the cut, is said to be 60 ft deep.

The country rock is a feldspathic quartz-muscovite schist with foliation that strikes N. 45° E. and dips 35° to 50° SE. The pegmatite dike also strikes N. 45° E. but dips 75° SE. to vertically. It is about 4 ft thick at the northeast end of the cut but thins abruptly to 2 ft in the middle of the opening and beyond that point thickens to about 6 ft. At the southwest end of the cut it terminates in a crest that plunges southwest. The hanging-wall, or southeast, contact is very irregular.

The deposit is not well exposed but appears to consist of plagioclase, quartz, perthite, and muscovite. The plagioclase is thoroughly kaolinized near the surface, and much of the perthite also is weathered. The mica is pale pinkish buff to cinnamon brown, and the books are as much as 5 in. in diameter. They are free splitting and flat, but some are ruled and moderately clay-stained.

ABERNATHY LONG CUT (HICKORY) MINE

The Long Cut mine, on the Julius Abernathy property about a quarter of a mile southwest of the Water mine (location 6, pl. 19), in Catawba County, was operated in 1944 by the Hickory Mining Co. and in the spring of 1945 by Bascom Henline and Jesse Rose. The open-cut is 146 ft long, 4 to 30 ft wide, and 8 to 30 ft deep. A drift that extends 34 ft south from the deep end of the cut is also connected with the surface by a shaft 20 ft from the cut rim.

The country rock, a mica schist, is contorted near the south end of the mine, but to the north its foliation strikes N. 20° to 40° E. The vertical pegmatite dike strikes N. 13° E. It is 9 ft thick at the north end of the cut but thickens southward to 25 ft. Tabular to wedge-shaped apophyses extend into the wall rock along its very irregular eastern contact. The irregularity and length of the projecting tongues increase southward, and at the south end of the cut the deposit consists of a thin vertical pegmatite mass with many nearly horizontal branches that extend eastward. The intervening septa of schist are 2 in. to 1 ft thick. The deposit is said to pinch out at the bottom of the lowest workings.

A core of coarse perthite and plagioclase with minor muscovite and biotite is flanked by kaolinized plagioclase

clase-rich pegmatite that contains much book muscovite. A thin layer of quartz and muscovite forms the east wall of the deposit but was not observed along the west wall. Mica also is abundant in the pegmatite apophyses along the east wall, where it is associated with plagioclase and quartz. The books are pale cinnamon brown. Although few are marred by mineral or clay stains, many are lousy and most are less than 3 in. in diameter. The abundance of mica in the wall zone and the very low recovery of sheet material from the mined books suggest that the deposit may be a satisfactory source of scrap mica. It is so irregular in many places that its reported pinching out at the lowest part of the cut may be a local feature only and reserves of mica-bearing pegmatite may be large.

OTHER MINES AND PROSPECTS

The data in the following descriptions of other deposits in the Burke County portion of the Burke Chapel area were obtained from the Colonial Mica Corporation:

Spake prospect.—A mica deposit about 2½ miles northwest of Valdese is owned by the Duke Power Co. (location 31, pl. 18) and was worked in 1944 by M. J. Spake. The pegmatite dike contains much mica with strongly developed "A" reeves.

Cannon prospect.—A prospect on the Awes Cannon property, 2 miles west of Burke Chapel and 6 miles south of Icard, was worked during 1943 by M. C. Snyder and F. C. Snyder, of Rutherfordton. The quality of the mica is said to be very poor.

Keller prospect.—A mica deposit owned by O. F. Keller, of Statesville, is in eastern Burke County, about 2 miles west of Brittan's store (location 34, pl. 18). It was opened in 1943 by a Mr. Peeler, who obtained small, pale reddish-brown mica books of fairly good quality.

Yancey prospect.—The Yancey deposit, one of a group that includes the Brittan and Reed mines near Brittan's store, was worked in 1943 by W. E. Loughridge. A little pale reddish-brown mica occurs in a large quartz mass that trends N. 70° E. Some 3- by 3-in. trimmed sheets were recovered during the recent operations.

Hudson prospect.—A prospect on property owned by Mrs. Bessie Hudson is 3 miles east of North Carolina Highway 18 and 30 miles north of Shelby. A hard pegmatite dike strikes east and contains moderately large quantities of light reddish-brown mica. Although some of the books are of the flat-A type, the recovery of sheet material is rather high and the quality is good.

Haywood Hoyle prospect.—In 1943 Haywood Hoyle opened a prospect on the farm of Mrs. Lola Bluff, 8 miles south of Icard (location 32, pl. 18). Little mica was recovered.

Henry Young prospect.—The Young deposit is near the Burke County-Catawba County line, about 9 miles south of U. S. Highway 70 (location 33, pl. 18). It is owned by Alice Brittan and Gete Brittan and was opened in 1920 by Art Buchanan. It was worked in 1924 by Albert Wilkie and in 1943 by Haywood Hoyle and Gete Brittan. Moderate quantities of good-quality mica are said to have been obtained.

The data on the following mines, in Catawba County, were obtained from the Colonial Mica Corporation:

George P. Young mines.—Two old mica mines on the George Young property, in southwestern Catawba County near the Burke County line (location 5, pl. 19), were reopened in 1943 by M. H. Rose and George Rose, of Jonas Ridge. The No. 1 mine was first operated in 1918 by J. E. Burleson. The pegmatite dike strikes N. 15° E. and dips 50° WNW. The Burleson workings were cleaned out to a depth of nearly 45 ft, but only barren pegmatite was exposed. A few flat books of light reddish-brown mica were obtained from the old waste. The No. 2 mine, an open-cut 44 ft long and 38 ft deep, also was cleaned out in 1943, but no mica was found.

CATAWBA, CLEVELAND, AND LINCOLN COUNTIES:

FALLSTON AREA

TALLANT PROSPECT

The Tallant prospect in Catawba County, 5 miles northeast of Toluca (location 8, pl. 19), is an open-cut that was dug about 1908 by Jasper Childers. It was cleaned out in 1929 by Jim Vance and was worked under lease by R. E. Kemmerer in 1943. The opening was 40 ft long and 25 ft deep but is now slumped. The country rock is mica schist with foliation that strikes N. 70° W. and dips 30° S. Float blocks of hornblende schist and quartz-sillimanite schist are abundant near the deposit. The poorly exposed pegmatite dike may trend N. 35° E. A granular quartz core about 1½ ft thick is flanked by a wall zone of quartz, kaolinized plagioclase, and book mica. This outer unit may be as much as 4 ft thick. The mica is cinnamon brown, and most books in the dump are less than 2 in. in diameter. Some are reeved.

A. F. HOYLE MINE

The Hoyle mine is on the Ambrose F. Hoyle property in Cleveland County, beside a southeastward-flowing tributary of Knob Creek 1.6 miles west of Toluca (location 14, pl. 19). It was opened in August 1943 and worked until April 1944 by F. B. Hendricks and H. L. Kennedy, of Charlotte. An open-cut 55 ft long, 7 to 10 ft wide, and at least 35 ft deep was dug in the hard rock of the valley bottom (fig. 90). A shallow pit lies 260 ft south of the main cut.

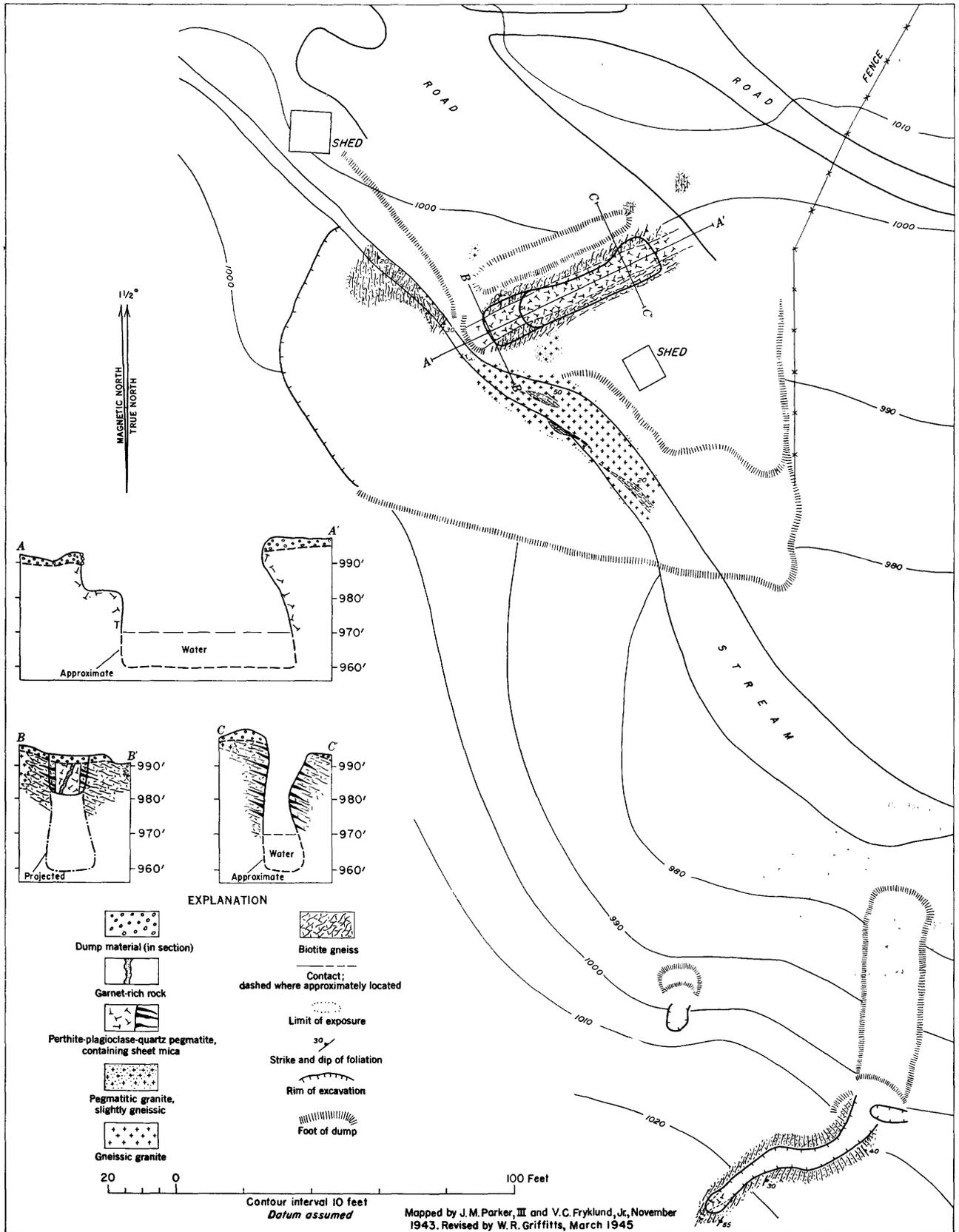


FIGURE 90.—Geologic map and sections of the Hoyle mine, Cleveland County.

The country rock is a medium- to coarse-grained, dark-gray biotite gneiss that is distinctly and continuously layered. Medium-grained, light-gray garnetiferous granite is exposed in the creek bed south of the open-cut. It is faintly foliated, owing to the arrangement of scattered biotite flakes and thin quartz laminae. The trend of the country-rock structure ranges from northwest to northeast, and the dip is 20° to 40° NE. and SE. Several sill-like masses of faintly foliated plagioclase-quartz-perthite pegmatite occur in the gneiss and granite and may be a coarse-grained phase of the granite.

The mica-bearing pegmatite dike strikes N. 65° E., dips steeply south-southeast at the surface, and dips steeply north-northwest in the lower part of the workings. It is clearly zoned. A ½- to 3-in. mica-poor border zone consists of fine-grained quartz and platy plagioclase. Its outer, plagioclase-rich part appears locally as a well-defined white selvage ⅛ to ½ in. thick. A distinct platy structure in the inner part of the border zone is nearly normal to the pegmatite contacts. The wall zone is a few inches to 3 ft thick and consists of coarse-grained plagioclase, quartz, and mica, with subordinate perthite. Many of the plagioclase masses are 4 in. or more in diameter and contain spindles of quartz arranged in a crudely graphic pattern. Small, thick books of mica are abundant near the outer margin of the unit. Prismatic crystals of green apatite are locally associated with the muscovite, and a little uraninite and autunite occur along adjacent fracture surfaces.

The inner part of the deposit consists of blocky white to light-gray perthite with subordinate plagioclase, light- to dark-gray quartz, and mica. Some quartz is graphically intergrown with both feldspars. Large, well-formed perthite crystals occur in blocks of massive quartz in the dumps, and these aggregates may represent the core of the deposit. Dense masses of garnet, green muscovite, quartz, and sulfide minerals fill several persistent fractures in the pegmatite. Later-stage fracture-filling minerals include calcite and a white friable zeolite. Local heavy iron stains in the deposit appear to have been formed through the oxidation of nearby grains of sulfide minerals.

Mica was abundant in the pegmatite mined from the upper part of the open-cut, but the concentration of books was found to decrease downward. Most of the books are pale pinkish buff to cinnamon brown, but some contain sharply defined yellowish-green margins. The sheets are clear and flat, but a few are intergrown with biotite.

A shallow pit was sunk in a pegmatite dike on the hillside several hundred yards northwest of the open-cut. Little mica appears to have been found.

JAKE HOYLE PROSPECT

The Jake Hoyle prospect is in Cleveland County, southwest of Knob Creek and a few hundred yards southwest of the A. F. Hoyle mine (location 15, pl. 19). It was opened in 1944 by Jake Hoyle, the owner, who excavated a cut about 20 ft long and 10 ft deep in a vertical pegmatite dike that strikes N. 70° E. The deposit thickens from 1 ft at the west end of the cut to 5 ft at its east end. It is a rather uniform aggregate of perthite, plagioclase, and mica in books 1 to 3 in. in diameter. The mica is light cinnamon brown and clear, but some is intergrown with biotite. A little is clay-stained.

BONNET SPLIT (BIG HILL) MINE

The old Bonnet Split mine is in Cleveland County, about half a mile west of Carpenter Grove Church and a mile west of the Hoyle mine (location 16, pl. 19). It was reopened in the fall of 1942 by H. L. Kennedy and was operated during the following year by L. P. Hunt, the owner. The main opening is a cut 90 ft long, 20 ft wide, and 10 to 15 ft deep.

The pegmatite dike strikes N. 55° E. and dips 75° NW. in garnetiferous mica gneiss with local sillimanite-bearing layers. The country-rock foliation strikes N. 80° W. and dips 55° S. The deposit probably is about 4 ft thick. Three other dikes, each about a foot thick, are exposed near the middle of the cut. A core of massive white quartz, said to be as much as 3 ft thick, contains cavities that are lined with well-formed prismatic crystals of clear quartz. The book mica in the deposit is light pinkish buff. Most of the books are small, and ruling and cracks are common.

COOKE MINE

The old Cooke mine, in Cleveland County 2.5 miles S. 73° W. of Toluca (location 17, pl. 19), is owned by A. L. Cooke. It was reopened briefly in 1942 by F. B. Hendricks and H. L. Kennedy. The workings comprise several small pits and an open-cut 70 ft long, 15 ft wide, and 20 ft deep. The country rock is a garnetiferous mica gneiss that contains many small pegmatite pods. Its foliation strikes N. 50° W. and dips 70° SW. The pegmatite dike is 15 ft thick, strikes N. 5° E., and dips 70° W. It consists chiefly of plagioclase with interstitial quartz, small books of muscovite, and accessory biotite and beryl. The muscovite is pale cinnamon brown and clear, but most of the books are small, ruled, and locky.

INDIAN GRAVEYARD MINE

The Indian Graveyard mine, in Cleveland County 2.5 miles S. 74° W. of Toluca (location 18, pl. 19), is owned by Jim Randall. The workings include many

old pits and tunnels in a 130-ft row that trends N. 65° E. Few are more than 20 ft deep. The mine was reopened in the spring of 1943 by F. B. Hendricks and H. L. Kennedy, and small-scale prospecting was done by others later in the year. A 4-ft pegmatite dike strikes N. 65° E. and dips 80° NNW. in garnetiferous mica gneiss. The country-rock foliation is somewhat contorted but in general trends N. 5° W. and dips 45° W. The pegmatite contains clear, flat books of pale cinnamon-brown mica. Some is marked by faint "A" structure.

INDIANTOWN (MULL) MINE

The old pits and open-cuts of the Indiantown mine, in Cleveland County, are 2.5 miles S. 70° W. of Toluca (location 19, pl. 19). In 1943 F. B. Hendricks and H. L. Kennedy excavated a cut in a hitherto unexplored pegmatite dike a short distance southeast of the main Indiantown cut. The new opening, 250 ft long, 50 to 70 ft wide, and 35 ft deep, exposes irregular, steeply dipping pegmatite pods in a series that strikes N. 30° E. The foliation of the enclosing mica gneiss strikes N. 50° E. and dips 40° NW. In one of the larger pods a little mica fringes a quartz mass at and below a depth of 20 ft. Most of the "A" books are strongly wedged and yield little but scrap material. Flat mica of better quality is said to have been found between the 20-ft level and the surface.

RANDALL (NORMAN) MINE

The Randall mine, in Cleveland County 2¾ miles S. 70° W. of Toluca (location 20, pl. 19), was last operated by F. B. Hendricks and H. L. Kennedy in the spring of 1943, when the old workings were obliterated during the excavation of an open-cut 200 ft long, 50 ft wide, and 35 ft in maximum depth. The pegmatite dike strikes N. 43° E. and dips 80° NW. in garnetiferous mica gneiss and is as much as 8 ft thick. The country-rock foliation strikes N. 50° E. and dips 25° NW. Book mica is said to have been recovered mainly from feldspathic pegmatite near the margins of a quartz core. Flat, light cinnamon-brown books were found near the surface but were not abundant. Only yellowish-green "A" mica was found in the deeper parts of the workings.

WOODROW PROSPECTS

The Woodrow prospects, in Cleveland County, about 1¼ miles west of Carpenter Grove Church (location 21, pl. 19), are owned by Julius Hoyle. Two shafts were sunk near a creek about 1895 by a Mr. Kirkway, and two pits were dug in 1944 by Woodrow Hoyle. The larger pit is in a creek bed east of the Hoyle residence, and the other is on a hill several hundred yards northwest of the house. Both are slumped. The pegmatite

body on the hill probably strikes N. 55° E. It consists of kaolinized plagioclase, massive white to light-gray quartz, and pale cinnamon-brown muscovite. The mica is hard and is flat to slightly wavy. Much is clay-stained. Many of the books are 3 in. or more in diameter, and very few are ruled or badly cracked.

BUMGARNER MINE

The Bumgarner mine, in Cleveland County, 3 miles S. 75° W. Toluca (location 22, pl. 19), was opened about 1900. It is owned by A. P. Meade. Four pegmatite dikes of diverse orientations occur in a row that is a quarter of a mile long and trends N. 30° E. They have been worked by means of open-cuts and shafts. The main Bumgarner dike, near the northeast end of the belt, was reopened in 1942 by F. B. Hendricks and H. L. Kennedy.

The country rock is garnetiferous mica gneiss with foliation that strikes N. 70° W. and dips 30° SSW. The northeasternmost cut exposes a feldspathic pegmatite mass that strikes N. 30° E. A 25-ft shaft to the southwest was sunk in an irregular but essentially vertical dike that strikes N. 70° W. It is 8 ft thick and consists chiefly of feldspar with a little quartz and mica. Farther southwest an open-cut 50 ft long, 20 ft wide, and 25 ft in maximum depth exposes an irregular 6-ft dike that strikes N. 65° E. and dips 70° NNW. This deposit is said to have yielded the best mica. The southwesternmost cut, 50 ft long, was excavated in a 15-ft pegmatite dike that strikes N. 50° E. and dips 70° NW. A lenslike core of massive white quartz is 10 ft in maximum thickness. Much "A" mica occurs along its margins and some flat books are said to have been obtained from adjacent feldspathic rock.

The deposits contain both cinnamon-brown flat mica and cinnamon-brown to yellowish-green "A" mica. Some of the books are conspicuously color-banded. Recovery of sheet material from the flat books is said to have been moderately high, but that from the reeved mica was low. All the books are hard and free from warping and locking, but many are lightly clay-stained.

MITCHEM DEPOSIT

Float fragments of pale cinnamon-brown mica occur on the Walter Mitchem property, which is in Cleveland County, a quarter of a mile west of St. Peters Church (location 23, pl. 19).

MARVIN KING PROSPECTS

The Marvin King deposits are in Cleveland County, half a mile southeast of St. Peters Church (location 25, pl. 19). Prospect openings have been excavated at several places on the property, chiefly between 1910 and

1915. The No. 1 group consists of several trenches along a large quartz mass that crops out in a field. The No. 2 opening, a 12-ft pit, was dug about 1930 by a Mr. Smith. Several smaller prospects were not examined. The property was leased during the spring of 1943 to Fred Clark and the Americal Minerals Co., Inc., of Spruce Pine.

The country rock in the vicinity of the workings is mica gneiss, but float masses of granite occur in an adjacent field. The pegmatite dike at the No. 1 prospect strikes N. 65° E. and is 10 ft or more thick. Book mica is said to occur along the margins of the quartz core, which is about 6 ft thick. The books are pale cinnamon brown and in general are of good quality. Most are small. The thin dike at the No. 2 prospect consists chiefly of kaolinized feldspar, with moderately large but severely cracked and heavily clay-stained books of pale cinnamon-brown mica.

SHORTY PROSPECT

The Shorty prospect is on the Marvin King property, near North Carolina Highway 18 and 16 miles north of Shelby, Cleveland County (location 25, pl. 19). Several pits were dug by King in 1941, and during the spring of 1944 M. H. Rose, of Jonas Ridge, sank a 28-ft shaft and drove a 10-ft drift southwest from it. All the workings are in feldspathic pegmatite. Book mica is scattered sparingly through the deposit. It is light cinnamon brown, hard, flat, and of good quality, but few sheets larger than 2 by 3 in. have been recovered.

ARCHIE NORMAN (W. H. THOMPSON, WYATT) MINES

The Norman mica deposits are on the farm of Archie Norman, a mile N. 70° E. of Belwood and 3.8 miles north of Fallston, Cleveland County (location 28, pl. 19). Two large mines and at least seven small mines and prospects have been opened on the property (pl. 21). The Norman-Thompson mine, about 350 ft northwest of the Norman residence, is said to have been operated in 1893 by a Mr. Peeler and from 1900 to 1905 by J. E. Burleson. According to Sterrett (1923, p. 189) Burleson reported the recovery of mica valued at about \$15,000. Marshall Hoppus, of Little Switzerland, is said to have mined intermittently and on a small scale between 1905 and 1943. The old workings comprise several shafts, drifts, and irregular stopes in a belt about 180 ft. long. Mining was extended to a maximum depth of 60 ft. During the first half of 1943 Charles G. Hollars, Norman, and C. K. Cecil excavated a large open-cut by power-shovel methods and sank a shaft from the bottom of this opening to the lowest old workings.

The Archie deposit, west of the Norman residence, had been little explored prior to 1943, when Norman

and Cecil excavated a large open-cut. The cut was deepened and extended to the west by George Rose in 1944. A shaft was sunk 18 ft from its floor near the west end, and a drift was driven westward for a distance of about 55 ft from the west end at the 38-ft level (pl. 21). When Rose abandoned the mine in April 1944, the cut was 180 ft long, 40 ft wide, and 30 ft deep to the top of the muck fill in its western end. Production of trimmed punch and sheet mica was moderately large.

The Lee mine is about 125 ft south of the house. The old workings were reopened in the summer of 1943 by Norman and again in the spring of 1944 by Rose, who sank a 35-ft shaft at the east end of an elongate open-cut. The Jimmy mine, north of the Archie workings, was opened by Weathers and Blanton, of Shelby, who dug a small pit on the west side of the road. Norman later deepened it to 14 ft and ran a drift several feet to the west. During the spring of 1943 L. H. Goodman, of Asheville, sank an 18-ft shaft east of the road and drove drifts 18 ft to the west and 12 ft to the east. Work in the west drift was halted by order of the State Highway Department.

The workings of the Elizabeth mine, about 500 ft east of the Norman-Thompson cut, include several shallow pits and an open-cut that were excavated between 1900 and 1905. Additional mining was done by Norman in 1943. Four small prospects occur in an east-west line north of the Norman residence (pl. 21). Three are shallow open-cuts, and the fourth is a shallow filled shaft whose position is marked by mica flakes in the soil.

The wall rock in most of the mines is garnetiferous mica schist, but gneissic granite of the western type is exposed in the east end of the Norman-Thompson cut, at the Elizabeth mine, and in the Archie cut. The foliation in both rocks strikes nearly due east and dips north and south at angles of 30° to 60°. Each mine was developed in a separate pegmatite body, so far as known, but the pegmatites occur in at least three eastward-trending belts that are 150 to 250 ft apart (pl. 21). A thin pegmatite dike that is parallel with the others and is north of the mapped area may be a part of another belt. Fracturing and drag effects in the country rock that encloses the Archie deposit (fig. 80) suggest that the pegmatite bodies may have been emplaced in a set of parallel faults. The deposits strike N. 80° E. to N. 85° W. and dip very steeply.

The Archie pegmatite may plunge west. Much of the mining was done in an elongate bulge about 15 ft thick. A quartz core encountered between the east end of the cut and the shaft is 5 ft thick in the shaft, where it is flanked by an irregular zone of coarse perthite-rich pegmatite (not shown on map). The wall

zone is rich in plagioclase. Mica occurs in the core, as well as in the feldspathic units, but the drift is said to have been driven along a horizontal, tabular concentration that was not associated with massive quartz. Norman reports that the mica in the core is of better quality than that in the adjacent units and that the books encountered along the south wall of the core in the shaft are distinctly more reeved than those in other parts of the deposit.

The Norman-Thompson dike is 35 ft in maximum thickness but appears to thin abruptly both eastward and westward from the deepest part of the cut. Large masses of quartz form a discontinuous core. The enclosing pegmatite contains partly kaolinized plagioclase, minor perthite, and book mica. Most of the mica has been mined from the west end of the cut, but its localization within the deposit is not known with certainty. It may be related to the quartz masses. Small offshoots from the main pegmatite body have been explored, but little book mica has been recovered.

The 2½- to 3-ft Jimmy dike strikes N. 81° E. and dips 87° N. It is composed of kaolinized plagioclase, interstitial quartz, and sparsely scattered small books of mica. The pegmatite dike in the Lee mine is 1 to 6 ft thick. It consists of plagioclase, quartz, and small books of mica. Short, conformable apophyses extend outward into the wall rock.

The pegmatite body at the Elizabeth mine is very irregular and about 20 ft in maximum thickness. A discontinuous quartz core 3 to 4 ft thick is fringed by concentrations of "A" mica. Blocks of quartz are abundant in the vicinity of prospect A, and fragments of float mica occur around prospects B and C. Mica flakes and blocks of quartz are scattered around the shallow pit at prospect D. Some of the quartz contains crystals of tourmaline.

The mica from all the deposits is pale cinnamon brown and in general is of good quality. Most of the books are clay-stained and marked by flat-A structure. Other defects include cracks and ruling. The mine-run books yield about 5 percent trimmed sheet material.

M. H. GANTT MINE

A mine on the M. H. Gantt property, about 500 ft west of the public road and about a quarter of a mile northwest of the Archie Norman mines (location 26, pl. 19) in Cleveland County, was first worked prior to 1884. A long period of idleness ended in the spring of 1943, when the old workings were cleaned out and enlarged by M. H. Rose. The present opening is a cut about 20 ft deep. The vertical pegmatite dike strikes N. 85° E. in a light-gray, faintly foliated granite. It is 2 ft thick at the west end of the cut, was about 4 ft thick near the middle, and is said to have been several

feet thick near the floor. The floor itself, however, is reported to consist chiefly of granite.

The deposit contains a massive quartz core about 1½ ft thick, a discontinuous perthite-rich intermediate zone, and a plagioclase-quartz wall zone. Both the core and the dike itself taper westward, and at the west end of the cut the intermediate zone occupies the center of the deposit. Flat books of mica as much as 6 in. in diameter occur in the wall-zone pegmatite, flat and faintly reeved flat-A books are clustered along the margins of the core, and some skeletal mica crystals occur in the quartz. The mineral is pale cinnamon brown to brown. Some of the core-margin books are locky.

Most of the main pegmatite body appears to have been mined out. A small pit 200 ft east of the open-cut exposes a pegmatite dike that strikes N. 85° E. in mica schist. It may be a continuation of the mass mined in the open-cut. The country-rock foliation strikes east and appears to dip synclinally toward the pegmatite contacts.

IRA LONDON PROSPECT

A pegmatite dike in the yard of the Ira London residence, 0.5 mile N. 75° E. of Belwood, Cleveland County (location 29, pl. 19), was prospected in 1942 by H. L. Kennedy. A trench exposes small, clay-stained mica books.

B. T. GANTT PROSPECT

Two pits were dug in the spring of 1943 on the property of Ben T. Gantt, 1¼ miles S. 75° E. of Belwood, Cleveland County (location 32, pl. 19). One is 10 ft deep and exposes a 2½- to 3-ft pegmatite dike that strikes N. 85° E. and dips 75° N. The deposit contains a thin core of gray quartz and small books of cinnamon-brown and dull yellowish-olive muscovite.

GRIGGS MINES

The Griggs mines are on the Baxter property in Cleveland County, approximately 2 miles N. 64° E. of Fallston (location 38, pl. 19). The main workings were developed many years ago by Baxter, and some were cleaned out during the period September 1943–May 1944 by D. L. Pendley, of Spruce Pine. Several new shafts also were sunk. The workings extend to depths of 40 to 56 ft (fig 55). A second pegmatite dike, 135 ft north of the main deposit, was worked by means of an adit, two drifts, and two shallow pits. The country rock is mica schist with foliation that strikes N. 80° W. and dips 40° S. It is locally contorted and broken, and a tight fold that is exposed 30 ft southwest of the north adit portal can be traced upward into a reverse fault of small displacement.

The main pegmatite dike trends N. 60° to 65° E., and has been mined for a strike distance of 95 ft. A quartz

core is 5 to 7 ft thick but pinches out in the southwest-most surface workings. The entire dike thins abruptly a few feet farther southwest. A wall zone of kaolinized plagioclase-rich pegmatite is 2 to 6 ft thick where it flanks the quartz, but it may be as much as 10 ft thick beyond the ends of the core. It contains scattered books of pale cinnamon-brown to yellowish-olive mica, some of which are 6 in. across. Most are flat and clear. The chief defects are reeves and clay stains.

The north dike strikes N. 63° W. Two drifts are in 2- to 4-ft thicknesses of plagioclase-rich pegmatite along the flanks of a 5-ft quartz core. These openings extend 30 ft from the inner end of the adit to old filled workings. Flat-A books of hair-cracked and heavily clay-stained mica are abundant in the plagioclase within 2 ft of the core, and some are in contact with the quartz. Several are as much as a foot in diameter.

Although most of the recent work in both pegmatites was aimed at exploration and development, moderate quantities of excellent sheet mica were recovered. Further operations might well yield a steady output of book mica, but a heavy flow of water below the 20-ft level is to be expected.

WRIGHT PROSPECT

A prospect on the Albert Wright property, 1.8 miles east of Fallston, Cleveland County (location 41, pl. 19), was opened in 1943 by H. L. Kennedy. A 19-ft shaft was sunk in quartz-muscovite pegmatite. Books of brown mica as much as 10 in. in diameter were encountered, but the bottom of the shaft is said to be in barren pegmatite.

ROYSTER MINE

The Royster mine, 2¼ miles east of Fallston, Cleveland County, and 300 ft south of the road (location 40, pl. 19), has been idle for many years. Two slumped cuts on opposite sides of a vertical quartz mass are said to have been 20 and 25 ft deep. The mica gneiss country rock strikes N. 70° E. and dips 75° N. (Sterrett, 1923, p. 193), and the quartz mass trends N. 50° W. Blocks of perthite can be seen northwest of the quartz, and plagioclase-quartz pegmatite probably occurs farther northwest. Books of pale cinnamon-brown mica as much as 5 in. in diameter are present in the dumps.

A second deposit on the property is north of the main workings and was opened prior to 1916.

FALLSTON PROSPECT

A deposit on the south side of the main dirt road 1.3 miles east of Fallston in Cleveland County (location 42, pl. 19), was opened prior to 1935. It may be on the Stough Beam property. Mica books of good size and

quality are said to have been recovered before mining was halted by order of the State Highway Commission. No pegmatite is exposed, but massive milky to light smoky quartz, perthite, brown muscovite, and greenish-brown biotite are present in the dump.

MAUNEY CARPENTER MINE

The Mauney Carpenter mine, 3 miles S. 55° E. of Fallston, Cleveland County (location 51, pl. 19), is owned by Mrs. Laura Carpenter, of Gaston County. It was operated under lease by Roy Grindstaff, Walt Grindstaff, and Ellis Burleson during the winter of 1942-43 and by Latt Young and G. L. Phillips in July 1944. The main opening is a cut 61 ft long, 8 ft wide, and 20 ft in maximum depth.

The nearly vertical pegmatite dike strikes N. 85° E. and is at least 20 ft thick. Large blocks of white, smoky, and nearly clear quartz in the dumps probably represent the core of the deposit, but much of the pegmatite is composed of perthite and kaolinized plagioclase. Muscovite is fairly abundant and is locally associated with biotite. Many books are said to have been exposed in the floor in the cut at the close of the last operations. Most of the mica is clear and pale cinnamon brown, but some books are yellowish olive and contain a little stain. Although reeves are common, substantial quantities of fairly large, flat mica sheet have been obtained.

LEM HAMRICK MINE

The Lem Hamrick mine is a quarter of a mile east of North Carolina Highway 18 and 3½ miles south of Fallston in Cleveland County (location 55, pl. 19). The old workings, now completely filled, are said to have been 40 ft deep.

PINK LEATHERMAN MINE

The Pink Leatherman mine, 2 miles N. 81° E. of Toluca, Lincoln County (location 13, pl. 19), has been worked intermittently since 1935 by Leroy Hooper, Preacher Street, and Pink Leatherman, the owner. It was leased to the Asheville Mica Co., of Biltmore, in the fall of 1942. The main opening, a cut that extends 90 ft up a hillside from a point near a creek bed, is 4 to 12 ft wide and 35 ft in maximum depth. Its lower end is flooded.

The vertical pegmatite dike strikes N. 70° E. in garnetiferous mica gneiss. The country-rock foliation strikes N. 55° W. and dips 45° SW. The deposit is now exposed only at the west end of the cut, where it is not more than a foot thick. Its thicker parts contain a 2-ft core of massive quartz, and some blocks of burr rock are present in the dump. The mica books are

light cinnamon brown, large, and of fair quality, but the dike is said to have "played out" at the bottom of the cut.

SHULL (JOHN DILLINGER) MINES

A mine on the property of G. F. Shull, $5\frac{3}{4}$ miles east of Toluca, Lincoln County (pl. 19), was developed to a depth of 18 or 20 ft by the Cawood Mica Co. in 1906 and 1907 (Sterrett, 1923, p. 223). The deposit is irregular and strikes east in contorted sillimanite-bearing mica gneiss. In August 1943 Robert E. Kemmerer sank three pits along a vertical quartz mass that trends east. Books of "A" mica were recovered from the quartz and from the feldspathic pegmatite at its edges, and a little small, flat mica was found in the wall zone farther from the core. All the books were hard, clear, and pale cinnamon-brown, but few yielded trimmed sheets as much as $1\frac{1}{2}$ in. in diameter.

Another deposit, about a quarter of a mile west of the main Shull workings, contains "A" mica and some beryl. According to Sterrett (1923), most of the mica occurs near ledges of quartz.

HULL (ROCK CUT) MINE

The Hull mine, about 4 miles east of Toluca, Lincoln County (location 11, pl. 19), is owned by Sarah A. Hull. It was opened about 1891, and by 1913 an open cut 40 ft long, 5 ft wide, and 20 ft deep had been excavated. During the summer and fall of 1943 Ned Sigman and John H. Booth, of Charlotte, sank several shafts and drove a drift. The country rock is a sillimanite-bearing mica schist that strikes N. 10° E. and dips 50° E. The vertical pegmatite dike strikes N. 70° E. and is 3 to 5 ft thick. Book mica occurs in plagioclase-quartz pegmatite. It is pale cinnamon-brown, hard, and free from stains and cracks. Most of the books mined in 1943 were small, although some 10- by 14-in. sheet material is said to have been obtained.

HALLMAN MINE

A mica mine on the J. A. Hallman property, $1\frac{1}{2}$ miles S. 22° E. of Toluca, Lincoln County (location 24, pl. 19), had lain idle for many years prior to the fall of 1943, when Zeno Martin began cleaning out an old 25-ft shaft. He later excavated a cut 45 ft long, 15 ft wide, and at least 30 ft deep. This opening is now partly flooded. The deposit appears to strike N. 70° E. and to be nearly vertical. The north wall and the flanking mica schist are exposed along the north side of the cut.

A massive quartz core also strikes N. 70° E., and between it and the north wall are a 4- to 6-ft intermediate zone of extremely coarse, blocky perthite and a 4-ft wall zone of kaolinized plagioclase-quartz peg-

matite. Irregular tongues of quartz extend from the core nearly to the wall-rock contact. Flat and flat-A books of pinkish-buff to light yellowish-green mica are scattered through the wall zone. The sheet mica is clear and free from waviness and warping. Some is lightly clay-stained. Neither the south margin nor the bottom of the deposit has been exposed by mining.

A small pit was sunk in a pegmatite dike that cropped out at the side of the road north of the Hallman workings. Pegmatite is no longer exposed, but massive quartz, weathered feldspar, muscovite, and biotite are present in the dump.

SHIDAL PROSPECT

A prospect on the Ed Shidal property, 2 miles southeast of the intersection of North Carolina Highways 27 and 274 in Lincoln County (location 43, pl. 19), was opened by Eugene Hegler, of Charlotte, who sank two 15-ft shafts and drove short drifts. The deposit strikes east and dips 70° N. It contains lousy books of mica.

W. T. FOSTER (W. A. THOMPSON) MINES

The Foster mines are in western Lincoln County, about 4 miles N. 10° E. of Fallston (location 27, pl. 19). They were worked intermittently and on a small scale for many years prior to 1941, and since that time they have been considerably enlarged. At least 12 mica-bearing pegmatite bodies occur in a 1,400-by-2,000-ft area. Many were prospected and developed by means of shafts and shallow irregular drifts prior to 1912, and much work was done at the No. 5 mine, in the southeast corner of the area, between 1900 and 1912 (Sterrett, 1923, p. 222). Few of the old workings extend below water level.

In October 1941 William T. Foster reopened several of the deposits and began to clean out and enlarge the cut at the No. 1 mine, near the center of the area. Different parts of the No. 1 deposit later were worked by Foster and by the Asheville Mica Co. of Biltmore. Operations were abandoned late in 1943, and Foster has since mined on a small scale at many other places on the property. The most recent work in the area involved the reopening of the King (Norman and Cecil) mine by Archie Norman and C. K. Cecil. The workings of the nine mines on the property comprise several open-cuts, trenches, pits, and shafts, with irregular drifts and stopes (pl. 22). All the underground openings are flooded or caved.

The main opening at the No. 1 mine is a cut 225 ft long, 20 to 40 ft wide, and 50 ft deep. A short crosscut that extends north from the bottom of a 45-ft shaft near the southwest end of the cut leads to a 50-ft southwest drift in the pegmatite (not shown on pl. 22). Several trenches and shallow shafts are northeast of the main

cut. The No. 2 mine, north-northeast of the No. 1, consists of a 38-ft timbered shaft that was sunk from the bottom of a shallow open-cut. The No. 3 mine, west-northwest of the No. 1, includes an open-cut 60 ft long, 30 ft wide, and at least 26 ft deep and two old caved shafts at its southwest end. The extent of the underground workings is not known.

The open-cut at the No. 4 mine, near the southwest corner of the area, is 85 ft long, 30 ft wide, and 30 ft deep. The No. 5 mine, 200 ft south of the No. 4, is an open-cut 40 ft long, 30 ft wide, and at least 15 ft deep. Some underground workings may be present. The No. 6 mine workings, about 200 ft southwest of the No. 1 pit, comprise a cut 100 ft long, 25 ft wide, and 15 ft deep, a shallow shaft, and a short drift. The No. 7 mine is near the south edge of the area and consists of two pits, one of which was deepened to about 30 ft in 1944. The No. 8 mine, 200 ft south of the No. 6 workings, is a 15-ft shaft with short appended drifts. The open-cut of the King mine is near the east edge of the area. It is 200 ft long, 40 ft wide, and 45 ft in maximum depth. Several shallow old workings were obliterated during the excavation of this cut and a 160-ft bulldozer trench to the north.

The country rock is mainly fine- to medium-grained garnetiferous quartz-biotite gneiss. It contains garnet crystals as much as a quarter of an inch in diameter, as well as fine-grained crystalline aggregates of garnet. Sulfide minerals are a minor constituent. The foliation appears to trend northwest, with prevailing southwesterly dips. The rocks are highly contorted near the pegmatite bodies. In general they appear to strike nearly parallel with their pegmatite contacts but dip less sharply. Unweathered gneiss was seen only in the lower part of the No. 1 mine and in scattered outcrops in the southeastern part of the area. Blocks of wall rock in the dumps from the No. 1 mine contain very coarse muscovite foils along the pegmatite contacts.

Boulders and small outcrops of fine-grained gneissic granite are present in the southeastern part of the area. The rock consists mainly of feldspar and quartz, with thin alined flakes of biotite and some garnet crystals a tenth of an inch or less in diameter. It appears to be interlayered with the biotite gneiss and is the dominant rock type at and south of the King mine. Scattered outcrops and float masses of weathered hornblende gneiss have been observed in the area, and fine-grained garnetiferous kyanitic mica gneiss is reported by Sterrett (1923, p. 221). Abundant cobbles of granular quartz on the crest and upper slopes of the ridge south of the King mine probably are remnants of terrace or channel gravels.

The pegmatite dikes strike N. 50° to 85° E. The No. 2 pegmatite appears to dip steeply south-southeast, but the others are vertical or dip steeply north-northwest. The deposits range in thickness from 1 to 30 ft. The thickest is the No. 1 pegmatite, which splits into two branches at the southwest end of the mine. The north branch is exposed in the crosscut from the bottom of the shaft, where it is 10 ft thick. The No. 2 pegmatite is very irregular, with an average exposed thickness of 8 ft, and the pegmatite body in the cut between the No. 1 and No. 2 mines is about 5 ft thick. The No. 4 deposit is 7 ft thick in the open-cut but tapers to 3 ft in the westernmost prospect pit. Only small pegmatite stringers are exposed in the No. 3 and No. 5 mines. The No. 6 pegmatite is 15 ft in maximum thickness but tapers distinctly along the strike. The No. 7 deposit is 7 ft thick, and the No. 8 measures about 3 ft. The main pegmatite body in the King mine is 5 ft thick at the west end of the cut but probably was as much as 10 ft thick near the center of the opening.

The pegmatite contacts are irregular, with many offshoots and stringers that extend into the wall rocks. Gneissic inclusions are common. A horse of biotite-garnet gneiss was encountered in the floor of the open-cut about 50 ft from the northeast end of the No. 1 mine; it is reported to extend diagonally across most of the deposit. The continuity of the deposits can be inferred only from scattered mine and prospect workings and pegmatite float. The deposits generally cannot be traced for more than 150 ft. The No. 1, or thickest, pegmatite body may pinch out within 200 ft southwest of the main cut. The bottom of the wall-rock septum at the west end of the No. 1 mine and possibly the richest concentrations of book mica in the adjacent pegmatite plunge steeply in a westerly direction, but no other indications of plunge structures are known in the area.

The No. 1 pegmatite is the most extensively exposed. It contains a quartz core 125 ft long and 3 to 12 ft thick. This unit appears in the west half of the pit near the floor and is surrounded by a nearly continuous intermediate zone of coarse, light olive-green to white plagioclase with perthite quartz, and small mica books. Some large, well-formed plagioclase crystals are scattered through the core. A 1- to 5-ft outer intermediate zone consists of abundant book mica, light olive-green plagioclase, and dark blue-gray quartz. It is in contact with massive quartz along about half the hanging-wall side of the core (pl. 22). The medium-grained wall zone is 1 to about 6 ft thick and consists chiefly of plagioclase and interstitial quartz. The border zone is best developed in the east end of the mine, where it occurs along both walls and around a small gneissic

inclusion. It consists of fine- to medium-grained plagioclase, quartz, and abundant small books of scrap mica.

The general mineralogy of the other deposits in the area appears to be similar to that of the No. 1 pegmatite. Blocks of white quartz, irregular aggregates of kaolinized feldspar and quartz, and fragments of mica are present in the dumps. Much of the mica contains a surface stain of manganese oxide. The accessory constituents are biotite, brick-red granular garnet, pyrite, apatite, and black tourmaline. Two irregular "streaks" of garnet occur near the west end of the No. 1 mine, one near the hanging wall and the other near the footwall. They are vertical and strike parallel to the pegmatite walls. Both are exposed for a length of about 4 ft and a width of 2 to 4 in. Pyrite generally occurs with blue-gray quartz in the intermediate and wall zones, but some also has been found in the quartz core of the No. 1 deposit. Cavities in some of the pegmatite bodies are lined with well-formed crystals of quartz, muscovite, and sulfide minerals.

Most of the mica mined from the No. 1 deposit occurred in the outer intermediate zone, along or near the margins of the core. The quartz mass is said to thicken downward and to occupy nearly the entire width of the deposit at the bottom of the mine. The flanking mica-bearing zones taper out correspondingly. Mica is most abundant on the hanging-wall side of the deposit, and the richest part of the zone appears to have been followed southwestward down its plunge. Most of the book mica in the other deposits appears to occur in plagioclase-rich pegmatite along or near bodies of massive quartz.

In general the mica is clear, flat, cinnamon brown, and of good quality. Some books contain pale yellowish-olive streaks and mottling, and much of the near-surface mica is clay-stained. The richest concentrations of high-quality material were encountered in the hanging-wall portion of the outer intermediate zone of the No. 1 deposit. Mica is not as abundant near the footwall, and many of the books are badly ruled and cracked. Some of the mica near the northeast end of the workings is lightly specked. Flat-A books are said to constitute about 25 percent of the output from the mine. Much of the mica at the No. 2 mine is clay-stained, but the books appear to be abundant and of good quality. Some excellent large, flat mica was recovered when the No. 3 mine was cleaned out. Flat-A books are said to have constituted about 40 percent of the production from the No. 4 mine. Many were large, but most were badly clay-stained, and the output was chiefly scrap. Mica of good quality was recovered during development operations at the No. 5 mine, and fragments of clear, light cinnamon-brown mica are abundant

in the dumps from the other mine and prospect openings. Most are small, and many are bounded by well-developed crystal faces.

Production of trimmed punch and sheet mica from the No. 1 mine during the period 1941-44 was large, and that from the King mine was moderately large. The King pegmatites are in granite and are so irregular that recommendations for development of the deposit cannot readily be made. Mica-bearing pegmatite in the other deposits appears to be closely associated with quartz cores, and further operations might well be aimed at the development of intermediate-zone concentrations like those in the No. 1 deposit. Additional mica-bearing pegmatite may be present in the No. 1 deposit, especially southwest of the main pit and at lower levels.

BIGGERSTAFF (DEADMAN) MINE

The Biggerstaff mine is in Lincoln County, a quarter of a mile north of the Charles Y. Biggerstaff residence and 3 miles N. 25° E. of Fallston (location 33, pl. 19). It was opened in 1942 by H. A. Haack, who excavated a cut 100 ft long, 30 ft wide, and 30 ft deep by drag-line methods (fig. 91). The wall rock on the south side of the cut is hornblende gneiss with layers of granite 6 to 10 in. thick. Coarse-grained mica gneiss with abundant quartz-feldspar lenses 1 to 4 in. long is exposed on the north side, where it contains scattered garnet crystals as much as 2 in. in diameter. The foliation of the hornblende gneiss strikes west-northwest and dips moderately south-southwest, whereas that of the mica gneiss strikes nearly due west and dips south. The differences in lithology and attitude suggest the presence of a fault parallel to the pegmatite, with the north wall upthrown.

The pegmatite dike, which probably was emplaced along the fault, is exposed for a strike length of 240 ft. It is 8 in. thick in a prospect pit west of the main cut but thickens eastward to 11 ft in the cut and then thins to about a foot in a trench to the northeast. It is slightly arcuate in plan, with a northeast trend and a steep northerly dip. A massive quartz core at least 70 ft long and 3 to 7 ft thick occurs in the thickest part of the dike, and its easterly end is very near the north wall of the deposit. The quartz is broken by many joints that dip 55° S. The wall-zone pegmatite consists largely of kaolinized plagioclase, with a little interstitial quartz and 2 to 5 percent muscovite and biotite. The micas are most abundant near the walls of the deposit. The book muscovite is brown to cinnamon-brown, with many buff, colorless, and yellowish-olive streaks. Many of the books are soft, reeved, cupped, wavy, or badly fractured, and some are ruled. The amount of recoverable sheet material in the deposit

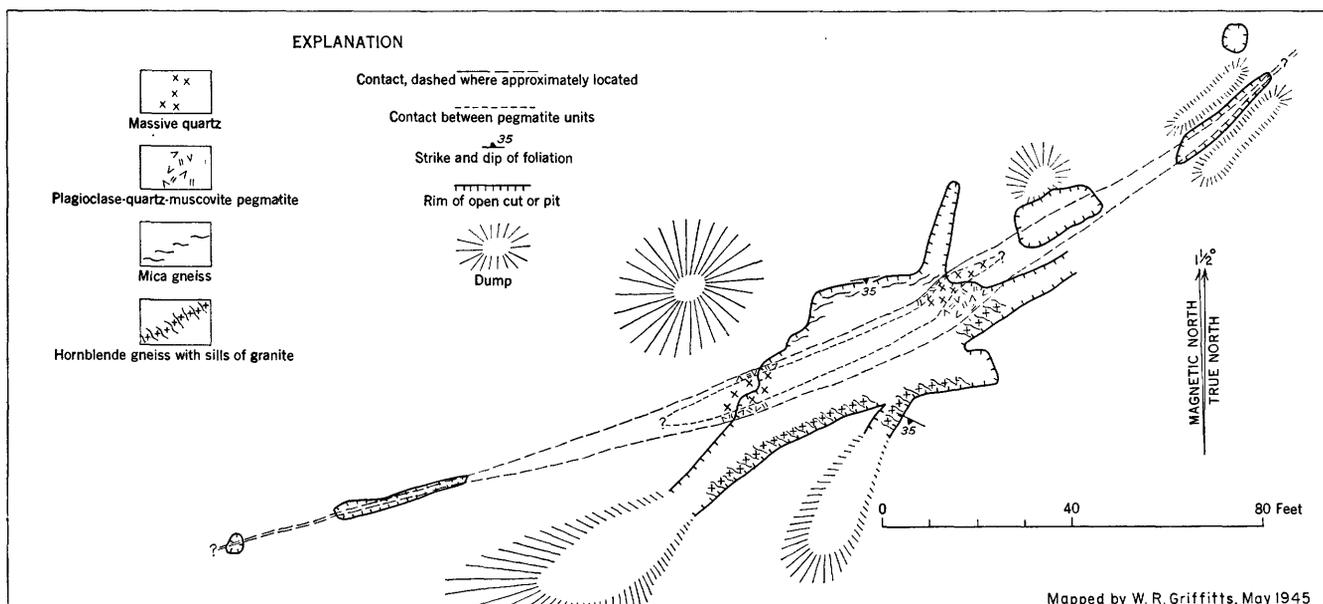


FIGURE 91.—Geologic sketch map of the Biggerstaff mine, Lincoln County.

probably is not large, although some 3- by 3-in. sheets were obtained during past operations.

WEHUNT PROSPECT

A mica deposit on the J. C. Wehunt property, near the southwestern corner of Lincoln County, was opened in 1943 by Harry Arthur. Flat-A mica of rather poor quality was taken from a pit in a field, and a second pit in an adjacent wooded area yielded stained mica.

PLATO HOUSER MINE

The Plato Houser mine, in Lincoln County $4\frac{1}{4}$ miles northeast of Fallston (location 36, pl. 19), is owned by D. P. Houser. It was worked prior to 1910 by the Empire Mining Co. and was last operated from June to October 1944 by Ray Self, of Lawndale. The principal opening is a cut 90 ft long and $3\frac{1}{2}$ to 23 ft wide. It is partly backfilled but is said to have been 47 ft deep at the west end. Three small pits lie beyond the cut to the west (fig. 92). A second open-cut, 21 ft long, 25 ft wide, and 12 ft deep, was excavated in another pegmatite body 180 ft south of the main workings. A row of small pits and trenches extends southeastward from this opening, most of them outside the mapped area.

The country rock is garnetiferous quartz-muscovite schist that contains a little biotite and feldspar. Its foliation strikes east and dips 40° to 70° S. in and near the main cut, where the rock is thoroughly weathered. The main deposit is a vertical pegmatite dike that is exposed discontinuously for a strike distance of 165 ft. It may extend 150 ft farther west to several small pits beyond the edge of the mapped area. It is about 15 ft

thick near the middle of the cut and thins to 6 ft at the west end, but it does not appear to taper eastward or down the dip. The pegmatite consists of quartz, plagioclase, muscovite, and possibly a little perthite. A 4- to 8-ft massive quartz core is flanked by a wall zone of kaolinized feldspar, quartz, and scattered large books of muscovite.

The south dike is very poorly exposed. It contains a 5-ft quartz core that trends $N. 65^\circ W.$, and float blocks of massive quartz indicate a probable strike length of at least 100 ft. The wall-zone pegmatite contains coarse plagioclase, book mica, and a little interstitial quartz. The deposit is locally flanked by a fine-grained granitic rock that consists chiefly of quartz, plagioclase, and muscovite. This rock also appears to occur as inclusions.

The book mica in the main deposit occurs in feldspathic pegmatite and is most abundant and of highest quality near the crest of the westward-plunging quartz core. It is reported to occur in tabular layers or "beds" separated by feldspar-rich layers. This layering is nearly horizontal and therefore contrasts strongly with the vertical attitude of the dike as a whole. The books near the bottom of the pit are said to be smaller and more lumpy than those near the surface. Pale cinnamon-brown mica is abundant near the crest of the quartz mass, and brown to yellowish-olive mica occurs along the flanks. Most of the reddish books are flat, and some are lumpy. Specks are not common and clay stains not serious. The greenish and brown books are reeved and lightly specked. Mica is said to be abundant in the bottom of the cut, and the last mining operations were abandoned only because the quality of the mica de-

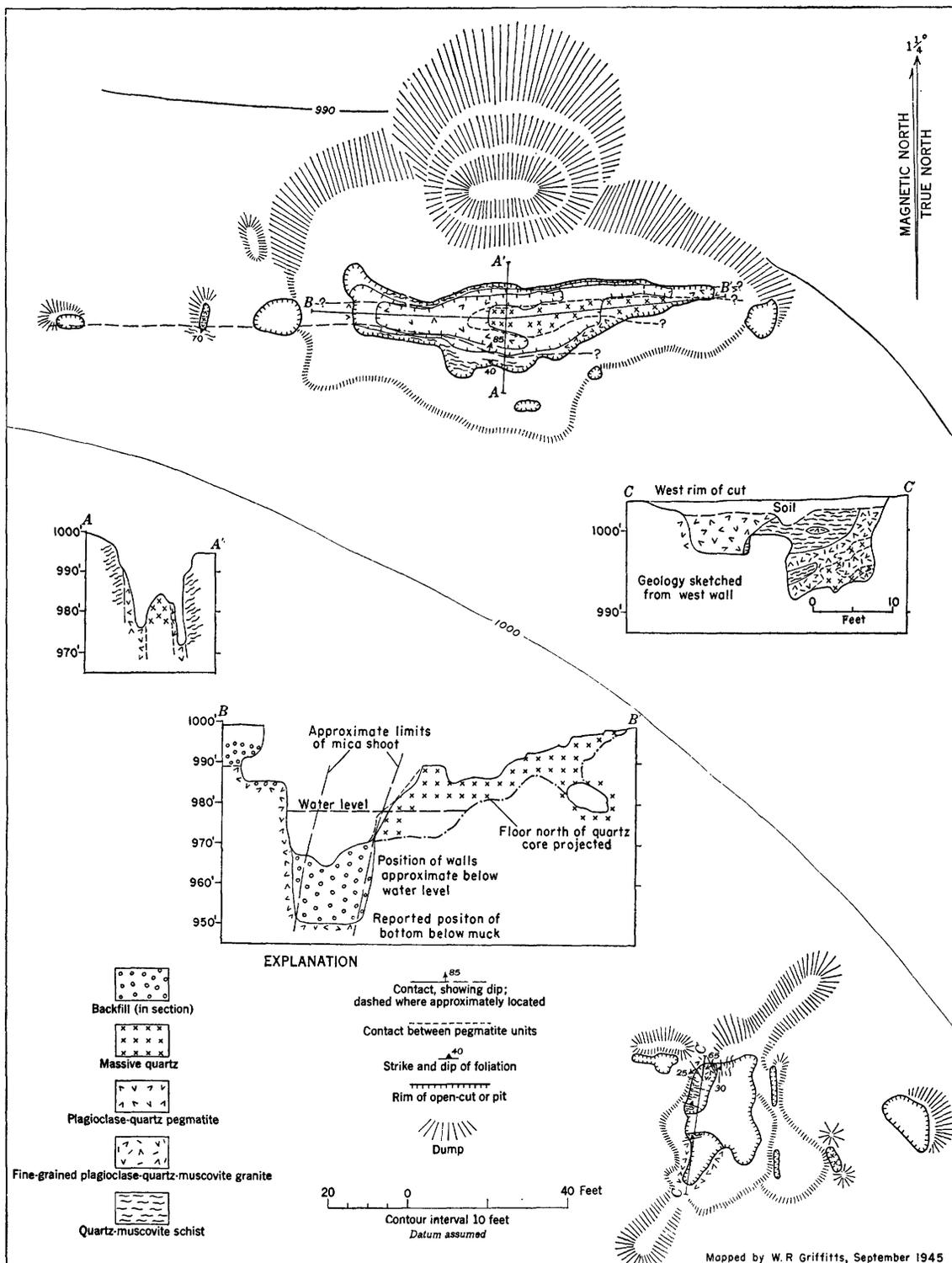


FIGURE 92.—Geologic map and sections of the Plato Houser mine, Lincoln County.

creased. Material of better quality might be encountered at greater depth.

PLATO HOUSER NO. 2 MINE

The Plato Houser No. 2 mine is in Lincoln County on the east side of the county road opposite the Peeler mine, $3\frac{1}{4}$ miles N. 37° E. of Fallston (location 35, pl. 19). The main opening is a slumped cut 50 ft long, 20 ft wide, and 10 ft deep. It trends N. 85° E., probably parallel to the strike of the pegmatite dike. The dump contains large blocks of quartz, masses of kaolinized plagioclase, and books of flat pinkish-buff mica and flat-A pinkish-buff and yellowish-olive mica. Some of the books contain tiny dark-gray to black specks and streaks.

BESS MINE

The Bess mine is in Lincoln County several hundred feet north of the Plato Houser No. 2 mine (location 35, pl. 19). It was operated for a very short time by Ray Self in the fall of 1944 but otherwise has lain idle for at least 30 years. Several old pits and caved shafts form a row that is about 100 ft long and trends east. The country rock is not exposed, but is reported to strike east and dip 30° N. (Sterrett, 1923, p. 223).

Pegmatite is exposed only along the wall of one of the pits, where it consists chiefly of kaolinized plagioclase. The dike probably strikes east, parallel to the row of workings, and dips very steeply in general accordance with most of the pegmatite dikes in the area. The dumps contain clay-stained and badly weathered fragments of pale pinkish-buff scrap mica. Some of the books are as much as 5 in. in diameter, but many are reeved. The mica probably is similar to that in the Plato Houser deposit, although a larger proportion of it may be of the flat-A type.

J. B. PEELER MINE

The J. B. Peeler mine is in Lincoln County immediately west of the Plato Houser property and on the opposite side of the road from the Plato Houser No. 2 mine (location 34, pl. 19). It has been worked since 1918 by George Self and others. It was reopened in the summer of 1943 by Ed Love, of Spruce Pine, and was operated during the fall of 1943 and early in 1944 by Love and by Homer Hise. The most extensive mining was done in the fall of 1944 by Marshall Mills and the Victor Mica Co., with recovery of both scrap and sheet mica. The main workings are an open-cut 20 ft long and 30 ft deep and a drift that extends about 10 ft to the southwest and thence westward for a short distance.

The country rock is mica schist in which the foliation strikes north and dips 45° W. The pegmatite dike

strikes N. 40° E. in the cut but abruptly swings to nearly west at the end of the drift. It dips 80° SE. in the cut and is 8 ft in maximum thickness. A core of massive quartz is flanked by kaolinized plagioclase-quartz pegmatite that contains abundant muscovite. The mica is pinkish buff, with some nearly colorless streaks. Many books are flat, but others, especially those with rhombic outlines, are reeved and locky. Most are less than 5 in. in diameter.

BEAM PROSPECT

A prospect on the Beam property, in Lincoln County 0.7 mile east of Flay and a short distance south of the road (location 44, pl. 19), was opened many years ago. All the workings are now filled. The deposit was explored for scrap mica during the spring of 1945 by F. B. Hendricks and H. L. Kennedy, who sank several hand-auger holes. The pegmatite dike trends N. 85° W., dips very steeply, and consists chiefly of plagioclase and quartz with subordinate muscovite and biotite. The muscovite is brown, and some is very lightly specked. Many of the books on the dump are locky or are marred by "A" structure.

W. L. C. FOSTER PROSPECT

A small pit on the W. L. C. Foster property in Lincoln County, near the south side of a gravel road half a mile northeast of Bess Chapel (location 45, pl. 19), was dug in the spring of 1943 by Charles Hollars, of Charlotte. The mica books in the deposit are small, fractured, and slightly stained.

LINCOLN MINE

Several pegmatite dikes in Lincoln County, 2.6 miles N. 56° E. of Fallston (location 37, pl. 19), were mined many years ago. The most extensive work was done at the edge of a wooded area north of the road, where a dike strikes N. 85° E. and dips 80° S. A quartz core at least 60 ft long and 10 ft thick is flanked by a 5-ft wall zone of kaolinized plagioclase-rich pegmatite. The border zone, exposed locally along the south wall of the deposit, consists of granular quartz and small flakes of mica. Books of yellowish to brownish-olive mica and masses of granular quartz occur in the plagioclase-rich rock and are most abundant about 2 ft from the core. Few of the books are more than an inch in diameter. An elongate shoot of yellowish-green "A" mica books plunges directly down the dip of the core about 15 ft from its west end. This shoot is about 2 ft wide. Most of the mica is in contact with the quartz of the core, and some books are embedded in it. All are soft, clay-stained, and heavily spotted.

A second dike is exposed in a field 200 ft to the south, where it strikes N. 80° E. A row of pits extends about

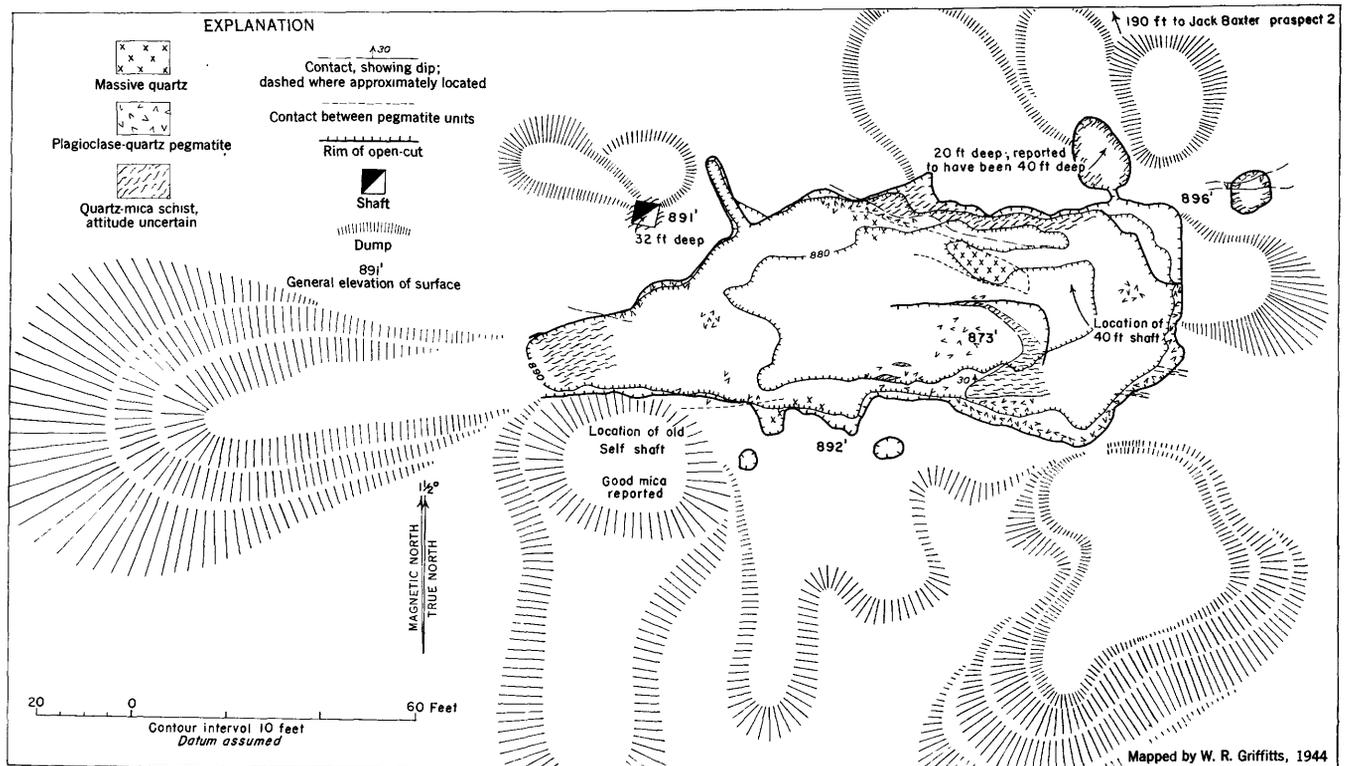


FIGURE 93.—Geologic map of the Jack Baxter mine, Lincoln County.

200 ft along the outcrop. Green mica occurs in the dumps from the western pits, brown mica in those farther east. A thin and probably discontinuous core is suggested by small blocks of quartz in some of the dumps.

CARL HARRELSON PROSPECT

A 10-ft prospect pit dug in the spring of 1943 by Carl Harrelson is in Lincoln County half a mile southeast and half a mile south by road from Bess Chapel (location 46, pl. 19). A thick quartz core exposed in the pit probably is flanked by a plagioclase-rich wall zone. The book mica in the wall zone is flat and dark-colored but clear. Some is locky.

DORIS EAKER MINE

The Eaker mine is in Lincoln County, near a cross-road half a mile west of a point on North Carolina Highway 274 that is 2 miles south of Flay (pl. 19). It was opened about 1928, and in the spring of 1943 the owner, a Mr. Eaker, sank a 25-ft shaft and drove a crosscut to the pegmatite. The older shafts and pits are in a line that trends N. 80° E. along the outcrop of the deposit. A second dike 2 or 3 ft thick is reported to occur nearby. The country rock is garnetiferous mica gneiss in which the foliation strikes N. 65° W. and dips 45° NE.

The main dike contains a massive quartz core that strikes N. 80° E. The book mica in the deposit is pinkish buff and is said to be of good quality, although some is a little wavy and some is lightly reeved. Light to moderate clay stains are common.

JACK BAXTER (TOM BAXTER) MINE

A mine on the Jack Baxter property, in Lincoln County near the main gravel road 3.2 miles east of Fallston (location 49, pl. 19), was opened prior to 1870 and was worked intermittently during later years. It was reopened in 1942 and worked until the spring of 1943 by Eugene Hegler, of Charlotte. During the summer of 1943 Jack Baxter sank and timbered a 12-by-18-ft shaft to a depth of nearly 40 ft from a point near the eastern end of the open-cut (fig. 93), but he did not reach the bottom of the old workings. The cut itself was cleaned out and enlarged by Baxter and H. A. Haack during the fall of 1944. Later the work was continued by Baxter and G. C. McGimsey. The cut was deepened to about 65 ft about a year later by F. B. Hendricks, who later refilled all the openings.

The country rock is a quartz-mica schist in which a rude foliation probably strikes east-northeast. Sterrett (1923, p. 221) reports that granite was exposed a few yards west of the mine at the time of his visit, probably about 1910. The pegmatite body exposed in the cut is at least 120 ft long and 40 ft thick. The north

wall of the dike and at least one quartz mass in the floor of the cut strike N. 70° to 80° W. A longer quartz mass that trends N. 70° E. was exposed at the surface but has been mined away since 1910. Apparently it forked downward, but its shape is not known in detail.

The deposit is irregular in both shape and internal structure. As shown in figure 93, it appears to extend northwest from the cut, but the shaft only 12 ft from the cut rim was sunk chiefly in country rock. Either the southern wall of the dike bends sharply northward, or the dike forks westward at the west end of the cut. The northern wall, where exposed in the cut, is straight and regular. Most of the pegmatite in the workings consists of kaolinized plagioclase with a little interstitial quartz and a few scattered books of muscovite. Massive quartz is exposed in the south side of the cut and in and near the north wall. The two northern exposures are said to be connected beneath the debris on the floor of the cut, and Baxter reports that they are also connected with the exposures at the south wall of the cut. An outcrop of quartz near the old Self shaft is said to be buried beneath the dump southwest of the cut.

The pegmatite exposed near the south rim of the cut contains abundant inclusions or septa of schist. One of these, about 2 ft thick, occupies a large area in the cut 30 to 45 ft from its east rim, and its upper surface forms the side of the cut. Its lower surface is fringed by small mica books. The plagioclase-quartz pegmatite that composes most of the deposit is locally rich in book mica. In addition, flat-A mica is moderately abundant along the margins of the northernmost quartz mass. A mica shoot may plunge along the east end of the quartz mass, as suggested by the depth of the old workings in that part of the deposit. All the mica is pinkish buff and free from specks. Some is lightly clay-stained. Most of the books in the plagioclase-rich pegmatite are flat, and most of those along the quartz masses are marked by "A" reeves and color bands.

Both book and scrap mica are said to have been obtained during the early working of the deposit and were recovered during all the recent operations as well. The large size of the dike and the apparently widespread distribution of mica within it suggest that the original amount of punch and scrap material must have been substantial. Paul Lancaster, mine foreman during the Hendricks operation, reports that the pegmatite dike pinched to a thin stringer and that old workings extended to a depth only 6 ft less.

JACK BAXTER PROSPECT

The Baxter prospect, 260 ft north of the Jack Baxter open-cut in Lincoln County, is a pit about 12 ft deep.

It exposes massive quartz and plagioclase-rich pegmatite that contains moderate to large quantities of brownish-olive muscovite. The mica is most abundant in and near lenses and nodules of granular quartz. It is very flat, and some of the books are 5 in. or more in diameter. Many of the larger books and some of the others are moderately to heavily specked.

BAXTER EAST PROSPECT

An old filled open-cut that was dug prior to 1910 lies near a cross road east of the Jack Baxter mine in Lincoln County (location 48, pl. 19). A pit recently excavated at the east end of this old cut exposes a pegmatite dike that probably trends east. Many thin offshoots of pegmatite extend into the flanking mica schist. The country-rock foliation trends north and dips about 15° W. The pegmatite consists of plagioclase, quartz, mica, and a little perthite. The occurrence of a massive quartz core is indicated by several large blocks on the dump. Most of the exposed book mica occurs with nodules of granular gray to smoky quartz that are scattered through the plagioclase-rich pegmatite. Some of the books are clear and pinkish buff, and others are greenish and specked. Most are flat and lightly clay-stained.

OTHER MINES AND PROSPECTS

The data on the following deposits, all in the Cleveland County portion of the Fallston area, were obtained from the Colonial Mica Corporation and D. B. Sterrett (1923):

George Cook prospect.—During the spring of 1945 S. C. Cook sank a 25-ft shaft on the property of Mrs. George Cook, 6 miles northwest of Toluca. The pegmatite dike contains a quartz core and a feldspar-rich wall zone. Pale reddish-brown books of wedge-A mica are moderately abundant.

McNeely prospect.—A mica deposit near a branch stream on the J. E. McNeely property, three-quarters of a mile south of North Carolina Highway 10 and 5 miles east-northeast of Casar, was opened during the spring of 1944 by Joe Price. Light reddish-brown mica of good quality occurs in a hard, unweathered pegmatite dike that strikes nearly east and dips south.

Old Lutz prospect.—The old Lutz deposit, owned by E. L. Spangler, is half a mile southeast of Belwood (location 30, pl. 19). The pegmatite contains stained "A" mica of poor quality.

Jim King prospect.—A mica deposit on the Jim King property is on the bank of a branch stream three-quarters of a mile southeast of Belwood and a short distance south of St. Peters Church (location 31, pl. 19). It was opened during the spring of 1943. The pegmatite body may be pipelike in shape. It contains flat, light reddish-brown mica of good quality.

P. O. Ross prospect.—A prospect on the P. O. Ross property, 2 miles southeast of Fallston (location 52, pl. 19), was opened during the fall of 1944. A pegmatite dike that strikes N. 80° E. contains massive quartz, abundant perthite, and small, broken books of light reddish-brown mica.

Baker prospect.—An old 15-ft pit on the Blaine E. Baker property, about 2½ miles southeast of Fallston (location 53, pl. 19), exposes a pegmatite body that strikes northeast. The deposit contains books of pale reddish-brown mica.

T. A. Beam deposit.—Small, cracked books of light reddish-brown mica occur in pegmatite that crops out in a branch on the T. A. Beam property, 3.3 miles southeast of Fallston (location 54, pl. 19).

Fraser-English prospect.—A prospect opened many years ago by Fraser & English is a little more than half a mile south by east of Beam Mill. The openings include a crosscut trench 90 ft long and 12 ft deep, a shaft near one end of the trench, and several shallow pits. The country rock is interlayered mica schist and granitic biotite gneiss. Its foliation is nearly flat but is complicated by small rolls or warps. The pegmatite dike strikes N. 30° E., dips irregularly west-northwest, and is 8 to 10 ft thick. Quartz occurs in lenticular segregations, and one long mass probably represents the core. Much of the surrounding feldspar is kaolinized. The mica books are clear, brown and mostly small.

The following mines and prospects are in the Lincoln County portion of the Fallston area. The data in the descriptions were obtained from the Colonial Mica Corporation.

J. G. Leatherman prospect.—A prospect near a branch stream on the J. G. Leatherman property, about 1½ miles northeast of the junction of North Carolina Highways 27 and 274 (location 12, pl. 19), was opened in 1944 by Archie Norman and Robert Norman. The deposit strikes N. 70° W. and contains reddish-brown book mica.

J. M. Beam prospect.—A pit 10 ft deep near a branch stream on the J. M. Beam property, 11 miles northwest of Lincolnton, exposes pegmatite that contains book mica. Some of the books are spotted, and those that are clear have other defects. The average quality is poor.

Bangle prospect.—A prospect about 4 miles by road northeast of a point on North Carolina Highway 27 that is 8½ miles east of its intersection with North Carolina Highway 18 was opened in the fall of 1943 by W. P. Miller and Luther Scronce. Pegmatite that contains hair-cracked books of "A" mica is exposed in a 16-ft pit.

Dennard prospect.—A mica deposit on the property of Mrs. Georgia Dennard, of Charlotte, is 2½ miles north of a point on North Carolina Highway 27 that is 8 miles from its intersection with North Carolina Highway 18 (location 10, pl. 19). A pit 20 ft deep was excavated by Fred Wood in a pegmatite dike that strikes N. 20° W. A little reddish-brown mica was obtained.

D. C. Heavner mine.—The Heavner mine, 5 miles southwest of Reepsville, was worked by the Cawood Mica Co. during the period 1900–1910. The main openings, a cut and a shaft, exposed an irregular pegmatite body enclosed in mica gneiss that strikes north and dips 20° E. The pegmatite body tends to be discordant. Sheet mica of very good quality was obtained during the operations.

Some prospecting was also done about 150 yd north of the Heavner house.

I. K. Wilson prospect.—The Wilson prospect, 1¼ miles north of the southwest corner of Lincoln County, consists of two pits about 25 ft apart. The deposit probably trends north. Large masses of quartz were encountered in each pit. The quartz core in the north pit is 8 ft thick and is flanked by feldspathic pegmatite with abundant small crystals of mica. The wall rock is granitic gneiss.

Mica is reported to have been mined on the old David Lackaye farm, which adjoins the I. K. Wilson property. Mica-bearing pegmatite was prospected years ago on the land of C. D. Dillinger on the old Lincolnton-Rutherfordton road, about a third of a mile east of the Cleveland County line.

Frank Baxter mine.—The Frank Baxter mine, three-quarters of a mile northwest of the southwest corner of Lincoln County, consists of two shafts connected by a 30-ft tunnel that trends east. The pegmatite is enclosed by highly contorted, locally garnetiferous mica gneiss. The dumps contain reddish-brown mica of good quality, as well as "A" books that are slightly specked.

Ernest Brown mine.—A mine on the property of Ernest J. Brown, 4¼ miles north of Cherryville, was first worked about 1905. Latt Young and the Mica-Rock Mining Co. cleaned out the old workings in 1943 and sank three shafts to depths of 12 to 15 ft. The pegmatite dike strikes nearly east, is 8 ft wide, and is at least 75 ft long. A core of massive quartz is surrounded by kaolinized plagioclase-rich pegmatite. Flat-A mica books of moderate size are abundant along the footwall of the dike. The quality of recovered sheet material is said to have been very good, and the deposit might merit further attention.

GASTON COUNTY: CHERRYVILLE AREA

CLAUDE BEAM PROSPECT

A prospect on the Claude C. Beam property is on a hillside west of a creek, 1 mile east of North Carolina Highway 274 and 4.5 miles southeast of Cherryville (location 60, pl. 19). It was opened in the summer of 1943 by Robert D. Kemerer and reopened in the spring of 1945 by Claude Buchanan and Oakley Buchanan, of Hawk. The workings comprise six pits in a line that trends nearly north. The largest pit, 55 ft south of an east-west fence, is 12 ft long and 8 ft deep.

The country rock, a mica schist, is exposed in the wall of the northernmost pit. This schist also forms a tabular inclusion in pegmatite in the largest pit. The inclusion strikes N. 15° W. and dips 45° WSW. The pegmatite dike strikes N. 15° W., dips steeply west-southwest or is vertical, and is exposed at intervals over a strike distance of 130 ft. Blocks of quartz are present in the dumps from the pits in the southern 100 ft of the workings, and a vertical 3-ft mass of quartz with a little tourmaline is exposed in a pit 18 ft south of the largest opening. At least 10 ft of feldspathic pegmatite is exposed in the largest pit, but no massive quartz appears to be present.

The wall-zone pegmatite contains kaolinized plagioclase, muscovite, and minor interstitial quartz. Scattered mica books probably constitute as much as 15 percent of the eastern 4 ft of the dike near the north end of the quartz core. In the northernmost pit, where the west wall of the dike is exposed, the adjacent schist is impregnated with quartz and muscovite within 2 in. of the contact, and books of muscovite as much as 4 in. in diameter are abundant near the border of the pegmatite. Most of the exposed pegmatite is composed of kaolinized plagioclase with a few scattered books of mica.

Although mica was encountered along the entire exposed length of the deposit, the greatest concentration appears to lie immediately north of the quartz core. The books range in diameter from 1/2 to 8 in., and a few are crudely developed rhombic crystals. Many are ruled, and some contain herringbone or "A" structure. Most are lightly clay-stained, but all are free of mineral stain. The flat books are pale pinkish buff, whereas some of the severely reeved mica is colorless or very pale yellowish olive. Some of this material shows color bands parallel to "A" reeves.

BIG BESS (M. M. CARPENTER, M. S. BESS) MINE

A mica deposit on the M. S. Bess farm, at the east side of the Kings Mountain-Cherryville highway 3.5 miles S. 32° E. of Cherryville (location 58, pl. 19), was opened up by Jasper Glenn about 1897. A short time

later M. M. Carpenter, of Kings Mountain, drove at least three inclines down the gentle dip of the pegmatite dike from its outcrop and opened drifts and small lateral rooms in parts of the deposit that lay above the water table. The workings were extended to a maximum depth of 47 ft during World War I by means of vertical shafts. Much sheet mica was obtained during the early mining, but a strong flow of water and soft, caving ground made operations very difficult.

In November 1943 F. B. Hendricks and H. L. Kennedy, road contractors from Charlotte, sank a shaft (fig. 94) and drove several tens of feet of drifts from it. Old workings were encountered at several places. Open-cut operations with bulldozer and power shovel were started early in 1944. The soft country rock was stripped from the pegmatite, which then was benched. Several stages in the development of the pit are shown in figure 94. The deeper parts of the opening were worked by dragline methods, but early in 1945, owing to the increasing hardness of the rock, a distinct steepening of the dike, and an increase in the height of the working face to 70 ft, stripping operations were discontinued. Several inclines and drifts, not shown on plate 23 or figure 94, then were driven from the north end of the cut, and mining was continued by F. B. Hendricks until the summer of 1946.

The area immediately north of the open-cut was explored by the U. S. Bureau of mines in the summer of 1945. Thin, flat-lying dikes of pegmatite were found by diamond drilling, but all the holes passed north of the main pegmatite body.

The country rock is a quartzose schist that contains both muscovite and biotite, with some feldspar and accessory garnet, ilmenite, sillimanite, and zircon. Small lenses and thin layers are moderately rich in sillimanite. Pyrite is common in disseminated grains and thin veins, and some marcasite was found in the deeper part of the open-cut. The marcasite may have been deposited during the weathering of the overlying rock. The schist contains the coarsest muscovite and the least feldspar immediately below the pegmatite. The trend of the foliation ranges from north to east, with westerly and northerly dips of 5° to 30°.

The pegmatite dike trends nearly east. In general its dip is gentle and to the north, but the dip is locally reversed. It is moderately steep near the southeast corner of the cut and is very steep in the underground workings to the north. In most places the dike is less than 10 ft thick, but the steeply dipping parts are much thicker (pl. 23). In the lowest workings, probably at a depth near 90 ft, the dike is reported to have flattened in dip and to have pinched to a thin stringer. This either does not thicken northward or steepens greatly, as no pegmatite that could be correlated with it was

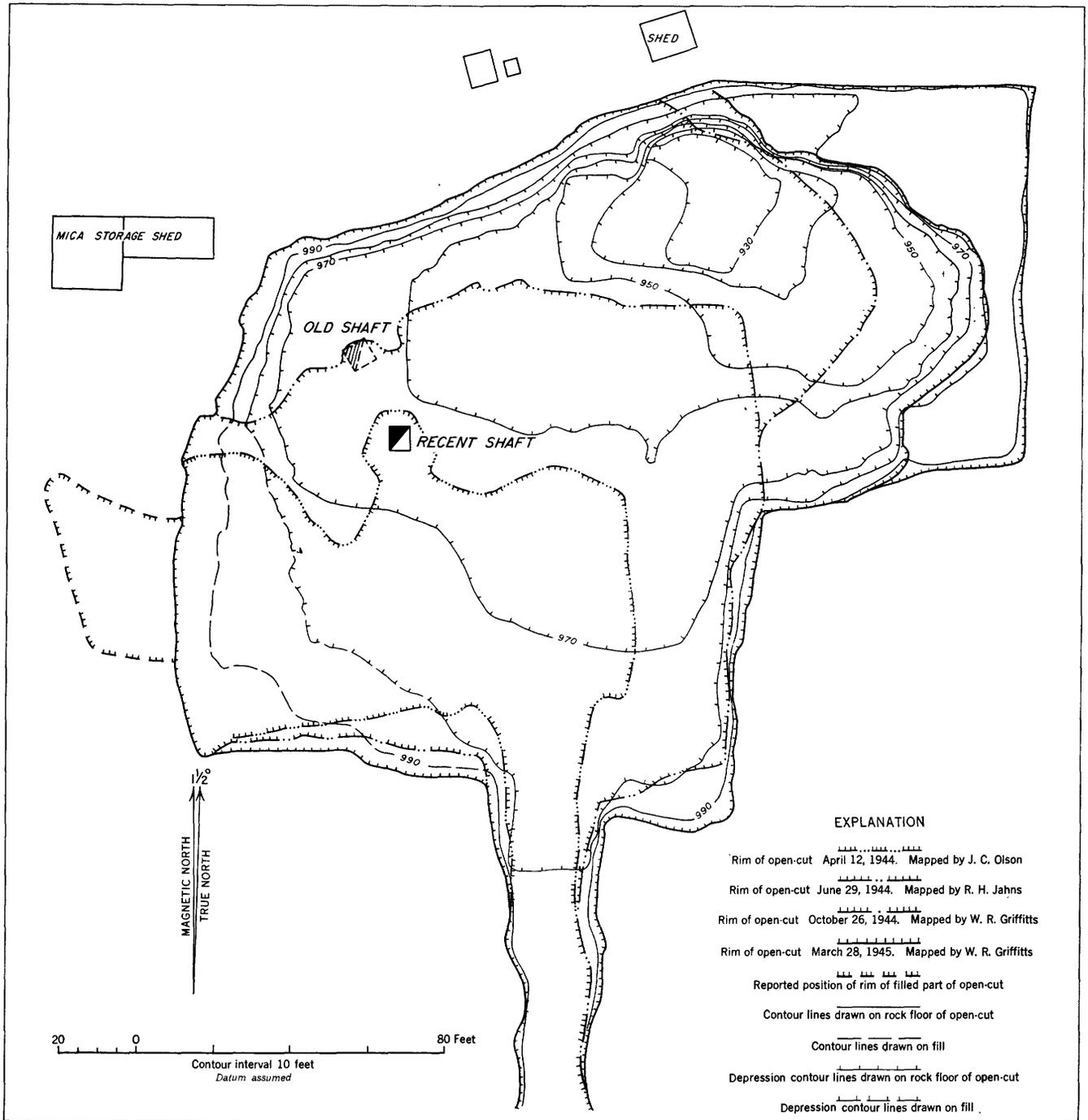


FIGURE 94.—Plan of the workings, Big Bess mine, Gaston County, showing successive outlines of the open-cut.

found in the diamond-drill holes. The maximum thickness of the dike, near the north end of the cut, was nearly 30 ft.

Several rolls in both the hanging wall and the foot-wall, as exposed in June 1944, were as much as 12 ft wide and 8 ft high, with an average height of 3 ft or less. A larger roll in the hanging wall, exposed during the fall of 1944, is shown in the cross section of plate 23. Most of the rolls trend east. Those in the southern

two-thirds of the cut plunge very gently east and east-northeast, whereas those in the northern third plunge west. Other rolls trend north and plunge directly down the dip of the deposit. Paul Lancaster, foreman at the mine during the recent operations, reports that the northward-plunging rolls are quite common in places. Several apophyses of pegmatite extend into the schist at acute angles, and nearly flat lying wall-rock septa are common in the steeply dipping lower part of the

dike. A remarkably continuous 6-in. to 2½-ft dike overlies the main dike and joins it at the crest of the highest roll.

The pegmatite is composed of oligoclase, perthite, quartz, muscovite, biotite, beryl, apatite, garnet, and tourmaline. Its composition and internal structure vary greatly with the depth and dip of the dike (fig. 19, chapter A of this series). In the upper steeply dipping part, the dike is a granitoid aggregate of plagioclase, perthite, quartz, muscovite, and biotite. No mass of quartz is more than a few inches across, and the mica books also are small. The flat-lying part of the dike, in contrast, is sharply zoned, with an inner zone that is rich in perthite and contains small to moderate amounts of block plagioclase. Some of the plagioclase contains intergrown masses of quartz that are about an inch in diameter. The outer part of the dike here is plagioclase-muscovite-quartz pegmatite in which mica books several inches to 3 ft or more in diameter are very abundant. The border zone, where present, is a thin layer of quartz and fine mica.

The lower steeply dipping part of the dike is similar to the upper in that it is mainly plagioclase-perthite-quartz pegmatite. It differs from the upper part, however, in that biotite is scarce, large books of muscovite are abundant, and quartz is segregated in a massive core several feet thick. The border zone in this part of the deposit is several inches thick and consists of plagioclase, quartz, muscovite, and apatite. In the lowest workings rosettes of cleavelandite occur along the edge of the core. Beryl is present in the core and along its margins and forms crystals at least a foot in diameter. The small dikes above the main dike are homogenous plagioclase-quartz pegmatite that locally contains small concentrations of mica books.

Mica is exceptionally abundant near the hanging wall of the dike and in places constitutes 25 percent or more of the pegmatite. It is much less abundant near the footwall, although even there the rock may locally be quite rich. Most of the books are large. Many are 12 in. in diameter, and a few are 2½ ft long and 2 ft wide. The heaviest book recovered recently weighed 78 lbs. The mica is pinkish-buff to cinnamon-brown, with local colorless or pale-yellow rims ⅛ to ¼ in. wide. Most books are free splitting, very flat, and hard. "A" structure is rare, although some books are faintly reeved near the margins. Ruling is severe, especially in the lower part of the deposit, and many books in the weathered parts of the pegmatite are badly clay-stained. Some near the footwall also are heavily manganese-stained. Such stains greatly reduced the recovery of sheet mica from the mine-run material obtained from much of the open-cut. After elimination of the most heavily weathered and stained books the

mica ordinarily yielded 5 to 8 percent trimmed sheets. The recovery of sheet from the crude mica obtained from the lower workings was substantially higher. About a third of the sheet mica, when properly prepared, is of no. 1 quality.

The mica appears to occur in a very broad shoot that plunges directly down the dip of the deposit, parallel to the northward-plunging rolls but normal to the eastward- or westward-plunging rolls. The pegmatite along the strike of the dike from the shoot is reported to contain much mica in small books. Lancaster reports that large pillars left in the underground workings contain moderate amounts of book mica.

E. R. SELF (OLD NEALE) MINE

The Self mine is 4.3 miles southeast of Cherryville and can be reached from that town via North Carolina Highway 274, the Kings Mountain road, and a dirt road that extends eastward from a point 0.3 mile south of the Big Bess mine (location 59, pl. 19). The workings are several hundred yards north of the road and about a mile east of the paved highway. Both surface and mineral rights are owned by E. Ray Self, who resides near the mine.

The deposit was opened about 1895, probably by M. M. Carpenter, and is said to have lain idle until 1941, when E. W. Harold and a Mr. Huffstetter excavated two open-cuts and connected them at a depth of 20 ft by means of a tunnel. The dumps had been worked for scrap mica several years earlier, but no mining was done at that time. D. W. McArthur, Claude Buchanan, and Ira Buchanan, of Shelby, began work in October 1943. They sank a 35 ft shaft and drove a drift 50 ft to the southwest. Early in 1944 they began to dig a cut by means of a hoist and dragpan. F. B. Hendricks and H. L. Kennedy greatly enlarged the cut by power shovel, dragline, and bulldozer methods between August 1944 and the spring of 1945 (fig. 95). Oakley Buchanan operated the mine for a short time later in 1945.

Schist composed of muscovite, feldspar, and subordinate quartz and biotite appears in the south wall and northeast corner of the open-cut. Hornblende gneiss is exposed in the southeast ramp, where it is thoroughly weathered. Hornblende, biotite, feldspar, and minor quartz appear to be its chief constituents. The country-rock foliation strikes north to northeast and dips 40° to 80° W. to NW. The hornblendic rock in the southeast ramp is broken by many closely spaced vertical joints that strike N. 50° W., but most of these die out in the adjacent mica schist.

A light-gray granite forms a mass at least 60 ft thick in the north half of the cut. A smaller mass is exposed in the southwest ramp. This rock, which cuts the mica

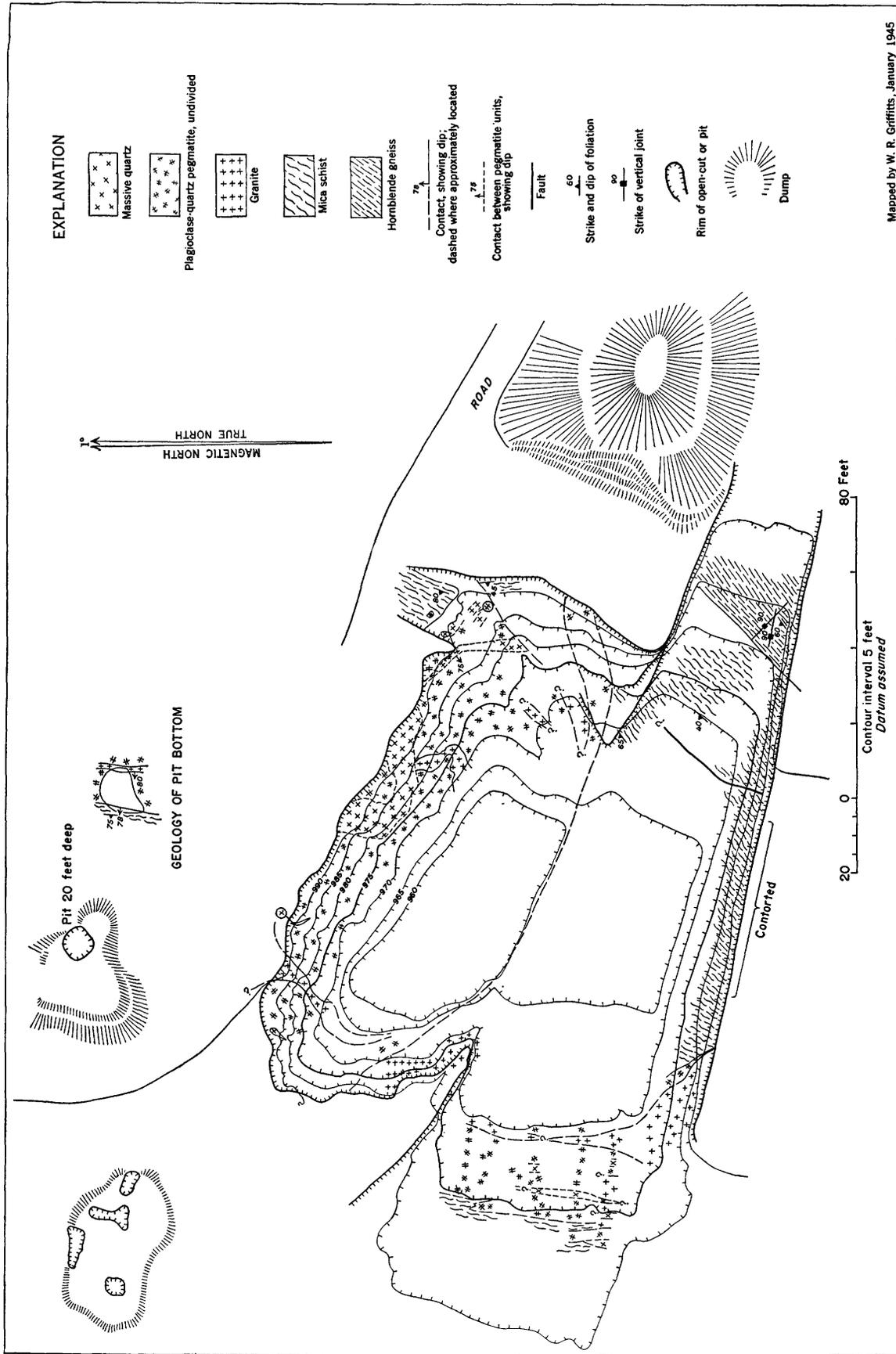


FIGURE 95.—Geologic map of the E. R. Self mine, Gaston County.

schist, consists of kaolinized feldspar, quartz, and muscovite in grains $\frac{1}{8}$ to $\frac{1}{4}$ in. across. Biotite occurs within a few feet of contacts with pegmatite. Zircon, sillimanite, and minor magnetite or ilmenite are accessory constituents.

Most of the pegmatite appears to have intruded the granitic rock and spread along its contacts with the mica schist, probably during or shortly after the fracturing of the granite. Only in the east end of the open-cut is pegmatite enclosed on two sides by schist. The largest dike strikes N. 63° W. and dips 80° SSW. An offshoot of this mass was parallel in trend but dipped north-northeast. It was found to join the main dike at a depth of 30 to 35 ft and has been completely mined away. Another dike, or possibly a row of parallel dikes, that strikes north is exposed in the southwest ramp.

Most of the book mica was obtained from the northernmost dike, which contains a 2-ft core of massive gray quartz. Coarse perthite locally flanks the core; the wall zone consists of plagioclase-quartz pegmatite. The core appears to lie near the north wall of the deposit. Books of muscovite less than 2 in. in diameter are scattered in poorly defined layers throughout the plagioclase-quartz pegmatite, but those that yield sheet material occur in pegmatite and in granite within 2 ft of the hanging-wall, or south, contact, where they are very abundant. Many are 8 to 18 in. in diameter, and most are associated with biotite. Those in the granitic country rock commonly have well-formed crystal faces. Many transect the contact between granite and pegmatite, and the parts that are in pegmatite are more irregular and cracked than the parts in granite. Crystals of feldspar, as much as 2 ft across, also are in the granite near the pegmatite.

The pegmatite mass that was once exposed in the south wall of the cut contained abundant rectangular blocks of feldspar 3 to 4 ft across that projected from the dike into the adjacent granite, and a few were entirely in country rock and not connected to the pegmatite dike. No massive quartz core was present, and mica was encountered only in one small pocket near the hanging wall. The pegmatite in the southwest ramp is chiefly kaolinized plagioclase with interstitial quartz and mica. Most of the muscovite books, which are less than 4 in. in diameter, occur with pods and thin tabular masses of granular gray quartz.

The quality of the mine-run mica has been found to vary with its position in the main, or northern, pegmatite body. Many books in the pegmatite are badly fractured, whereas most of those partly or wholly within the granitic country rock are free from such defects. The books in pegmatite at some distance from the contact generally contain more cracks than those at or near the contact. Several books in the pegmatite

were more than 12 in. in diameter but were so badly broken that they yielded few sheets larger than 2 by 2 in. All the mica is pinkish buff and contains very few specks. Clay, iron, and manganese stains are present on the surfaces and in the most extensively cracked parts of many books. The mica is hard and little ruled, but much is lumpy.

The west end and the bottom of the hanging-wall mica concentration in the northern pegmatite have not yet been found, but the deposit is so irregular that accurate estimates of reserves could not be made.

HUSKINS MINE

Mica-bearing pegmatite was prospected many years ago 5 miles southeast of Cherryville (location 61, pl. 19), on the property now owned by John Huskins. In the fall of 1943 J. Claude Self and Allan Self dug several small pits and sank a 31-ft shaft. Drifts were driven 65 ft southwest from shaft 1 (fig. 96) and 32 ft northeast. A 38-ft shaft was sunk during the spring of 1945 to connect with the longer drift from the first shaft. Other workings include trenches, pits, and shallow shafts.

The country rock, a fine-grained hornblende schist, contains small quantities of feldspar and is locally garnetiferous. It is impregnated with tourmaline near the pegmatite dikes. At the mine the schist has been weathered to a soft brown clay with irregular stains of manganese oxide, and both fresh and slightly weathered rocks are exposed in a creek bed several hundred feet to the north. In general the foliation strikes northeast, but its attitude varies greatly in the mine area.

Two pegmatite dikes are exposed. Both consist of plagioclase, quartz, muscovite, and tourmaline; the southern dike also contains beryl. The southern dike, which is exposed discontinuously for a strike distance of 210 ft, ranges in breadth from 9 to 23 ft. It trends N. 55° E. for most of its exposed length but swings toward the north in the eastern exposures, where it dips 50° to 55° WNW. A core of granular quartz 2 to 7 ft thick can be traced 150 ft south and southwest from the northeasternmost pits. Its contacts with the flanking feldspathic pegmatite are in places very irregular, and in the largest pit a horizontal tongue of quartz 1 to 3 ft thick extends 6 ft eastward into plagioclase-rich pegmatite. Subhedral to anhedral muscovite books as much as 5 in. in diameter occur in the quartz exposed in the middle pits. Pods of quartz and mica also occur in the wall zone, which is a coarse aggregate of plagioclase and quartz. Coarse granular quartz and mica occur locally along both walls of the dike, but this rock was not mapped separately. Mica is most abundant in the northernmost pit in this dike, where books 1 to 15 in. in

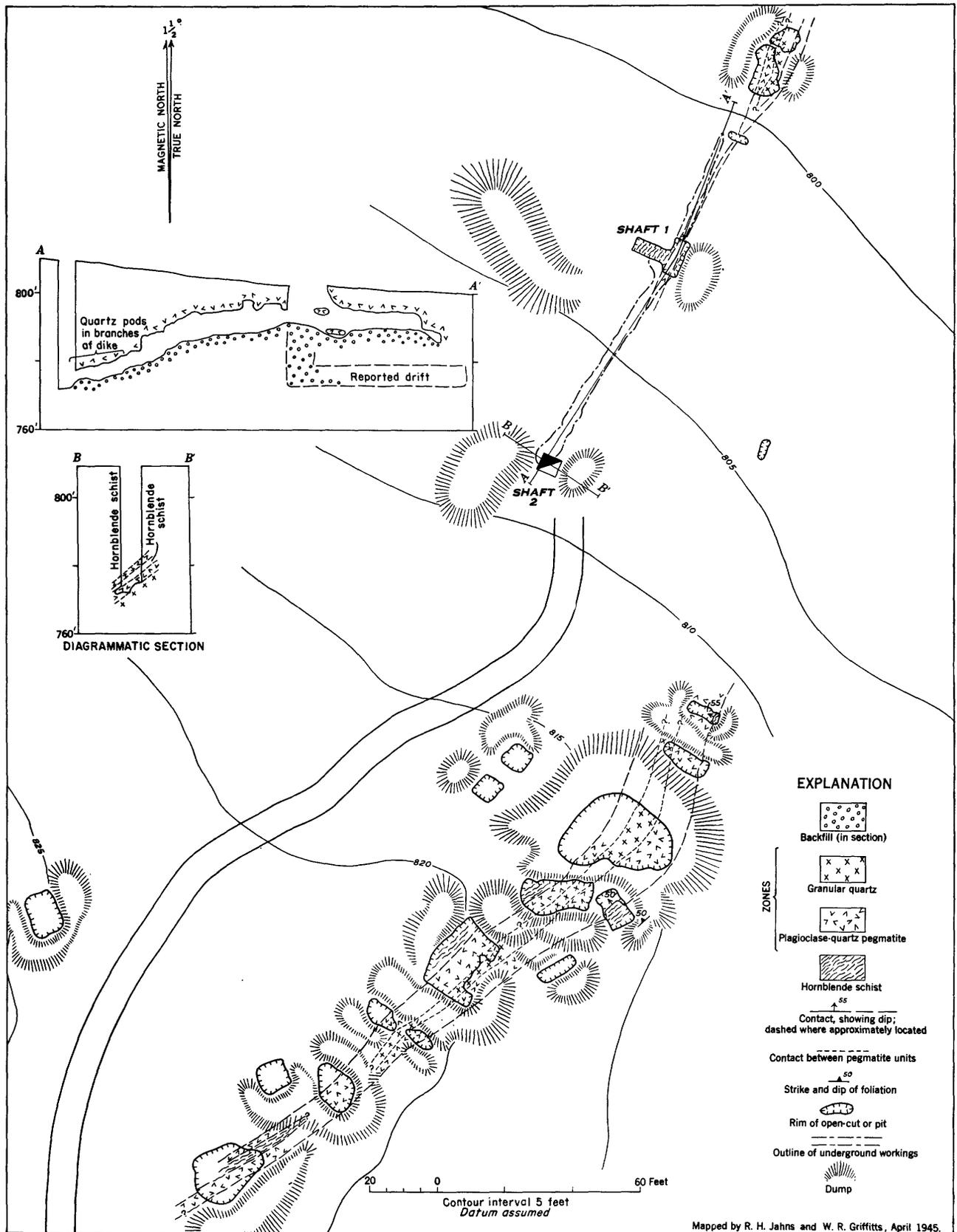


FIGURE 96.—Geologic map and sections of the Huskins mine, Gaston County.

CLEVELAND COUNTY: KINGS MOUNTAIN AREA

SCISM PROSPECT

A little prospecting was done during the spring of 1943 on the J. W. Scism property, 3 miles north-northwest of Kings Mountain near County Line Road (location 68, pl. 19). Small clay-stained books of mica occur in feldspathic pegmatite.

BUN PATTERSON (OLD CARROLL) MINE

The Bun Patterson mine is about 1 mile N. 15° W. of the junction of U. S. Highways 74 and 29 in Kings Mountain (location 70, pl. 19). It was opened in 1904 and worked on a small scale between that time and 1943. During recent years D. C. Buchanan, the Stamey brothers, and Jeff Carroll mined at the edge of the woods 0.3 mile west of the road, where they dug two pits: 165 ft S. 50° W. of the pits, where they sank an incline and a 20-ft shaft and drove a drift; and about 400 ft south of the incline, where they excavated a cut. The largest opening appears to have been a cut 25 ft long and 15 to 20 ft deep. A small pit was dug at a fourth locality about 150 ft south of the first.

A separate body of coarse pegmatite evidently was mined at each place. The pits at the edge of the woods expose a pegmatite dike. It strikes N. 25° W. and dips very steeply west-southwest to vertically in somewhat contorted mica schist. The axes of small folds in the schist plunge 25° S. 10° W. A layer of pegmatite along the east wall consists of mica and quartz. It is about 4 in. thick at the surface but thickens rapidly downward to 2 ft. The largest mica books in this rock occur near its inner margin, rather than against the schist. The inner part of the dike is at least 6 ft thick and consists of kaolinized plagioclase, interstitial quartz, and scattered masses of quartz and burr rock.

The pegmatite body exposed in the shaft, incline, and drift is flanked by fine- to coarse-grained pegmatitic granite that consists of kaolinized feldspar (probably sodic plagioclase), quartz, and muscovite. It occurs over an area several hundred feet across. The pegmatite dike, 2 ft or more thick, contains a border zone of fine-grained plagioclase, quartz, and mica in books that tend to lie normal to the wall-rock contact. Mica books as much as 6 in. in diameter are scattered through the remainder of the dike, which is composed of medium- to coarse-grained plagioclase and quartz. The wall rock may be part of a fairly large intrusive mass much older than the pegmatite, but more probably it is closely related to the pegmatite.

The other pegmatite dikes are not exposed, but the distribution of the workings indicates that they probably trend slightly west of north. All the dikes may have been emplaced along fractures of a single set.

diameter constitute 10 percent or more of the exposed pegmatite. A septum of country rock is exposed in the southernmost pit, and the dike probably forks southwestward.

Most of the recent mining has been done in a second dike about 70 ft to the north-northeast (fig. 96). It strikes N. 30° E., dips 80° WNW. at the north end of the underground workings, steepens southward to vertical, and splits into several branches that dip 30° to 50° WNW. near the end of the southwest drift. It is 6 in. to 5 ft thick in the underground workings and reaches a maximum known thickness of about 8 ft in the northernmost pit. In this pit a 3-ft quartz core with minor muscovite and tourmaline is flanked by plagioclase-rich pegmatite. The dike thins northeastward in the upper drift. A lower drift, now inaccessible, extends farther northeast, and minable thicknesses of pegmatite evidently lie farther in this direction at greater depths. Rolls in the pegmatite walls south of shaft 1 also suggest a gentle to moderate northward plunge.

The quartz core of the northeast dike, less continuous than that in the southwest dike, is being exposed in several segments with a total length of less than 50 ft. The exposures in the back of the drift northeast of shaft 1 consist of plagioclase-rich pegmatite with scattered books of mica. In the southwest drift quartz occurs in feldspathic pegmatite as layers about an inch thick. The pegmatite branches near the end of the drift contain thin quartz cores.

Muscovite books are scattered throughout the plagioclase-rich wall zone but appear to be most abundant in the thick quartz-bearing parts of the southwest dike. Mica is especially abundant in the northeast dike at the northeast end of the row of pits, apparently near the north end of the main core segment. Thus a well-defined mica shoot may occur along the plunging nose of the core, as in the Plato Houser and Cliff Blanton mines. In contrast, mica in the southwest dike is most abundant in the southernmost exposures, which may be close to the keel of the deposit. The books in both dikes are pinkish-buff and moderately clay-stained. Mineral stains are rare. The chief defects are cracks and reeves, particularly in books near the core segments.

S. E. PEELER PROSPECT

A 15-ft prospect pit in a pegmatite on the S. E. Peeler property, 4½ miles S. 28° E. of Cherryville (location 62, pl. 19), was excavated in the summer of 1944 by B. J. Lochmund, of Blacksburg, and E. C. Caldwell, of Kings Mountain. The dike strikes N. 30° E. It contains clay-stained, broken, and lanky books of pinkish-buff mica.

The mica from all the workings is hard, clear, and pinkish buff. Some books are flat and free splitting, but many are lanky or marred by herringbone or "A" structure. The mica content of the coarse pegmatite is rather high, but the coarse pegmatite bodies themselves appear to be small.

Small float fragments of mica are reported to occur at several places on the neighboring J. R. Champion property.

RICE MINE

The Rice mine is a few hundred feet northwest of the Southern Railway underpass on the paved road to Margrace, about three-fourths of a mile west of the Margrace mills (location 72, pl. 19). It was worked in 1944 by Jasper Rice, the owner, who dug several pits in a row that trends N. 10° E. All the openings were caved and filled when the mine was visited in May 1945.

The mica on the dumps is small, hard, and pinkish buff. Some of the books contain intergrown biotite. Ruling and lockiness are other defects. Nearly all the mica is scrap. No blocks of massive quartz are present in the dumps, but a few masses of granular quartz with small flakes of muscovite were noted.

HERNDON MINE

Two shafts were sunk by Walter Smith in the spring of 1944 on the property of W. P. Herndon, a quarter of a mile west of U. S. Highway 29 and 3.4 miles southwest of Kings Mountain (location 74, pl. 19). The pegmatite dike tends N. 30° to 35° E. As exposed in the southwestern shaft, it consists of coarse, blocky perthite surrounded by a wall zone rich in kaolinized plagioclase. The perthite-rich unit is said to have enveloped a discontinuous core of massive quartz. The only exposed mica occurs in a 1-ft layer of granular quartz. It is clear, pale pinkish-buff, and lightly clay-stained. Some of the books are flat, and others are of the flat-A type. Many are slightly wavy. Some 2- by 3-in. sheets are said to have been obtained.

OTHER PROSPECTS

The information in the following four descriptions was obtained from the Colonial Mica Corporation:

Nebo prospect.—The Nebo prospect, near the Scism prospect on County Line Road 3 miles north-northwest of Kings Mountain (location 68, pl. 19), is owned by Allen Herndon and was opened in the spring of 1945 by H. S. Huffstetler and R. C. Gantt. A 17-ft shaft was sunk in feldspathic pegmatite, and abundant mica was encountered at depths of 6 to 8 ft. The books are small and reddish-brown.

Fulton prospect.—A narrow open-cut was dug by E. A. Harrell in mica-bearing pegmatite on the H. T.

Fulton property near Kings Mountain. The hole was abandoned at water level, or a depth of 27 ft. The deposit strikes N. 80° E. and contains clay-stained books of reddish-brown mica.

Greer prospect.—The Greer prospect is about 1¼ miles southwest of Kings Mountain (pl. 19). Lanky books of clay-stained mica were obtained in the spring of 1944 from feldspathic pegmatite in a 15-ft shaft.

Howell prospect.—A prospect was opened by Walter Smith during the summer of 1944 on the Cleo Howell property, about 3 miles S. 50° W. of Kings Mountain. The pegmatite dike strikes northeast, and at a depth of 8 ft it is very rich in reddish-brown books of "A" mica.

CLEVELAND COUNTY. POLKVILLE AREA

GETTYS NO. 1 MINE

The Gettys No. 1 mine, 0.9 mile northeast of Polkville (location 85, pl. 19), is owned by Mrs. Maggie Crowder Gettys and has been worked intermittently for many years. It was reopened briefly in 1932 by H. A. Haack, who re-leased the property in 1943 and cleaned out the old open-cut. When the mine was abandoned in July 1944 the cut was 96 ft long, 6 to 40 ft wide, and 48 ft deep (fig. 97). The production of trimmed punch and sheet mica was large.

The country rock is schist that consists chiefly of muscovite with many small lenses of quartz. In the east side of the cut it contains many small grains of garnet and much chalky, altered sillimanite. All the minerals but muscovite and quartz have been thoroughly weathered. The country-rock foliation strikes north to northwest and dips east to northeast.

The pegmatite body is thoroughly weathered and is exposed above water level only in the ends of the cut. It probably was nearly 15 ft thick near the surface and at the middle of the cut but pinched along the strike to about 4 ft at the ends of the cut. It is 7 to 8 ft thick at a depth of 48 ft. A core of massive quartz is flanked by a wall zone of kaolinized plagioclase, interstitial quartz, and book mica. Secondary marcasite occurs in the lower part of the cut as fine-grained masses and as aggregates of crystals that line cavities in the pegmatite.

Mica occurs sparingly in the wall zone at the north end of the cut. The southern and northern limits of the main mica concentration were found to converge downward, and the mica-rich part of the deposit may well end at a depth not much greater than that of the cut. The mica is flat, hard, and pale pinkish-buff. That obtained from the richest part of the dike was clay-stained but yielded moderate quantities of trimmed sheet mica of good quality. The books at the bottom of the cut are badly reeved and fractured and are heavily stained by clay, iron oxide, and manganese

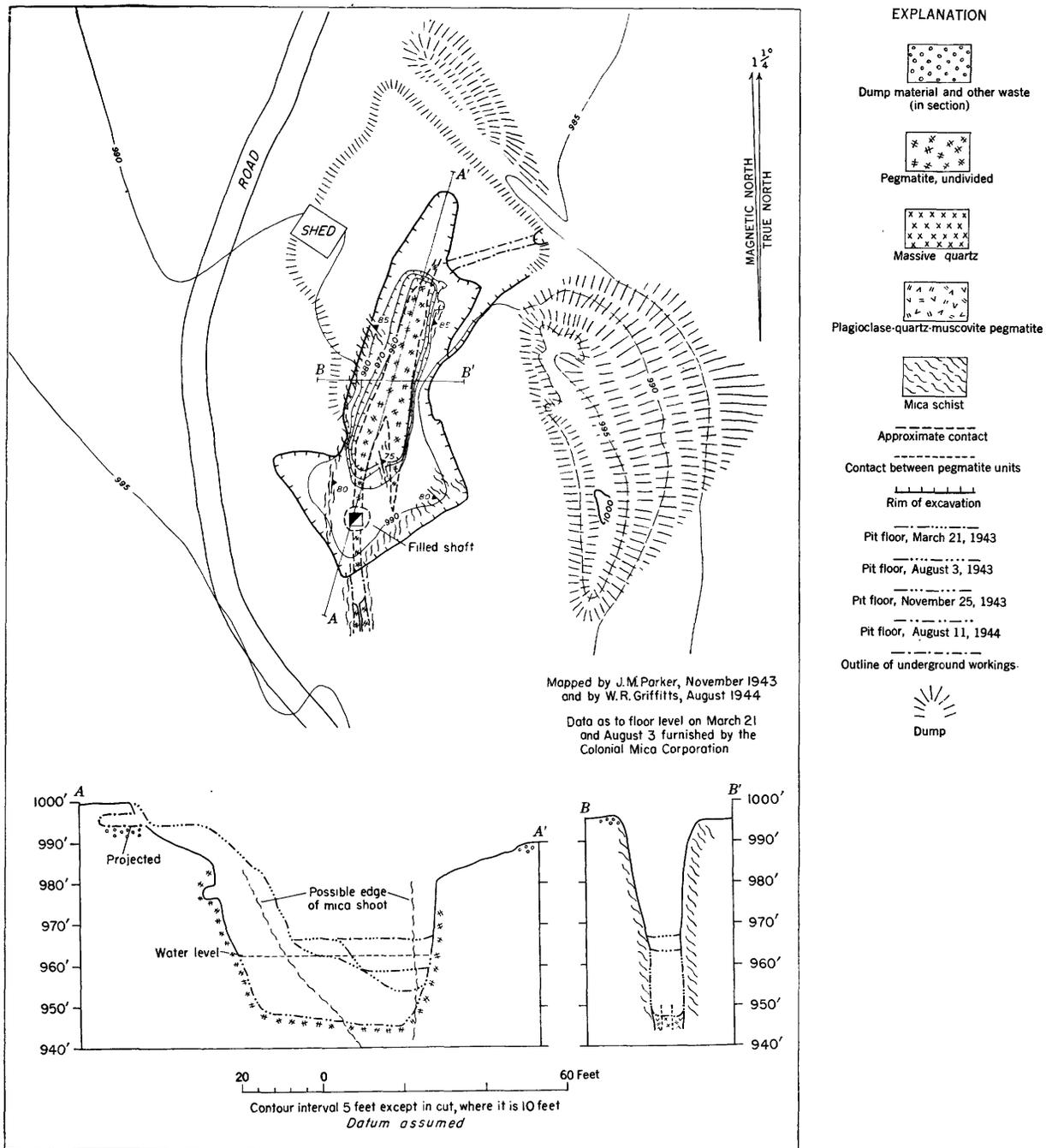


FIGURE 97.—Geologic map and sections of the Gettys No. 1 mine, Cleveland County.

oxides. They yield little sheet material. The mine was abandoned because the quality of the mica became very poor and because of incipient caving of the walls of the cut.

GETTYS NO. 2 MINE

The Gettys No. 2 mine, 400 ft southeast of the No. 1 (location 86, pl. 19), was last worked in the spring of 1943, when Gettys reopened an old shaft and excavated a pit. The vertical pegmatite dike strikes N.

25° E. Its thickness is not known. The exposed pegmatite is rich in plagioclase and contains a few inclusions of schist. Gettys reports that a small quartz mass lay near the middle of the deposit. The book mica is clear and pinkish-buff. Most is hard and free splitting, but some is ruled and faintly reeved.

WALLACE MINE

The Wallace mine, 1.1 miles northeast of Polkville (location 88, pl. 19), was reopened and operated most

extensively during the summer of 1943, when an open-cut 20 ft long, 10 ft wide, and at least 25 ft deep was excavated. The pegmatite dike strikes N. 10° W., dips 80° W., and is 1 to 4 ft thick in the south end of the cut. It is thinnest at floor level but thickens abruptly upward. Its lower part is composed largely of kaolinized plagioclase-quartz pegmatite with a thin border zone of quartz and muscovite. In its upper, thicker part masses of granular quartz and small mica books 6 to 10 in. in diameter occur in the plagioclase-rich pegmatite.

An irregular discontinuous core of quartz 6 in. to 2 ft thick extends from a point 6 ft above the floor of the cut to the south rim. The core is 4 ft thick at the north rim of the cut but thins downward and pinches out at a depth of about 15 ft. Many septa or inclusions of country rock appear in the dike near the floor at the north end of the cut. The workings plunge northward at an angle of about 50° and perhaps reflect the plunge of the deposit.

The book mica, which is similar to that in the neighboring mines, is pinkish buff, free from specks and other mineral stains, and only slightly reeved.

PEELER NO. 1 MINE

The two northeasternmost deposits in the Polkville area are on the E. O. Peeler property, about 1.2 miles northeast of Polkville and 400 ft north of the Wallace mine (location 87, pl. 19). The No. 1 mine was opened about 1917 but lay idle until the spring of 1943, when the Schmidt brothers, of Rutherfordton, began to clean out the old workings. In the spring of 1945 an open-cut 20 ft long, 10 to 15 ft wide, and 43 ft deep was accessible, and a shaft in the south end of the cut extends to an unknown depth. A drift was driven 27 ft north from the cut, and the overlying pegmatite was stopped nearly to the surface.

The pegmatite dike strikes N. 30° E. and dips 80° WNW. It is enclosed by garnetiferous quartz-mica schist, the vertical foliation of which strikes N. 10° W. The mine workings extend progressively farther northeast with increasing depth; hence the mica-rich part of the deposit, or perhaps the entire dike, plunges northeastward. The angle of plunge probably is moderate.

A core of massive quartz is surrounded by a plagioclase-quartz wall zone. The core is lenticular, and little of it is exposed in the ends of the workings. Books of pinkish-buff muscovite occur in the wall zone, where they range from 1 to 7 in. in diameter. Most are flat, free splitting, hard, and free from mineral stains. Clay stains are light. Some of the mica is lightly reeved, and some is ruled.

PEELER NO. 2 MINE

The Peeler No. 2 mine, about 600 ft northeast of the No. 1 (location 87, pl. 19), was opened in 1894 by a Mr. Whistnant, who excavated a cut 12 ft wide, 40 ft long, and 25 ft deep. Bert Smith, of Asheville, cleaned out the cut to a depth of 12 ft during the summer of 1943 and recovered small quantities of pinkish-buff book mica. Most was flat and free splitting, and some books yielded 2- by 3-in. trimmed sheets.

FRED FALLS PROSPECT

Mica-bearing pegmatite was prospected by Alvin Cook on the farm of Dr. Fred Falls, 1 mile east of Polkville (location 89, pl. 19). The mica occurs in feldspathic pegmatite along and near a quartz core.

CLEVELAND COUNTY: SHELBY AREA

POWELL (SUGAR BARREL) MINE

The Powell mine is 2.9 miles S. 53° E. of Polkville (location 92, pl. 19). A 20-ft shaft was sunk many years ago by a Mr. Dycus, who is said to have recovered "three sugar barrels full" of trimmed mica. After a long period of intermittent operations, the mine was reopened in 1943 by F. C. Snyder and V. V. Wallace, of Rutherfordton. They cleaned out an old open-cut to a depth of 20 ft, then sank a shaft from its floor to a total depth of 30 ft. A smaller pit was dug 40 ft south of the cut.

The country rock, which is exposed in a gully near the mine, is a quartz-mica schist that strikes N. 25° E. and dips 15° ESE. In the southern pit the schist strikes N. 45° E. and dips 45° SE. The country-rock foliation along the west wall of the deposit bends upward near the contact in a manner indicating drag along the pegmatite or along a fault older than the pegmatite.

The deposit strikes N. 25° E. and dips 75° WNW.; the dip may decrease toward the south. It is 2 ft thick at the north rim of the cut and about 1 ft thick at the south rim, but it bulges to about 6 ft at a depth of 20 ft. It appears to be an elongate pod that plunges north at an angle of 75° and contains a core of massive quartz in its thickest part. The wall zone is an aggregate of plagioclase and subordinate quartz and muscovite, and a thin border zone rich in small flakes of muscovite is best developed in the part of the deposit above the level of the core. The deposit resembles those of the Polkville area to the north more closely than it does those farther south in the Shelby area.

The book mica in the dumps is clear and pinkish buff. Most is flat and free splitting, but some books contain reeved sheets between flat sheets. Few appear to be heavily clay-stained. Many of the mica books are 4 to 5 in. in diameter.

JIM BLANTON PROSPECT

The Jim Blanton prospect is about half a mile west of Union Church (location 93, pl. 19). Pegmatite is exposed in four pits that form a row 50 ft long. The deposit trends N. 80° E. and is enclosed by garnetiferous quartz-rich mica gneiss. The country-rock foliation strikes N. 65° E. and dips 25° NNW. A quartz core at least 5 ft thick extends through the pits. The feldspathic wall zone contains clear, pinkish-buff books of mica. Most are of good quality, but some are reeved.

WILLIAMSON MINE

A 30-ft shaft and small lateral workings were excavated about 1928 beside the road on the Pierce Williamson property, three-fourths of a mile west of Union Church (location 94, pl. 19). The shaft was reopened and deepened to 35 ft (water level) by Williamson in the summer of 1944 but was abandoned because it lay on the right-of-way of the State highway. A second hole, sunk from a point 75 ft to the south-southeast during the spring of 1943, was first worked by Williamson and later by L. H. Goodman, of Ashville.

The pegmatite dike trends N. 45° E. and is at least 15 ft thick. It contains quartz, perthite, plagioclase, muscovite, and biotite. A quartz core is present but apparently is thin. Mica is said to be abundant. Some of the books are reeved and locky, but others are flat and free splitting. The flat and reeved books are reported to occur in different parts of the deposit. All are red brown.

McINTYRE MINE

The McIntyre mine is near the south bank of Little Harris Creek, about 1¾ miles east-southeast of Union Church (location 106, pl. 19). It is owned by Mrs. Margaret McIntyre and was opened in 1918 by Frank White and Sam Hamrick, who dug three pits to depths not greater than 20 ft. Mica books are reported to be abundant but of poor quality.

BOWEN MINE

The Bowen mine, owned by L. G. Bowen, of Forest City, is about 2½ miles east-southeast of Union Church (location 109, pl. 19). It was opened about 1918 by Frank White and Sam Hamrick, who excavated a cut 45 ft long, 15 to 20 ft wide, and 35 ft deep, and was reopened in the fall of 1942 by D. T. Vance, R. L. Weathers, and Sam Vance, of Plumtree. A shallow shaft was sunk during the last operations.

The biotite gneiss country rock contains greenish chlorite-rich layers and is interlayered with hornblende gneiss. The foliation strikes N. 25° E. and dips 30° to 60° ESE. The pegmatite dike mined in the cut strikes

N. 65° E. and dips 80° NNW. It probably is about 10 ft in maximum thickness. A quartz core is surrounded by a coarse-grained intermediate zone of perthite, plagioclase, and subordinate quartz. The wall zone is a medium-grained aggregate of plagioclase and quartz.

The intermediate zone contains accessory pyrrhotite, dolomite, calcite, chlorite, tourmaline, and pale yellow-green muscovite. Dolomite forms blocky crystals in cavities between crystals of feldspar; and calcite, perhaps with dolomite, forms anhedral masses that completely fill cavities or are embedded in feldspar. The calcite penetrates feldspar grains along fractures and cleavage cracks and may have replaced some of it. Black tourmaline, which also occurs in the vugs, appears to have formed earlier than the carbonate minerals, but the carbonates and yellow-green muscovite may have been formed almost contemporaneously. Fine-grained yellowish-green muscovite is particularly abundant along cracks and cleavage surfaces, as well as in small pits and cavities in the blocky perthite.

The pegmatite dike in the Vance shaft is 3 ft or less thick and consists chiefly of plagioclase.

The mica that occurs in the small dike and in the wall zone of the large dike is hard and flat to slightly reeved. Some books are locky. All are cinnamon brown but are mottled and streaked in shades of brown and yellowish olive.

HARRIS MINE

The Harris mine is at the edge of a wooded area west of a barn, south of Little Harris Creek, and about 0.4 mile west-southwest of the Bowen mine (location 108, pl. 19). The surface and mineral rights are owned by Kent Harris and the Harris heirs. A 10-ft pit that was dug many years ago was cleaned out and deepened in 1942 by Dr. F. A. Story and Brack Buchanan. By May 1945 the workings comprised two open-cuts 20 ft deep and a connecting tunnel.

The country rock is a fine-grained mica gneiss with minor interlayered hornblende gneiss and pods and stringers of coarse granitic rock. The granitic layers contain feldspar crystals ½ to 2 in. in diameter and garnet crystals as much as 3 in. in diameter. Along the south wall of the pegmatite dike the country-rock foliation strikes N. 55° E. and dips 60° SE. The deposit strikes N. 80° E., dips 85° S. to vertically, and is about 3 ft thick. A core of massive gray quartz, 2 ft thick, is surrounded by a thin wall zone of mica-bearing kaolinized plagioclase-quartz pegmatite. The 1- to 2-in. border zone consists of burr rock.

The book mica is clear and light cinnamon brown. Sheets as much as 5 in. in diameter are common. Despite a few reeves and local lockiness, the proportion of recoverable sheet material is substantial. Although

the deposit is therefore moderately rich, the reserves of mica-bearing pegmatite may not be large.

HORNE PROSPECT

A mica deposit on the W. Y. Horne property, 5.7 miles N. 24° W. of Shelby (location 107, pl. 19), was extensively prospected in 1942 or 1943. An open-cut 18 ft long was excavated, and two 25-ft shafts were sunk and connected by a tunnel. The workings extend along the deposit for a strike distance of 35 ft.

The vertical pegmatite dike strikes N. 80° E. and is in quartz-mica schist. The country-rock foliation strikes N. 20° E. and dips 20° WNW. Most of the pegmatite is kaolinized plagioclase with a few mica books and a little interstitial quartz. A thin core of massive quartz is exposed in the western end of the cut. The deposit thickens from 1 ft at the surface to about 3½ ft at a depth of 20 ft. It apparently pinches out west of the easternmost shaft. Most of the red-brown mica books are less than 4 in. in diameter, and many of them are reeved and heavily clay- and iron-stained.

BOWEN SOUTHEAST PROSPECT

The Bowen Southeast prospect is one-half a mile east-northeast of the Bowen mine and east of the paved highway to Double Shoals (location 110, pl. 19). A small pit exposes coarse-grained feldspathic pegmatite on the north side of a quartz mass, probably the core of the deposit. The partly kaolinized plagioclase-quartz pegmatite is about 3 ft thick and contains flat books of pinkish-buff and yellowish-olive mica associated with scattered masses of granular quartz. Books of greenish "A" mica as much as 6 in. in diameter fringe the quartz core.

MARY GOLD MINE

The Mary Gold mine, on the south side of a dirt road 1.5 miles southwest of Double Shoals (location 112, pl. 19), was worked about 1885 by Webb Morgan, but its early history is otherwise unknown. It was reopened in 1943 by Jeter and Claude Stamey, who sank six shafts to depths of 8 to 20 ft and drove about 120 ft of drifts. Most of the country rock is quartz-mica gneiss, but small float fragments composed almost wholly of quartz and sillimanite are scattered in the field northwest of the mine. Gneissic granite crops out in the creek bed southeast of the mine.

The pegmatite dike is poorly exposed. Its vertical southeast wall strikes N. 60° E. It is at least 20 ft thick and consists chiefly of plagioclase with scattered masses of quartz, some of which are several feet in diameter. Inclusions of gneiss are abundant. Most of the book-mica concentrations exposed during the recent opera-

tions surround or flank these inclusions. Some of the books are as much as 6 in. in diameter. The mica is pinkish buff and commonly is fractured, slightly reeved, and lightly to moderately clay-stained. The mica recovered during the Stamey operation occurred in pockets, none of which extended to a depth of more than 20 ft. Exploration along the strike of the dike might reveal a more persistent shoot, inasmuch as the deposit has not been thoroughly explored.

PLATO SCISM PROSPECT

A mica deposit on the Plato Scism property, 1.2 miles southwest of Double Shoals (location 111, pl. 19), was opened about 1920 by a Mr. McMasters, of Ohio, and was reopened briefly in 1943. The only accessible working is a pit 12 to 15 ft deep. As exposed in the north wall of this pit, the foliation of the mica-schist country rock strikes N. 20° E. and dips 25° WNW. The north wall of the pegmatite dike strikes N. 70° E. and dips 80° NNW. The deposit evidently is about 7 ft thick and contains a core of massive quartz with minor blocky perthite. An intermediate zone consists of perthite (?) in 8-in. masses, and the wall zone is an aggregate of kaolinized plagioclase, quartz, muscovite, and biotite.

The intermediate zone contains books of green "A" mica, especially in its center directly beneath the keel of the core and sporadically along the flanks of the core. The wall-zone mica also is green, but the books are flat. Some yield 2- by 3-in. trimmed sheets.

S. S. MAUNEY (M. M. MAUNEY, HOMESTEAD) MINE

The S. S. Mauney mine, 1 mile west-southwest of Union Church (location 95, pl. 19), was opened about 1880, but little mining was done from about 1895 to 1940. The deposit was reopened briefly in 1940 by Lee Weathers, and Doc Henline and Milt Swann also worked it during the same year. The open-cut was deepened to 40 ft in the spring of 1943 by the General Minerals Corp.

The pegmatite dike strikes N. 15° to 20° E. and dips 80° WNW. in garnetiferous mica schist that strikes northwest. It is 8 to 15 ft thick. Red-brown mica occurs in a plagioclase-rich wall zone that surrounds a quartz core that is 4 feet thick. Some of the books are flat, but most are reeved, somewhat wedged, soft, cracked, and badly clay-stained.

BAILEY MAUNEY MINE

The Bailey Mauney mine is 1.1 miles southwest of Union Church (location 97, pl. 19). It was operated intermittently for many years prior to World War II, was reopened in 1942 by Lee Weathers and Doc Henline, and was operated in the spring of 1943 by the General Minerals Corp., of New York. The workings

comprise three narrow connecting open-cuts that extend along the strike of the deposit for a distance of 100 ft. The easternmost cut is 16 ft deep, the middle cut 23 ft deep, and the westernmost cut 42 ft deep.

The country rock is somewhat contorted garnetiferous mica schist in which the foliation strikes N. 25° W. to N. 10° E. but in general trends north-northwest. The pegmatite dike strikes N. 52° E. and dips 85° N. to vertically. It is 4 to 7 ft thick in most of the workings but thins to 2 ft or less at the northeast end of the mine area. A core of massive quartz is 2 to 6 ft thick in most of the workings but pinches out along the strike. In most places the wall zone, an aggregate of kaolinized plagioclase and minor quartz, is about a foot thick. The wall zone contains moderate to large amounts of pinkish-buff mica in the middle and eastern openings. In the westernmost cut abundant mica was found only above a depth of about 35 feet. Most of the books are marked by "A" structure, and a few are ruled. Some 4- by 6-in. trimmed sheets were recovered during the recent operations, but the bulk of the production was 2-by-2 in. or smaller.

D. H. SPANGLER PROSPECTS

The D. H. Spangler prospects are at the side of a road 1.6 miles southwest of Union Church (location 96, pl. 19). Two pits about 10 ft deep and 50 ft apart expose mica-bearing pegmatite. The country rock is garnetiferous mica schist in which a contorted foliation strikes northeast to northwest. The larger pegmatite dike, near the road, is vertical, strikes N. 25° E., and is 4 ft thick. The outer dike, about 1½ ft thick, strikes N. 60° W. and dips 75° SSW. Both are aggregates of medium- to coarse-grained kaolinized plagioclase, quartz, and muscovite. The mica occurs in small brown books that are clear to slightly stained. Many are locky. The thinner dike contains small crystals of clear quartz that are coated and penetrated by flakes of yellowish-green mica.

CAMPBELL MINE

The E. W. Campbell deposit is 1.2 miles south of Union Church (location 99, pl. 19), in a wooded area 200 ft southwest of a farm road. In 1940 Lee Weathers worked near the west end of a row of old pits and open-cuts that trends nearly east. Solon Webb later sank a 30-ft shaft at the east end of the Weathers open-cut. J. C. Green, of Clarissa, worked the deposit for 2 weeks in July 1943. Most of the recent operations appear to have been confined to old filled workings that extend to a depth of about 20 ft. These were cleaned out and probably deepened for a distance of 100 ft along the strike of the deposit.

Mica schist is exposed in the north wall of the open-cut, where its foliation strikes N. 40° W. and dips 60° NE. The early vertical pegmatite dike strikes N. 70° E. Apparently it was about 5 ft thick where mined, but it is said to pinch out at a depth of 35 ft in the Green workings. Drifts driven for 25 ft along the keel of the deposit failed to expose any downward continuation. A massive quartz core said to be about 3 ft thick is flanked by a wall zone of kaolinized plagioclase, interstitial quartz, and scattered books of muscovite and biotite. The muscovite is clear, pinkish buff, and free from clay stains. Many books are lightly reeved, and flat-A structure is common.

WEATHERS MINE

The Weathers deposit is near the west side of a public road 1.1 miles south of Union Church (location 100, pl. 19). Dr. F. A. Story and a Mr. Buchanan began to clean out the old mine workings in the spring of 1943, and the work was later continued by Craig and Sparks, who reached the bottom of the old openings. G. W. Myers operated the mine later in 1943. When it was finally abandoned, the workings consisted of an open-cut, 26 ft long and 25 ft deep, and a shaft at its west end. The deposit is owned by W. T. Weathers.

The country rock is a mica gneiss that is rich in garnet. Its foliation strikes N. 55° W. and is vertical along the north wall of the deposit. The vertical pegmatite dike strikes N. 85° E., is about 5 ft thick in the middle of the cut, and apparently thins and splits both eastward and westward. A few blocks of massive quartz are present in the dump, but the pegmatite exposed in the cut consists chiefly of plagioclase with minor quartz and muscovite. The mica is clear and pinkish buff. Most books are flat, but some contain "A" reeves. Little of the mica is heavily clay-stained.

CLIFF BLANTON MINE

The Blanton mine, 2¼ miles southeast of Union Church (location 114, pl. 19), was opened many years ago by Cliff Blanton, the owner. The workings comprise two rows of open-cuts and pits in pegmatite bodies 240 ft apart. The north row contains 19 cuts and is 360 ft long; the south row contains 14 cuts and is 300 ft long. Both trend N. 67° to 70° E. The largest openings are at the east end of the rows. The cut at the east end of the north row is 13 ft long, 9 ft wide, and 30 ft deep, and that at the east end of the other row is 30 ft long, 2 to 11 ft wide, and 60 ft deep.

W. W. Martin worked at the east end and near the middle of the south row of cuts (pl. 24), and D. W. McArthur mined in the southeast cut from the fall of 1942 to the summer of 1943. In the spring of 1944

Leburn Wright sank an 18-ft shaft at the east end of the northern deposit. It was deepened to 30 ft during the following summer by C. T. Shytle and G. D. McNeill, who also drove short drifts both east and west. Water was encountered at the 30-ft level.

The country rock is quartz-muscovite schist that contains minor weathered biotite and kaolinized feldspar. Its foliation strikes northwest to east and dips 20° to 30° E. to 10° S. Most of the variation in attitude occurs near the pegmatite contacts, where the schist is recrystallized and consists chiefly of coarse-grained muscovite.

The south dike strikes N. 70° E., dips 80° N., and is 2 to 13 ft thick. It thins very abruptly at the east end of the largest cut. The north wall is straight, whereas the south wall bends north in the largest cut and is somewhat irregular elsewhere as well. Most of the pegmatite is a medium- to coarse-grained aggregate of oligoclase, quartz, and muscovite. A quartz core extends 100 ft westward from the middle of the large cut and is flanked by a plagioclase-rich wall zone. In the three westernmost cuts, the dike may be represented by a layer 2 to 3 ft thick that consists chiefly of mica in books 1/2 to 1 1/2 in. in diameter.

Flat, pinkish-buff mica books of good quality occur in small pockety concentrations in the wall zone, but the only large mica concentration thus far discovered plunges 60° to 70° E. along the crest of the quartz core. This shoot extends 30 ft eastward from the end of the core and 5 to 10 ft westward along its flanks. Within the shoot the mica is localized in layers separated by layers of mica-poor feldspathic pegmatite that are 2 ft thick and dip 60° to 70° E. Along the flanks of the quartz the mica is most abundant in an 18-in. layer of pegmatite. The entire shoot has been mined for a distance of 50 to 60 ft down its plunge. Brown to greenish "A" mica occurs near the west end, or keel, of the core.

The north pegmatite dike is 3 to at least 20 ft thick and at least 360 ft long. It thins at the west end of the mine but is 7 ft thick at the east end. It strikes N. 70° E. and dips steeply south, but, as both walls appear to be very irregular, local reversals are common. The pegmatite contains abundant inclusions of schist. The core, a large quartz mass, extends about 100 ft westward from the east cut. An intermediate zone rich in coarse-grained perthite extends beyond the east end of the core and tapers out westward along its flanks. The surrounding wall-zone pegmatite is a medium- to coarse-grained aggregate of oligoclase, quartz, and muscovite. Small masses of quartz are exposed in the three westernmost cuts. None is more than 20 ft long or 2 ft thick. Biotite and masses of quartz-muscovite rock 6 to 18 in. thick occur in the wall zone in the west half of the mine

area. Book muscovite appears to be most abundant along the north flank of the large quartz mass.

Most of the muscovite in both deposits is clear and pinkish buff. Many books are lightly clay-stained, and some contain "A" reeves. Greenish books of "A" mica locally fringe the cores. The most recent operations in the south pegmatite, chiefly in the large easternmost cut, are said to have been stopped because the weathered rock tended to cave into the workings, rather than because of a decrease in the quantity or quality of the mica.

CABANISS-STORY (CABANISS THREE SISTERS) MINES

The Cabaniss-Story No. 1 mine, 1.7 miles south of Union Church (location 102, pl. 19), is owned by Susan and Blanche Cabaniss. It was worked shortly before 1943 by Rube Sparks and Grady Allen, of Spruce Pine, and during the summer of 1943 by Dr. F. A. Story, of Shelby. A row of old pits and shafts extends for a distance of several hundred feet along the strike of the deposit. The latest opening, the Story shaft, is 20 ft deep.

The pegmatite dike strikes N. 85° E. and dips 85° N. to vertically in mica gneiss. The country-rock foliation trends N. 25° E. and dips 40° WNW. but is somewhat irregular near the pegmatite contacts. The deposit has been exposed discontinuously for a strike distance of at least 525 ft. It ranges in thickness from 4 ft at the east end of the workings to about 20 ft near the middle and thins westward to 6 ft. Segments of massive quartz 6 to 10 ft thick occur near the middle of the dike for a strike distance of 150 ft to 200 ft, but no massive quartz is present in either the eastern or the western workings. The wall-zone pegmatite is a coarse-grained aggregate of kaolinized plagioclase, interstitial quartz, and muscovite.

Most of the muscovite is pinkish buff; a little is light yellowish green to nearly colorless. Some occurs as wedge-A books, and much of it is reeved. The proportion of recoverable sheet material probably is low, but the quality of the product is good and the total production of trimmed sheet mica is moderately high. The richest concentrations of mica may occur between the blunt eastern end of the quartz core and the point where the dike thins; thus they may be similar to the mica shoots in the Cliff Blanton and Plato Houser deposits.

Pegmatitic material in the soil suggests that a second, nearly parallel pegmatite dike may lie about 150 ft north of the mine workings.

The workings of the Cabaniss-Story No. 2 (location 103, pl. 19) consist of three shafts sunk east of the road. They explore a pegmatite dike 3- to 5-ft thick that strikes about N. 85° E. It contains a thin quartz core flanked by mica-bearing feldspathic pegmatite.

T. N. SPANGLER (REUBEN SPANGLER) PROSPECTS

A mica deposit on the property of T. N. Spangler and Ralph Spangler, 1.6 miles south of Union Church (location 101, pl. 19) was worked by Lane Buchanan and Doc Henline in 1942. It was leased in the spring of 1943 to N. S. Poole, who assigned the lease to Robert E. Kenmerer, superintendent for the General Minerals Corp., of New York. The main opening is a narrow, shallow cut 80 ft long. The mica gneiss country rock, the foliation of which strikes N. 10° W. and dips 20° W., contains many small pegmatite pods near the main dike, a vertical pegmatite body that strikes N. 75° E. and is about 10 ft in maximum thickness. This dike has a massive quartz core, about 3 ft thick, surrounded by a plagioclase-quartz-muscovite wall zone. The mica books are as much as 8 in. in diameter, but many are reeved, cracked, and locky. The mica is pinkish buff and somewhat clay-stained.

A pit west of the main cut and on the west side of a ravine was excavated by Sherman Withrow, the tenant on the Spangler farm. He is reported to have recovered at least 100 lbs of sheet mica. Another prospect opening near the main mine workings exposes a thin vertical pegmatite dike that strikes N. 80° E. in garnetiferous mica gneiss. The country-rock foliation trends N. 10° W. and dips 70° W.

ELI GLOVER MINE

The Glover mine is on the west side of a country road 2 miles due south of Union Church (location 104, pl. 19). An open-cut 20 ft deep exposes a vertical pegmatite dike that strikes N. 80° E. The wall rock is garnetiferous mica gneiss with a distinct foliation that trends N. 15° W. and dips 45° WSW. The deposit is about 8 ft thick and contains a thin quartz core that is flanked by a perthite-rich intermediate zone. The plagioclase-rich wall zone contains scattered small flat books of clear pinkish-buff mica.

WALTER DAVIS MINE

The Davis mine, 2¼ miles south-southeast of Union Church (location 105, pl. 19), was leased in the spring of 1943 to D. W. McArthur and the Buchanan brothers, who sank a 25-ft shaft at the northeast end of old workings that probably extend to a similar depth. The deposit is said to have been opened about 1880 by Ansel Irwin.

The country rock, a garnetiferous sillimanite-mica schist, encloses a nearly vertical pegmatite dike. The deposit strikes N. 30° to 50° E. and is about 10 ft thick. A 4-ft core of massive quartz is exposed in the bottom of the shaft. The book mica, which occurs in the feldspathic wall zone, is flat, pinkish buff, and free from mineral stains, but it is somewhat clay-stained.

METCALF MINE

The Metcalf mine, 2.6 miles south-southwest of Double Shoals (location 115, pl. 19), has been idle for many years except for the work of D. W. McArthur, who partly cleaned out an old shaft in the eastern part of the mine area in 1943. The workings comprise two partly caved shafts about 50 ft apart and several caved or filled shafts in a row that trends N. 70° E. The foliation of the country rock, a garnetiferous mica schist, strikes N. 5° E. and dips 50° E.

The vertical pegmatite dike strikes N. 70° E. and is 6- to 10-ft thick. It contains a thin quartz core and a wall zone of kaolinized plagioclase, interstitial quartz, and muscovite. Book mica is moderately abundant. Many books are as much as 6 in. in diameter, and some are flat. The mica is clear, pinkish buff, and only lightly clay-stained.

BLANTON PROSPECT

The Blanton prospect, 4.5 miles N. 36° W. of Shelby (location 116, pl. 19), was opened near the Blanton residence in April 1943. A slumped pit 25 ft long and 5 ft deep trends N. 50° E. The country rock is mica gneiss. A quartz core in the pegmatite dike is indicated by large blocks of massive quartz in the dumps. The mica books, which apparently occur in the wall zone, are of moderate to large size, but some of the mica is reeved, locky, and clay-stained. The recoverable sheet material is pinkish buff and of good quality.

CABANISS PROSPECT

The Cabaniss prospect is about 100 ft west of a county road and 4.7 miles N. 39° W. of Shelby (location 122, pl. 19). A vertical pegmatite dike that strikes N. 75° E. is exposed in an open-cut about 30 ft long, 5 ft wide, and 20 ft deep. The deposit is 3- to 5-ft thick. A shallow pit several hundred feet to the west may be in a second dike.

The pegmatite consists of kaolinized plagioclase, minor quartz, and scattered books of mica. No large masses of quartz are exposed. The mica from the open-cut is fractured, badly clay-stained, and commonly reeved. Some is pinkish buff, and some is yellowish olive. The book mica exposed in the shallow pit is pinkish buff, flat, and lightly to heavily clay-stained. Some is accompanied by biotite.

PUTMAN MINES

The Putman mines, owned by Dan Gold, are 4¼ miles N. 38° W. of Shelby (location 117, pl. 19). The No. 1 mine, east of the road, was idle for many years but was reopened in the fall of 1942 by D. W. McArthur. In 1944 the General Minerals Corp. cleaned out an old shaft and sank two new 20-ft shafts. The pegmatite dike, which is at least 5 ft thick, strikes east and dips 75° N.

in garnetiferous mica schist. The country-rock foliation strikes N. 55° E. and dips 25° SE. The dip may flatten near the south wall of the pegmatite body. The deposit contains a thin quartz core and a wall zone rich in kaolinized plagioclase. Muscovite and a little biotite occur with the feldspar. Much of the red-brown muscovite is clay-stained, but the flat books yield a moderately high proportion of clear to slightly specked sheet material.

The No. 2 mine, west of the road, was operated concurrently with the No. 1 by the General Minerals Corp. An old open-cut was lengthened to 50 ft and deepened to 26 ft, but little pegmatite is reported to have been encountered.

CHARLES CORNWELL PROSPECT

Five pits were dug early in 1943 on the Charles Cornwell property, 3¼ miles N. 22° W. of Shelby (location 120, pl. 19), but all were refilled shortly thereafter. Neither the pegmatite nor the country rock is now exposed, but the size and position of the pits suggest that the deposit is 3 to 4 ft thick and trends N. 85° W. The mica in the dumps is clear and pinkish buff, but most of the books contain "A" reeves and are cracked.

W. H. WELLMAN PROSPECTS

Three pits were dug in 1941 and 1942 by D. W. McArthur and W. H. Wellman on the Wellman property, 3¼ miles N. 20° W. of Shelby (location 121, pl. 19). One pit, 15 ft deep, exposes a plagioclase-rich pegmatite dike that strikes N. 25° E., dips 55° ESE, and is about 8 ft thick. A smaller pit 150 ft to the northeast exposes a vertical dike that strikes N. 85° W. and contains a thin core of massive white quartz. The mica in both deposits is pinkish buff, lightly stained, and somewhat lumpy. Most of the books are small.

MARTIN MINE

The Martin mine is 4¾ miles northwest of Shelby (location 119, pl. 19). It has been worked intermittently since about 1905, and the earlier operations are said to have yielded mica valued at \$15,000. The deposit was leased by W. W. Martin, the owner, to F. Burleson and S. B., J. R., and C. W. Stamey in December 1942. Large quantities of excellent sheet mica were recovered during the first half of 1943. Mats E. Berg, of Spruce Pine, took over the operation in the summer of 1943, but the output of the mine gradually dwindled and work was abandoned in November 1943 after near-exhaustion of the deposit. The principal workings include a shaft with irregular appended drifts and stopes (fig. 98). The shaft is reported to be 99 ft deep. L. Rex Boone, of Charlotte, began to unwater the mine

and clean out the shaft in September 1944 but discontinued operations at a depth of about 70 ft. Two new shafts were sunk east of the main opening in November and December 1944. The first of these intersected old workings and was abandoned at a depth of 52 ft. The second was sunk to a depth of only 20 ft.

Both pegmatite and country rock are thoroughly weathered at the surface, and no outcrops are present in the immediate vicinity of the mine. The deposit is a discordant body in gneissic granite, sillimanite-rich mica-garnet augen gneiss, and mica schist. The foliation of the metamorphic rocks trends N. 20° E. and dips 50° to 60° ESE. The schist occurs at the west end of the mine and is separated from the granite to the east by a layer of augen gneiss. The gneiss forms the walls of the pegmatite in the upper mine workings. The granite is a medium- to coarse-grained aggregate of feldspar, quartz, biotite, and muscovite. Some layers are pegmatitic and contain crystals of feldspar as much as 3 in. in diameter.

The pegmatite body strikes N. 75° W. and dips 75° NNE. Its general tabular form is modified by a thick, gently plunging bulge. The upper part of the deposit is 2 to 8 ft thick, but the bulge, which was encountered in the shaft at a depth of about 45 ft, may be as much as 18 ft thick. The pegmatite consists of plagioclase, perthite, quartz, muscovite, and minor pyrrhotite, chalcopyrite, marcasite, pyrite, and calcite. A large podlike mass of quartz with minor plagioclase forms the core of the bulge and lies near the footwall of the dike (fig. 98). A little pyrite and pyrrhotite were encountered in unweathered pegmatite by Boone.

Most of the book mica occurs in feldspathic pegmatite in the thickest part of the deposit. Scattered books also are present in the thinner, near-surface parts of the dike and were obtained in small stopes from the upper part of the shaft. Some of the books are as much as 12 in. in diameter. The mica is pinkish buff, clear, and of good quality. A small proportion is slightly ruled and clay-stained, and faint "A" reeves occur in some books. Much of the mine-run mica yielded about 4 percent trimmed sheet and 12 to 15 percent punch material. Some of the sheets were as large as 8 by 10 in.

A drift that was run eastward for a distance of 90 ft from the bottom of the main shaft passed through the keel of the dike into country rock. The deposit probably has been mined out for its entire length at this level, and R. L. Rudasill reports that the mica-bearing rock pinches out downward at the lowest level of the workings near the shaft. Any extension of the deposit to greater depths probably would be down the gentle easterly plunge of the main bulge.

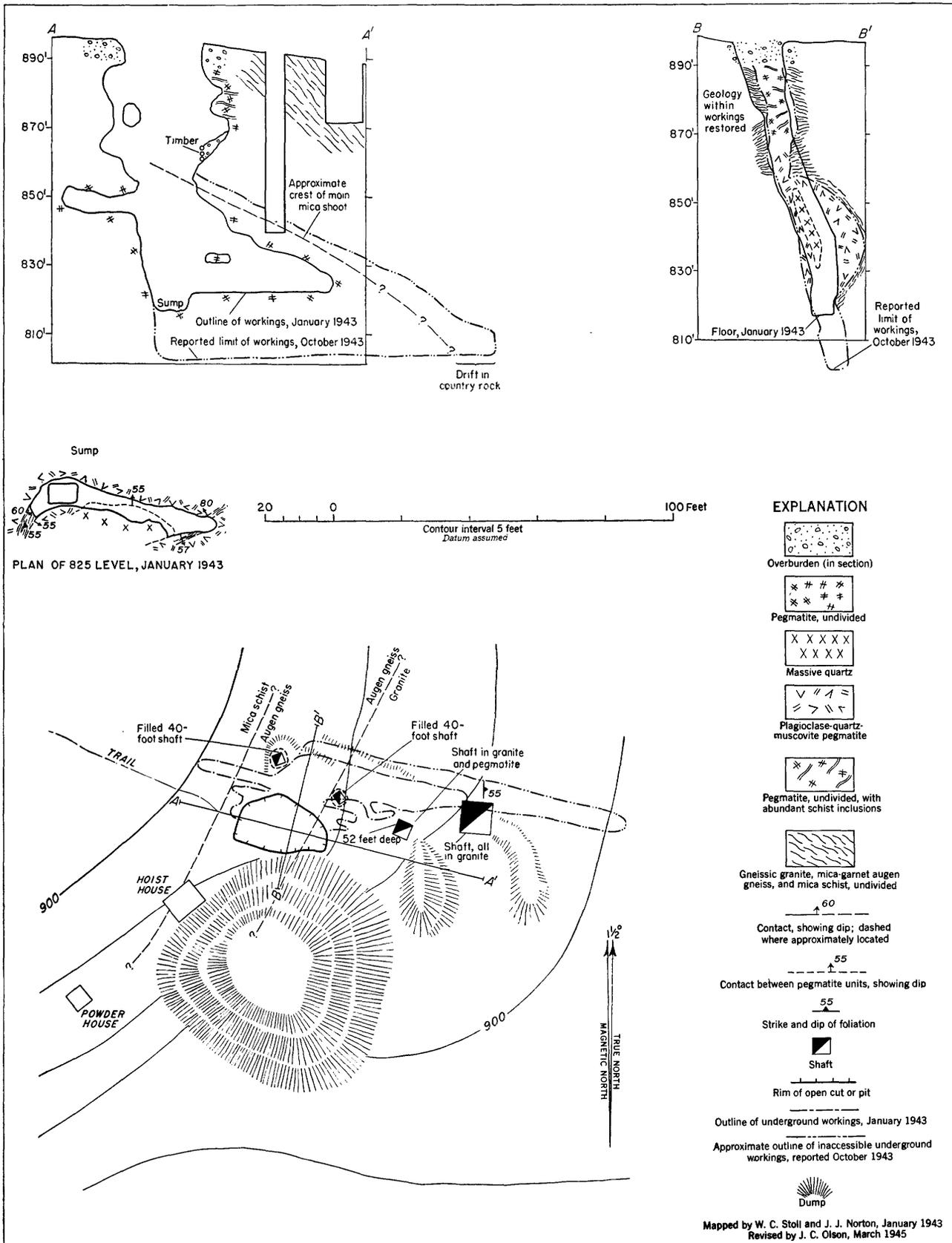


FIGURE 98.—Geologic map, plan, and sections of the Martin mine, Cleveland County.

ALMA CABANISS MINE

The Alma Cabaniss mine, 3.7 miles N. 40° W. of Shelby (location 118, pl. 19), was opened many years ago by a Mr. Kelley and was reopened in 1942 by the Smith brothers, of Rutherfordton. W. T. Hippey, of Micaville, leased the mine in the spring of 1943. The workings include an open-cut, now about 20 ft deep, and two shafts.

The country rock is granite in which a gneissic structure strikes N. 80° E. and dips 10° S. The pegmatite dike also strikes N. 80° E. but dips 85° N. to vertically. A thick, highly jointed core of massive quartz appears to be flanked by an intermediate zone of coarse plagioclase, quartz, and flat-A muscovite. The wall zone consists of plagioclase, quartz, and flat books of mica. The "A" mica is yellowish-green, with pinkish-buff to brownish-olive stripes parallel to the reeves. The flat mica is pinkish buff and is of high quality, except for numerous tiny black specks that occur in some books. These specks appear to be most abundant near the Smith brothers' shaft. The deposit might well contain substantial quantities of mica-bearing pegmatite.

CHRYSOLITE MINE

The Chrysolite mine is 4.4 miles N. 43° W. of Shelby (location 123, pl. 19). It was opened late in 1943 by the owner, Robert L. Rudasill, who dug a trench 50 ft long, sank a 40-ft shaft, and drove a drift. These openings were partly refilled and the mine was abandoned in 1944.

The nearly vertical pegmatite dike strikes N. 70° to 75° E. in mica schist. The country-rock foliation strikes N. 40° E. and dips 60° SE. The deposit is 18 in. thick at the east end of the trench but thickens westward. Little pegmatite is exposed in the workings, and no large blocks of massive quartz are present in the dumps. Most of the pegmatite is rich in kaolinized plagioclase, with scattered small books of biotite and pinkish-buff muscovite. Most of the muscovite books in the dump are less than 3 in. in diameter, and many contain tiny black specks. The mica is hard, flat, and free-splitting.

No pegmatite is exposed in a small pit near the woods more than 100 ft west of the main mine workings, but the dump contains many small books of pinkish-buff mica and irregular blocks of burr rock. An old open-cut, now 30 ft long and 6 ft deep, lies a few tens of feet to the northwest. The size of the dump suggests that the caved workings were not large. Flakes of weathered mica several inches in diameter litter the ground around the cut.

TOM CABANISS MINE

The Tom Cabaniss mine, owned by Robert L. Rudasill, is 4.4 miles N. 45° W. of Shelby (location 124, pl.

19). It was worked prior to 1910 and then lay idle until 1930, when it was reopened by a Mr. McSwain. It was later leased by Julius Henline and was last reopened in the fall of 1944 by W. L. Lenoir, M. H. Rose, and George Rose. The workings include a long trench, a shallow shaft, and a drift.

Two pegmatite dikes 10 to 15 ft thick are reported to have been mined. The one most extensively worked strikes N. 80° E. and dips 85° N. to vertically. It contains a massive quartz core that is fringed with books of yellowish-green to brownish-olive flat A mica. A discontinuous intermediate zone is rich in coarse perthite, and the wall zone consists of plagioclase, interstitial quartz, and scattered flat books of pinkish-buff mica. The border zone is a few inches thick and is composed of granular quartz and abundant small flakes of pinkish-buff mica. Most of the flat mica books are too small to yield trimmed sheet material. The larger flat-A books are soft and somewhat cracked and yield a low proportion of trimmed sheets.

RUDASILL PROSPECT

Two prospect pits on the R. L. Rudasill property are on a hilltop 4.2 miles N. 45° W. of Shelby (location 125, pl. 19). One of the openings exposes a vertical layer of burr rock about a foot thick. It contains a little stained mica in small books. A second, deeper pit exposes a vertical pegmatite dike that strikes N. 70° E. Books of stained mica occur in kaolinized feldspathic pegmatite that flanks a quartz core. The country rock, a mica schist, strikes north and dips 70° E.

PLEAZ BRIDGES MINE

The Pleaz Bridges mine, 5 miles N. 50° W. of Shelby (location 131, pl. 19), includes two deposits near the south side of the county road that extends northeast from Washburn siding. One deposit, only a few yards from the road, was opened in 1941 and mined to a depth of a little more than 15 ft by February 1942. The cut is about 30 ft long and 5 ft wide. Several other openings, about 40 ft to the south, have been idle for many years, and some of the trees growing in the slumped pits must date back 30 years or more. Still other workings are several hundred feet south of the road. The former size of these old workings is not known, but probably few were much larger than the recent cut.

The deposit nearest the road appears to be 3 or 4 ft thick and is composed mainly of quartz and plagioclase. No massive quartz is exposed in place, but the mined part of the deposit may well have contained segments of a quartz core as indicated by material in the dump. The other deposit is so poorly exposed that neither its size nor its composition can be determined. Both of the

dikes nearest the road appear to strike N. 80° E. and dip 80° S. to vertically. The attitude of the country rock cannot be accurately measured at the mine itself, but the mica schist in the road cuts less than a quarter of a mile to the west strikes N. 10° W. and dips 15° E.

The mica in the recently worked northern deposit is typical of that elsewhere in the district. It is pale pinkish buff to cinnamon brown and free from mineral stains, but it is slightly clay-stained. Some books are lightly reeved, and few of those remaining on the dump are more than 4 in. broad. The mica from the southern dike is distinctly different. The books in the dumps are badly weathered but are light yellowish to brownish olive. Many are lightly to moderately spotted or specked with iron oxides. The books appear to have been somewhat larger than those from the northern deposit.

COLEMAN BLANTON MINE

The Coleman Blanton mine is 3.6 miles N. 49° W. of Shelby (location 127, pl. 19). It was opened during World War I by J. E. Burleson and was last operated by the General Minerals Corp., of New York, in the spring of 1943. The main opening is a partly flooded cut 35 ft long, 7 ft wide, and at least 16 ft deep.

The country rock is weathered mica schist with scattered hard layers. Its foliation strikes uniformly N. 50° E. and dips 35° SE. The pegmatite dike strikes N. 85° W. and dips 85° N. to vertically. It is 1½ to 2 ft thick at the surface but thickens to 4 or 5 ft at a depth of 10 ft. A thin core of massive quartz is surrounded by a kaolinized plagioclase-rich wall zone.

Small books of muscovite are abundant along the north wall of the deposit, and larger books probably were scattered through the wall zone. The mica is clear and pinkish buff. Most is flat and free splitting, but some is reeved and slightly lanky. A few books contain cigarette burns or blotchy reddish-brown spots. Some of the reeved scrap mica that remains at the mine is heavily stained with clay and hydrous iron oxides. The books range from 1 in. to at least 6 in. in diameter.

JOE E. HUMPHRIES MINE

The mine on the Joe E. Humphries property, 1.5 miles N. 52° W. of Lattimore (location 137, pl. 19), was worked in the spring of 1943 by a Mr. Wallace. The main opening, a cut 20 ft long, 12 ft wide, and 23 ft deep, exposes a pegmatite dike that strikes N. 45° E. and dips 65° NW. in fine-grained biotite-muscovite gneiss. The country rock strikes N. 88° E. and dips 75° S. The deposit thins from 7 ft at the surface to 3 ft at the bottom of the cut. It may plunge west-southwest at an angle of about 40°.

The core is about a foot thick and consists of massive quartz with abundant tourmaline. It is flanked by an

intermediate zone of coarse, blocky perthite. Some of the feldspar crystals project into the quartz. Book muscovite is scattered through the fine- to medium-grained plagioclase-quartz pegmatite that forms the wall zone. A little beryl and biotite are in the dump. The muscovite is brownish olive; some is slightly mineral-stained, and most is clay-stained.

VESS COOKE PROSPECT

The Vess Cooke deposit, 1.8 miles N. 19° W. of Mooresboro (location 138, pl. 19), was prospected late in 1942 by means of a 15-ft pit. The pegmatite, which is no longer exposed, contains clear flat books of pinkish-buff mica.

FRANK CORNWALL (OLD J. S. BLANTON) MINE

The Frank Cornwall mine is 3 miles N. 50° W. of Shelby (location 128, pl. 19). It was opened many years ago by J. S. Blanton and was last reopened by the General Minerals Corp. of New York, in 1943. The accessible workings comprise a 34-ft shaft, a 25-ft drift that extends N. 70° E. at the 27-ft level, and a 25-ft crosscut that extends N. 10° W. at the 34-ft level (fig. 99). The drift connects with an old muck-filled shaft 23 ft from the new shaft.

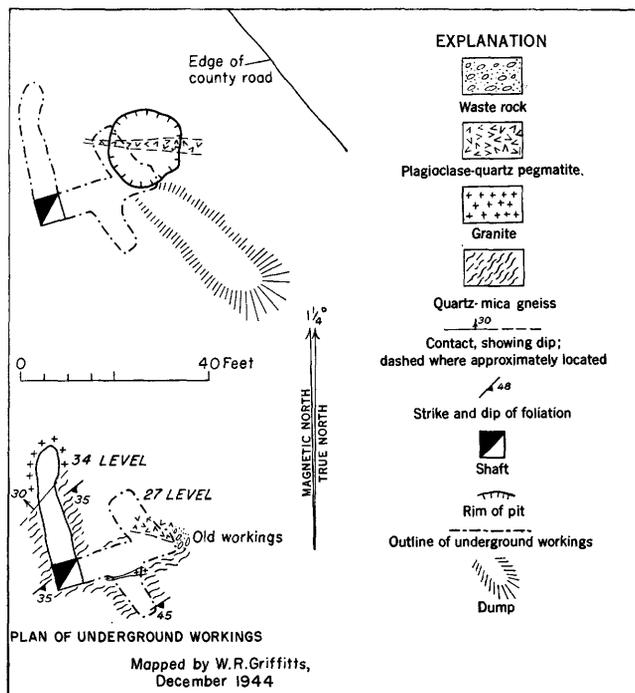


FIGURE 99.—Geologic map and plan of the Frank Cornwall mine, Cleveland County.

The country rock is fine-grained quartz-mica gneiss with many ¼- to 6-in. layers of dark-gray quartzite and lenses of dark-gray quartz. Both the quartzite beds and the schistose structure strike N. 55° E. and dip 35°

to 45° SE. The foliation strikes N. 35° E. and dips 30° to 40° SE. near the south wall of the deposit at the surface. Within 3 ft of the pegmatite the dip changes to 25° NW., but the strike is unchanged. The schist in the south wall of the drift near the pegmatite is bowed upward to form a small, southward-plunging anticline.

Three distinct types of intrusive rock are exposed in the workings. One granitic mass in the south wall of the drift lies parallel with the foliation of the country rock. It pinches and swells, ranging in thickness from a few inches to 1½ ft, and consists of microcline, sodic oligoclase, and quartz. Microcline crystals several inches in diameter are exposed near the shaft. A dike of granite exposed at the end of the crosscut strikes N. 45° E. and dips 30° NW. Its footwall contact is sharp but irregular, with many bulges 4 to 10 in. across. The granite within 4 ft of the contact is layered parallel with the foliation of the adjacent gneiss, whereas the granite farther from the contact is massive. The rock is composed of fine-grained quartz, plagioclase, and biotite. It is cut by several ½- to 1-in. stringers of somewhat coarser grained feldspar-quartz-muscovite granite.

Mica-bearing pegmatite is exposed in a very small area in the end of the drift and at the collar of the old shaft. It is a medium- to coarse-grained aggregate of quartz, oligoclase, perthite and muscovite. Exposures suggest that the deposit contains a core of massive quartz, a perthite-rich intermediate zone, and a wall zone of oligoclase-quartz pegmatite. It probably is 2 to 5 ft thick, but it appears to finger out upward near the surface. It strikes east, dips 75° N., probably is 30 to 40 ft long at the surface, and was mined down dip for at least 30 ft.

Muscovite was observed only along the north wall of the deposit, but books probably are scattered through the entire wall zone. The mica is pinkish buff and is free from mineral stains. Few books are ruled or reeved, and most are only slightly clay-stained.

C. ROBERT BLANTON MINE

The C. R. Blanton mine is 130 ft northeast of the Seaboard Railroad tracks and 4 miles west of Shelby (location 130, pl. 19). It was opened about 1919 by Jerry Camp and subsequently was operated by J. L. McSwain, who is said to have recovered mica valued at \$6,000. The General Minerals Corp. leased the deposit from C. R. Blanton in the summer of 1944 and sank two 22-ft shafts and drove 15 ft of drifts. A little pinkish-buff mica in small books was recovered from a small pegmatite body.

PHILBECK MINE

The Philbeck mine, 3 miles west of Shelby, was last worked in 1943, when G. C. Wallace, of Spindale,

cleaned out an old 26-ft shaft. The walls of the shaft are in kaolinized feldspathic pegmatite, and the bottom is in massive quartz. The feldspathic rock contains abundant small books of pinkish-buff flat-A mica. Much scrap mica is present in the dump.

NIAGARA MINE

The Niagara mine is on land owned by the Shelby Loan and Mortgage Co. 2.7 miles N. 60° W. of Shelby (location 129, pl. 19). It was opened in the spring of 1943 by M. H. Vermillion and Rowland Smart. In the fall of 1943 the General Minerals Corp., with Jesse Buchanan and A. L. McSwain as foremen, deepened the open-cut to 27 ft and lengthened it to about 25 ft.

The vertical pegmatite dike strikes N. 85° W. in mica schist. The country-rock foliation strikes uniformly N. 30° E. and dips 30° ESE. in the mine area. Within a few inches of the pegmatite contacts the schist contains much quartz and coarse flakes of muscovite. The south wall of the deposit is exposed only in the west end of the cut, where the dike is about 4 ft thick. The deposit thickens eastward to at least 10 ft.

The following pegmatite zones are distinguishable from the north wall to the south wall:

1. An 18-in. wall zone of plagioclase-quartz-muscovite pegmatite. About two-thirds of the rock is kaolinized plagioclase in masses 6 in. or less in diameter. The remainder is granular quartz, pinkish-buff muscovite, and biotite.

2. A 2½-ft intermediate zone of plagioclase-muscovite pegmatite. The plagioclase, which constitutes 80 to 90 percent of the rock, occurs in blocks as much as 2 ft across. Clusters of brown to yellowish-green "A" mica books fill the spaces between the blocks. Most are about 5 in. in maximum dimension, but some are as much as 2 ft long and half an inch thick.

3. A core of massive quartz 2 to 6 ft thick that thickens downward and pinches out upward at a point 10 ft beneath the surface.

4. Coarse-grained intermediate-zone pegmatite similar to that on the north side of the core. The south contact of this unit is not exposed.

The wall zone probably is present south of the core but is not exposed. It thins westward and becomes progressively more siliceous, and at the west end of the cut it consists chiefly of quartz and muscovite.

The wall-zone muscovite is clear and pinkish buff. Some books contain centers of biotite, and a few are lightly reeved. All are hard and free splitting, but some are cracked and clay-stained. The flat-A mica of the intermediate zone is commonly ruled and hair-cracked. Most is yellowish green, with yellowish to brownish-olive streaks parallel to the reeves. Many books are heavily clay-stained.

Most of the mining was restricted to the inner parts of the deposit and hence to the intermediate-zone mica. Recovery of sheet material might well have been more satisfactory if operations had been carried from wall to wall, with mining of the solid, clear, and flat wall-zone books. The dike shows little indication of pinching out in the present workings, but the downward thickening of the core might be accompanied by downward thinning of the feldspathic pegmatite.

HUNT MINE

The Hunt mine is 0.7 mile S. 73° E. of Lattimore (location 135, pl. 19). It was worked in the spring of 1942 by Walter Best and in the summer of that year by a Mr. Wilson, of Asheville. The main opening is a cut 45 ft long, 10 ft wide, and 30 to 40 ft deep. A row of small pits extends about 100 ft east from the cut, and a shallow pit dug in another pegmatite dike is about 400 ft to the northwest.

The deposit strikes N. 85° W. and dips 85° S. in mica gneiss whose foliation strikes N. 25° E. and dips 70° WNW. Pegmatite is exposed only in the east end of the cut, where it is 1½ ft thick. It was much thicker in the middle of the opening, where it contained a quartz core about 3 ft in maximum thickness. A little of the massive quartz on the dumps is clear, and some has a slight rose tint. Cinnamon-brown occurs in feldspathic pegmatite alongside the core. It is of good quality, but many of the books are small.

JONES MINE

The Jones mine, half a mile south of Lattimore (location 136, pl. 19), is owned by Malcolm Wilson. J. E. Burleson opened the deposit in 1915, and it was last worked in the fall of 1942 by Claude Wilson and L. H. Goodman, of Asheville. The openings include a shaft and an old caved cut 35 ft long, 20 ft wide, and 35 to 40 ft deep in original depth. The recent shaft was abandoned, owing to a very heavy flow of ground water.

The country rock is soft, weathered mica schist that strikes N. 40° W. and dips 60° SW. The pegmatite dike strikes east, dips 75° N., and is 2 to 5 ft thick. A fractured core of massive quartz contains scattered cavities that are lined with milky quartz crystals. The wall zone contains kaolinized plagioclase, interstitial quartz, and scattered but moderately abundant flat, pinkish-buff muscovite. Most of the mica is of excellent quality.

F. G. MCGINNIS MINE

After more than 50 years of idleness the McGinnis mine, 3.3 miles N. 76° W. of Shelby (location 134, pl.

19), was reopened by Mack Rose in 1943. The main workings included a caved open-cut 70 ft long, 5 to 20 ft wide, and 12 ft deep and shafts and drifts that are said to reach depths of 28 to 30 ft. The Rose shaft was sunk in old fill at the east end of the cut to a depth of 20 ft, where it was abandoned because of a large inflow of ground water.

The well-developed foliation of the country rock, a garnetiferous mica gneiss, strikes N. 60° E. and dips 50° SSE. near the pegmatite dike, but farther away the strike swings to N. 20° E. and the dip steepens to 60°. The dike strikes N. 80° E. and apparently is vertical or steeply inclined to the north. A quartz core that locally is as much as 6 ft thick is flanked by a wall zone rich in kaolinized plagioclase. The entire deposit is about 8 ft thick. Flat-A books of pinkish-buff mica occur near the core. They yield a fairly high proportion of clear, flat sheets, some of which are as large as 3 to 4 in.

W. H. HUMPHRIES PROSPECT

The Humphries prospect is in a wooded area southeast of a crossroad, 4.2 miles N. 79° W. of Shelby (location 133, pl. 19). Two shafts were sunk in pegmatite by N. S. Poole in the spring of 1943. The dike is 3 to 6 ft thick, strikes N. 58° W., and dips 85° NNE. The foliation of the enclosing garnetiferous mica schist strikes N. 40° E. and dips 65° SE. The thin core of the deposit consists of massive quartz with abundant tourmaline. It is flanked by a coarse-grained perthite-rich intermediate zone and a wall zone of kaolinized plagioclase, quartz, and scattered small, flat books of pinkish-buff mica. Much of the mica is hair-cracked and stained.

WEBB MINE

A mica deposit on the Toy B. Webb farm, 0.1 mile south of U. S. Highway 74 and 5.5 miles west of Shelby (location 143, pl. 19), was opened in 1940 and worked intermittently until the spring of 1943, when it was leased to John Cooper, of Asheville. The main opening is a cut 25 ft in diameter and 30 ft deep.

The pegmatite dike strikes N. 80° W. and dips 80° N. in feldspathic mica gneiss. The country rock is much contorted near the pegmatite, but 200 ft east of the cut it can be seen to strike N. 20° W. and dip 60° WSW. The deposit is 4 to 8 ft thick, with a probable average of 6 ft. The hanging wall is a straight, nearly plane surface, whereas the footwall is very irregular. The dike consists chiefly of plagioclase-quartz-muscovite-biotite pegmatite enclosing a discontinuous quartz core. The muscovite is clear and pinkish buff. Most books are flat, but some are reeved and many are clay-stained.

C. B. McSWAIN MINE

The McSwain mine is near a creek a quarter of a mile south of U. S. Highway 74 and 6.2 miles west of Shelby (location 142, pl. 19). The main workings comprise three narrow open-cuts, fig. 100). One is 28 ft long and 16 ft deep, and the second, 20 ft to the north, is smaller. The third cut, 65 ft southeast of the first, is 26 ft long and 15 ft deep. Its west end, apparently in fill, is timbered, and a shallow depression farther west appears to be an old filled pit. Another pit lies west of the easternmost cut.

The country rock is muscovite-quartz schist, with minor feldspar, sillimanite, and garnet. Sillimanite and garnet are locally very abundant, especially in the

creek bed near some outcrops of granite. The foliation trends N. 40° to 50° E. and dips 30° SE to 30° NW. Local changes in strike are common. Two masses of fine-grained granite (western type) 7 to 10 ft broad crop out in the stream bed. The rock consists of clear, colorless potash feldspar, kaolinized plagioclase, quartz, garnet, and biotite. It appears to occur as a sill in the mica schist. Fine-grained pegmatite (or coarse, pegmatitic granite) that is mineralogically similar also crops out in the creek bed. It contains much biotite near the west end of the mapped area. Like the fine-grained granite, it appears to be conformable with the structure of the enclosing schist.

Three pegmatite lenses have been mined. The westernmost mica-bearing pegmatite body thickens from

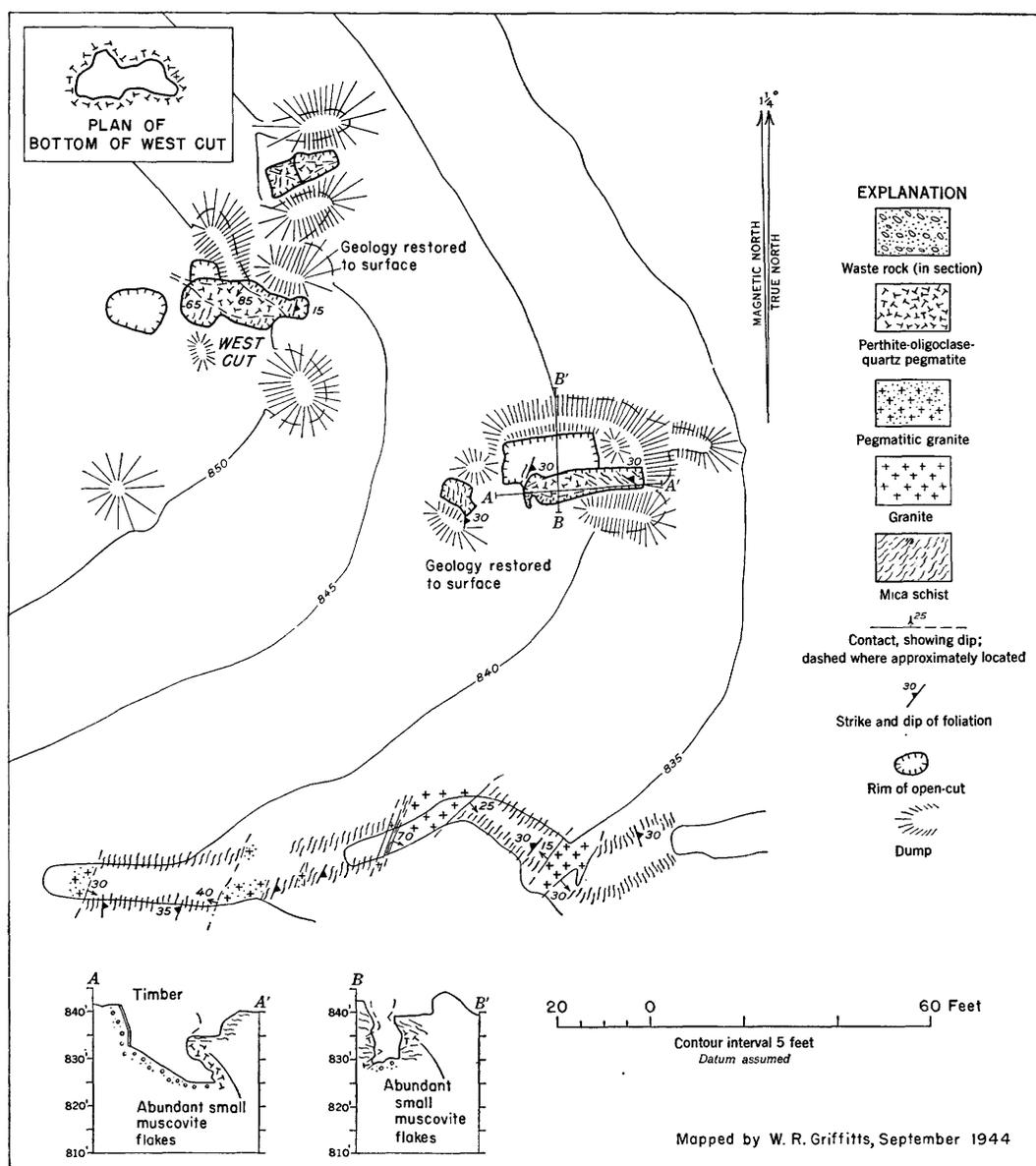


FIGURE 100.—Geologic map and sections of the G. B. McSwain mine, Cleveland County.

1½ to 2 ft at the west rim of the cut to about 6 ft near the middle and then thins to about 3 ft at the east rim of the cut. It is more than 9 ft thick at a depth of 16 ft directly beneath the west rim of the cut. The rock consists of perthite, plagioclase, quartz, and muscovite. No quartz-rich zone was observed. A poorly defined, nearly horizontal layering of plagioclase and perthite is exposed in the west face at a depth of 16 ft. The plagioclase-rich layers contain small scattered pods of quartz and mica.

As exposed in the easternmost cut, the southeast pegmatite body appears to be irregular in shape, thickening downward from 2 to at least 5 ft. A 1- to 4-in. border zone of quartz with scattered flakes of mica is well developed where the walls are flat or nearly so. A few large books of muscovite occur in the outer part of the wall zone, especially immediately beneath the quartzose border zone. Most of the exposed pegmatite is composed of perthite, plagioclase, and quartz. Dump material suggests that the deposit may contain a core of massive quartz and a coarse, perthite-rich intermediate zone.

The northernmost pegmatite body is lenslike in plan, with a maximum thickness of 4 or 5 ft.

The mica in the southwest and southeast pegmatite bodies appears to be scattered throughout the parts richest in plagioclase and quartz. The northernmost pegmatite is said to have yielded little mica. The books are pinkish buff, with brownish streaks parallel to "A" reeves. Some contain abundant tiny black specks, and many are badly reeved. Fractures and clay stains are not serious defects in these books. The westernmost deposit may well contain additional mica-bearing pegmatite, but there is little evidence to suggest that the reserves are large. Many pegmatite bodies in the vicinity of the mine are known to bottom at depths of less than 50 ft.

MILL RACE MINE

The Mill Race mine, 6.2 miles S. 73° W. of Shelby (location 144, pl. 19), is owned by the Spruce Pine Mica Co. and was last operated in the spring of 1943 by L. H. Goodman, of Asheville. The main opening is a cut about 125 ft long, 10 ft wide, and 10 to 15 ft deep to water level. The floor of the cut at the midpoint is 32 ft beneath the rim.

The country rock, a garnetiferous mica schist, is exposed only in the wall of the cut, where both the strike and dip are variable. The foliation appears to trend N. 85° E. and dip 50° S. The rock is much coarser within a few feet of the pegmatite contacts than elsewhere, and, in one block of rock, mica flakes 3 in. long and 1 to 1½ in. wide were observed. The recrystalliza-

tion of the schist is most pronounced between apophyses of pegmatite, which apparently are numerous.

The vertical pegmatite dike strikes N. 85° W. and is 6 to about 15 ft thick. It appears to thicken in both directions from the middle of the cut, but it thins again as traced farther along the strike. Little pegmatite is exposed above the water in the cut; hence most of the information about zonal structure in the deposit must be obtained from large blocks on the dump and from reported conditions at the bottom of the workings. A ⅛- to ½-in. border zone of plagioclase, quartz, biotite, and muscovite surrounds a medium-grained plagioclase-quartz-muscovite wall zone. The mica books are ½ to 4 in. in diameter. The wall zone also contains local accessory green apatite. The intermediate zone consists of plagioclase and minor perthite in blocks as much as a foot in diameter. The feldspar contains many small cavities and is veined by aggregates of small, thin flakes of yellowish-green mica. Between the feldspar blocks are clusters of mica books, some of which are 2 or 3 in. across. Many are euhedral and may have been formed in cavities.

The core of the deposit is massive quartz that contains a few blocks of plagioclase and masses of quartz-mica rock. Quartz-plagioclase veins also are present. Joint surfaces in the core are coated with calcite in thin, structureless crusts and in elongate rhombohedra. The carbonate rests upon quartz, feldspar, and mica. Sulfide minerals are said to occur at the bottom of the cut. The core is reported to thicken downward from a few feet at the rim of the cut to 10 or 15 ft at the floor. The flanking feldspathic zones taper downward correspondingly.

The wall-zone mica is flat and uniformly cinnamon brown. Most of the books are less than 2 in. in diameter. The intermediate-zone mica is somewhat reeved and contains cinnamon-brown to pale-greenish streaks parallel to the reeves. Operations were halted at the mine where the quartz core thickened, "squeezing out" the feldspathic units against the walls. Abundant mica-bearing pegmatite may lie farther along the strike of the dike, however, or even at greater depth beneath the floor of the cut. Large books of mica may occur along the crest of the core, as in the Plato Houser and Cliff Blanton deposits.

J. T. MARTIN PROSPECTS

Mica-bearing pegmatite was prospected in the spring of 1942 by N. S. Poole on the J. T. Martin property, 1¼ miles southwest of Boiling Springs (location 146, pl. 19). A 25-ft pit lies near a road, and there is a second pit 600 ft south of the road. The country rock is garnetiferous mica gneiss that trends N. 10° W. and dips 50° E.

The pegmatite dike in the pit near the road is 1½ to 4 ft thick and is irregular but roughly lenslike. It strikes N. 80° E. and dips 85° S. A core of massive quartz is flanked by kaolinized plagioclase-quartz-muscovite pegmatite. The muscovite is clear and pinkish buff to cinnamonbrown. Many of the books are cracked or are marred by "A" or herringbone structure. Most are small, and many of the reeved books are lousy as well.

The fill in the pit south of the road contains mica, kaolin, and blocks of quartz that probably were taken from the core of the dike. The mica is similar to that found in the pit near the road but is moderately to heavily clay-stained. Some books are color-zoned in shades of brownish olive, brown, and pinkish buff.

J. F. GREEN MINE

The Green mine is about a quarter of a mile east of the paved highway, at a point 1½ miles south of Boiling Springs (location 147, pl. 19). It is said to have been worked in 1918 by a Mr. Grindstaff, of Mitchell County, and it then lay idle until the summer of 1943, when Claude Anthony began to clean out the old open-cut. This cut is reported to have been deepened to 34 ft by the fall of 1944, when it was 24 ft long and 12 ft wide at the surface. Both ends are undercut.

The pegmatite dike strikes N. 70° W. and dips 85° SSW. in mica schist. It was oval in outcrop plan, with a length of about 25 ft and a maximum width of 8 ft. It pinched and swelled down the dip, and the strike length increased to at least 40 ft at a depth of 20 ft. Elongate rolls in the south wall may plunge 10° to 15° W. The deposit is reported to have been "cut out" by country rock at the bottom of the pit, and drifts driven 20 ft along the keel failed to expose any downward continuation.

A vertical layer of massive quartz 1 ft thick lies near the middle of the dike at the west end of the cut but probably is against the north wall near the east end. Large blocks of quartz, some as much as 4 ft across, attest the presence of a thicker layer, probably in the middle or lower part of the cut. The wall zone consists of kaolinized plagioclase, minor interstitial quartz, and scattered flat books of pinkish-buff mica. Only a few of the books in the mine scrap are as much as 5 in. in diameter. Somewhat larger flat-A books of brown to pinkish-buff mica are embedded in several quartz blocks on the dump.

OLD PLANTATION MINE

Emeralds were discovered in 1909 on the property of W. B. Turner (owned in 1944 by Lester Allen), 4¾ miles S. 30° W. of Shelby (location 151, pl. 19). The mineral rights then were purchased and the mine was

worked until 1913 by the Emerald Co. of America. The total production was about 3,000 carats of rough emerald valued at \$15,000 or more. The deposit has been described in some detail by Sterrett (1911, pp. 86-90) and by Keith and Sterrett (1931, p. 12).

The country rock is olivine gabbro and hornblende gabbro, and both biotite-rich and very quartzose varieties of western-type granite occur near the mine. About a quarter of a mile southeast of the mine the foliation in the granite strikes N. 10° E. and dips west. Several pegmatite dikes cut the olivine and hornblende gabbros. Three of these contain beryl, but the emerald variety is present in only one. The emerald-bearing dike strikes N. 70° W., dips 75° NNE., and ranges in thickness from a few inches to 6 ft. The strike length along the outcrop was 40 ft, and the keel of the deposit lies at a depth of 20 ft. A thin seam of pegmatite extends downward from the keel.

The pegmatite is a medium- to coarse-grained aggregate of quartz and plagioclase, with subordinate tourmaline, beryl, muscovite, and biotite. The plagioclase occurs as blocky crystals of median to sodic oligoclase and platy aggregates of calcic albite that approach the habit of cleavelandite. Quartz appears to have occurred as scattered masses rather than as a single large core. It is associated with brown muscovite and tourmaline. Some quartz-tourmaline stringers appear to fill fractures in oligoclase. Several miarolitic cavities in the pegmatite contain crystals of smoky quartz, plagioclase, tourmaline, and beryl. Some of the quartz crystals are moderately well formed and show trapezohedral faces that indicate a right-handed character. A little of this quartz is penetrated by thin, light-colored needles, possibly of rutile.

Emerald occurs as simple prismatic hexagonal crystals, many of which are deeply etched. Others contain internal striations or irregular tubes. Some of the tubes are large as compared with the size of the host crystal, but others are so small that they appear as silky striations. The emerald is embedded in both albite and quartz and also occurs as a vug mineral.

The mica in the main deposit is brown, hard, and clear, but most books are small. Most of the mica now on the dump occurs in small irregular masses of granular quartz that are interstitial to the plagioclase blocks. Probably little of the mined mica yielded sheet material.

Two other dikes, one 90 ft to the southeast and the other 200 ft to the east, contain beryl, some of which is aquamarine of gem quality.

ANTHONY PROSPECTS

Several prospect pits were dug during the fall of 1942 and the spring of 1943 on the properties of C. H. Anthony and J. R. Anthony, 1¾ miles south of Boiling

Springs (location 148, pl. 19), and additional prospecting was done on the neighboring Joe Hamrick and C. J. Hamrick properties. One pit several hundred yards west of the paved highway is 15 ft long, 4 ft wide, and 20 ft deep. Both ends are undercut. This pit exposes a vertical pegmatite dike that strikes N. 85° E. A 2- to 3-ft core of massive light-gray quartz in the east end of the cut pinches out downward and probably tapered westward in the cut.

At the west rim of the cut the deposit is represented by a few stringers of plagioclase-quartz pegmatite which coalesce and thicken to 5 ft at the 20-ft level. The zone of coalescence appears to plunge west. Books of muscovite are scattered through the plagioclase-quartz wall zone, but most are too small to yield even punch mica.

Two other pits on the C. H. Anthony property are partly flooded and caved. The northern opening is 25 ft deep and is inclined 85° E. The other is said to be larger. The mica schist country rock exposed in the northern opening strikes N. 5° E., dips 30° E., and is warped downward in a syncline above the pegmatite dike. The dike is 2 ft thick and probably trends N. 85° E. The pegmatite in the southern pit is at least 6 ft thick and consist chiefly of kaolinized plagioclase.

The mica in all the pegmatite bodies is pinkish buff, flat, and free from specks. Most is free splitting. Clay stains are common but not heavy. Many of the books are too small to yield trimmed sheet material.

LAIL PROSPECT

The Lail prospect, 2¾ miles south of Boiling Springs (location 149, pl. 19), was opened by Jim Randall in 1941. The open-cut was cleaned out to a depth of 15 ft in 1944 by Archie Norman, and the pegmatite body was found to have been almost completely mined out. Both clear pinkish-buff mica and spotted yellowish-olive mica occur at several other places on the O. G. Lail property.

OTHER MINES AND PROSPECTS

The information in the following descriptions of additional mines and prospects in the Shelby area was obtained from the Colonial Mica Corporation:

W. F. Gold mine.—The Gold mine is on the Shelby-Lawndale road, 6½ miles north by west of Shelby. A 12-ft pit near the Gold residence was sunk in pegmatite that contains books of "A" mica. Some clear sheets of good quality were recovered.

A second pegmatite dike a third of a mile south of the house was worked for a strike distance of 60 ft by means of pits and shallow drifts, and another pit lies 60 yd to the west. The country rock is mica gneiss that strikes north and dips 65° NE. A granite mass lies to the north. The vertical pegmatite dike strikes

east and contains a quartz core that locally is 8 ft thick. Most of the book mica occurs along the margins of the core. It is a clear reddish brown and is said to be of good quality.

Half a mile east of the Gold mine a 60-ft shaft is said to have been sunk on a mica concentration, but all the mica is reported to have been mined. Kaolin was found at the bottom of the shaft.

M. V. Davis deposit.—Mica occurs in a pegmatite dike on the M. V. Davis property half a mile south of Union Church (location 98, pl. 19). The deposit has not been explored.

S. J. Green mine.—The Green mine, about 7 miles northwest of Shelby, was first worked in the seventies and has been operated intermittently since that time. All the openings are caved. As shown by the position of 8 or 10 shafts and pits with appended tunnels, the pegmatite dike trends N. 70° E. and is at least 60 yd in outcrop length. The country rock, a coarse-grained mica schist, strikes north and dips 70° W. The deposit contains streaks of massive quartz as much as 3 ft thick, and in one of the workings book mica was obtained from the north margin of one of these masses. The mica is of good quality and is a clear reddish brown. The pegmatite is rich in partly kaolinized feldspar.

Lee Cornwell mine.—A mine on the Lee Cornwell property, near North Carolina Highway 26 and 5 miles northwest of Shelby, was worked by C. W. Hamilton in 1915. It was reopened in the summer of 1944 by J. R. Stamey, who sank a 32-ft shaft. The deposit trends nearly east and contains a core of massive quartz surrounded by mica-bearing pegmatite rich in kaolinized plagioclase. The mica is reddish brown and occurs in small books.

Esbridge prospect.—A mica deposit on the J. Lee Esbridge property, 6½ miles northwest of Shelby, was opened by George Gold between 1915 and 1920 and was reopened in the fall of 1944 by Jeter Stamey. The Stamey pit, 20 ft deep, exposes small books of reddish-brown mica in a pegmatite dike that strikes N. 80° E.

Ralph Gold mine.—Some old mine workings on the Ralph Gold property, 6 miles northwest of Shelby, were cleaned out during the summer of 1944 by Claude Buchanan, Ira Buchanan, and Arby Sparks, who also excavated an open-cut 44 ft long and 11 to 20 ft deep. The vertical pegmatite dike strikes N. 80° E. It consists chiefly of kaolinized feldspar, but a core of massive quartz is exposed in the floor of the cut. The mica content of the deposit is low.

Maynard Washburn mine.—The Washburn mine is 5 miles west-northwest of Shelby. The workings, which include three shafts, appended drifts, and two pits, were excavated prior to 1905. One pegmatite dike trends N. 70° W. and contains a large mass of quartz near its

south wall. It was worked by means of two 40-ft shafts. The other dike, about 50 ft north of the main workings, was opened by means of a shaft and pit. It contains a high proportion of "A" mica, but some good-quality sheets are reported.

Eskridge (A. Blanton) mine.—The old T. C. Eskridge mine, near the Washburn mine, has been idle for many years. The workings included a caved shaft and a slumped cut about 100 yds to the east. The dumps contain abundant flakes of clay-stained reddish-brown mica.

Bobby mine.—The Bobby deposit, $4\frac{1}{4}$ miles northwest of Shelby, was opened during the fall of 1943 by R. L. Rudasill, the property owner, who sank a 7-ft and a 23-ft shaft and drove short drifts from the deeper opening. The core of the deposit is massive quartz, and the wall zone is rich in kaolinized plagioclase. Small but hard and flat books of reddish-brown mica are abundant in the feldspathic pegmatite.

Magness prospect.—A prospect 4 miles northwest of Shelby (location 126, pl. 19), was opened by Sidney Cook, who exposed a thin pegmatite dike that contains badly reeved mica. No quartz core appears to be present.

B. H. Gregg deposit.—A quartz mass on the B. H. Gregg property, half a mile north of Washburn siding (location 132, pl. 43), is surrounded by mica schist. The deposit contains little book mica.

Johnson deposit.—Float fragments of flat, reddish-brown mica occur on the property of J. A. Johnson, 1 mile north of Lattimore. No prospecting has been done.

Carson prospect.—Mica-bearing pegmatite on the Carson property, 1 mile north of Lattimore, was prospected in 1942 by J. H. Goodman, who sank a 9-ft shaft.

Railroad prospect.—A pegmatite dike that strikes east is exposed near the Southern Railway tracks 1 mile southwest of Lattimore.

E. C. Hambrick mine.—The workings of the Hambrick mine, 4 miles west of Shelby, include an open-cut, a 45-foot shaft, and a tunnel. The pegmatite dike strikes east in coarse-grained mica schist. It contains clear mica of good quality. The output of sheet material is said to have been large, though mining was hindered greatly by water. Other mica-bearing pegmatite occurs on the property.

E. R. Ellis mine.—The Ellis mine workings, $4\frac{1}{2}$ miles west of Shelby, comprise several shafts, one of which is 50 ft deep. The mica in the deposit is badly ruled, and some is strongly marked by "A" structure.

Ellis North prospects.—Several mica prospects are reported on the land of a Mrs. McFall and Burl Blanton north of the Ellis mine, as well as on the land of

Coach McSwain and R. McSwain, 5 miles west of Shelby.

J. A. Lovelace mine.—A mica mine three-quarters of a mile southeast of Mooresboro (location 141, pl. 19), was worked by Will Blanton during World War I. It was reopened by Pink Lovelace, the present owner, in the spring of 1943, and further mining was done during the fall of 1943 and spring of 1944 by J. E. Phillips, of Spruce Pine. The largest opening, known as the No. 1 mine, is a cut 30 ft deep and 30 ft long. A 40-ft shaft, known as the No. 2 mine, is 75 ft to the west.

The pegmatite dike is 3 ft thick and strikes nearly east. It is reported to pinch out at the bottom of the shaft, but it is not known whether the deposit bottomed in the cut or merely became barren of mica. The pegmatite in the walls of the shaft contains moderate quantities of flat, clear, reddish-brown mica.

An old open-cut known as the Lovelace No. 3 mine was cleaned out by Phillips in October 1943. The deposit contains a quartz core that is flanked by pegmatite rich in kaolinized feldspar. Mica is moderately abundant in this wall-zone pegmatite, but the core thickens downward and the flanking mica-bearing rock thins to mere stringers at a depth of 25 ft.

Zoar Green prospect.—A prospect on the Zoar Green property, 2 miles south of Mooresboro, was opened by J. C. Gantt, who recovered a small amount of reddish-brown mica from feldspathic pegmatite.

T. A. Bridges prospect.—Clay-stained books of flat mica were recovered in three small pits dug in 1943 on on the T. A. Bridges property, 1 mile southwest of Mooresboro (location 140, pl. 19).

Ellis prospect.—A mica deposit 4 miles S. 70° W. of Shelby was opened in 1894 by a Mr. Glasscoe and was leased from the present owner, Sam Weathers, in the fall of 1943 by Paul Quinn and R. F. Ellis. A 9-ft shaft exposes a 4-ft pegmatite dike that contains much kaolinized plagioclase and scattered reddish-brown books of flat-A mica. Mica is plentiful in the part of the deposit that has been opened, and some books would yield 3-by-4-in. sheets.

Lovelace Heirs mine.—A mica mine on the property of the Lovelace Heirs, $1\frac{1}{2}$ miles north-northeast of Boiling Springs (location 145, pl. 19), was reopened in the summer of 1944 by L. D. Buchanan, Bob Buchanan, and J. Nat Hamrick. An old open-cut was lengthened to 29 ft and deepened to 16 ft. The deposit strikes N. 80° E. and contains a core of massive quartz. Flat, reddish-brown mica of good quality occurs in the surrounding feldspathic wall zone.

S. A. Green mine.—An old open-cut on the S. A. Green property, 1 mile north of Boiling Springs, was cleaned out and deepened to 22 ft in the spring of 1944 by W. P., J. H., O. D., and John Padgett, of Forest City.

The deposit contains a quartz core and a wall zone rich in kaolinized plagioclase. Reddish-brown book mica is locally plentiful.

W. A. Randall deposit.—Mica occurs in a creek bed on the W. A. Randall property, about 1½ miles east of North Carolina Highway 18 and near the South Carolina State line (location 152, pl. 19).

WESTERN ALEXANDER COUNTY

One outlying deposit is known in western Alexander County. This is the Benfield prospect, three-fourths of a mile from the Bethel M. E. Church and 10¼ miles southwest of Taylorsville (location 11, pl. 18). An old shallow pit that exposed massive quartz was cleaned out and deepened in September 1943 by Ray Jennings and A. H. DeVier. Very little mica-bearing pegmatite was found.

CENTRAL AND SOUTHERN CATAWBA COUNTY

MOOSE MINE

The Moose mine is 1.5 miles east-northeast of Newton (location 28, pl. 18). When recent operations were halted in the spring of 1944, the workings comprised an open-cut 60 ft long, 25 ft wide, and 36 ft deep at the southwest end and a 42-ft shaft near the middle of the cut (fig. 101). The country rock is mica schist that strikes N. 10° to 25° E. and dips steeply east-southeast. The pegmatite body is very irregular, and the eastern contact may bend to follow the southwestern half of the southeastern wall of the contact, delimiting the deposit in that direction. A core of massive quartz is locally more than 10 ft thick, and at one place near the middle of the cut it appears to strike N. 70° W. It is flanked by kaolinized wall-zone pegmatite that consists of plagioclase with minor perthite, muscovite, biotite, and quartz. Irregular pods and layers of dark-gray quartz and small mica flakes occur in this zone.

The book mica is pinkish buff and dark yellowish olive to yellowish green. Although some is stained, much clear sheet material can be obtained by careful rifting. Many books are 4 in. or more in diameter, and one yielded lightly reeved sheets 2 ft long and 15 in. wide. Although most of the books are of the flat-A type and some are locky, the yield of sheet mica is moderately high. Ruling and cracks are not common. Book mica evidently is most abundant near the quartz mass, especially east of it. Further work along the eastern part of the core might well reveal additional mica-bearing pegmatite.

No book mica appears to have been encountered in several pits north of the main openings. Pegmatite that contains abundant biotite and thick white quartz masses is exposed in a creek bed about 200 yd west of the mine, but little muscovite appears to be present.

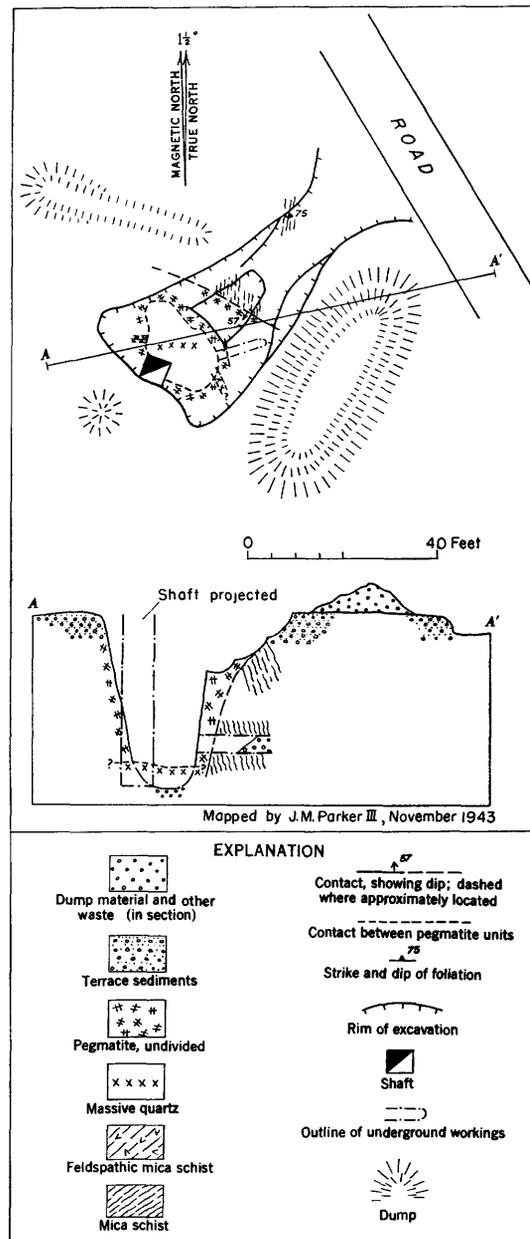


FIGURE 101.—Sketch map and plan of the Moose mine, Catawba County.

OTHER MINES AND PROSPECTS

Information on the following mines and prospects in central and southern Catawba County was obtained from the Colonial Mica Corporation:

Speagle prospect.—A prospect on the J. W. Speagle property is 1½ miles northwest of a point on North Carolina Highway 10 that is 5 miles northeast of the intersection with North Carolina Highway 18. A little reddish-brown mica was obtained in the summer of 1943 and spring of 1944 from a pit about 40 ft long and 10 ft deep.

Wyant prospect.—The Wyant prospect is 1 mile north of a point on North Carolina Highway 10 that is 4 miles

northeast of the intersection with North Carolina Highway 18. It was opened in the spring of 1944 by Ralph Young. A 7-ft pit exposes a pegmatite dike that appears to trend east. It contains reddish-brown book mica.

Jonas prospect.—Mica-bearing pegmatite has been prospected on the Roy Jonas property, $1\frac{3}{4}$ miles west-northwest of Plateau (location 7, pl. 19). A large quartz mass is flanked by hard feldspathic pegmatite. The book mica is clear and reddish brown.

Terry mine.—The Terry mine, about 7 miles south of Catawba, is owned by Lock N. Rink, of Catawba County. It was worked during the period September 1943–May 1944 by J. A. Terry, of Charlotte. The pegmatite dike strikes N. 20° W. and dips 45° WSW. It was opened to a depth of 31 ft, where it is said to be at least 4 ft thick. The irregular eastern contact is marked by tongues of pegmatite that extend outward along the foliation planes of the country-rock gneiss. The deposit is rich in kaolinized feldspar and contains flat-A books of muscovite. Trimmed sheets as large as 3 by 4 in. were obtained during the recent operation.

Withers prospect.—During the fall of 1943 a Mr. Blanton sank a prospect pit on the A. B. Weathers property, three-fourths of a mile from East Maiden. Abundant small books of pinkish-buff mica occur in kaolinized feldspathic pegmatite. Most of the mica is scrap.

Williams mine.—The Williams mine, about 6 miles east of Maiden, can be reached from that town over 7 miles of North Carolina Highway 16 and three-fourths of a mile of dirt roads that extend southward and eastward. It is owned by Ben Williams and was worked in 1944 by J. A. Moses, of Newton. The main opening is a narrow cut 39 ft long and 10 to 24 ft deep.

The vertical pegmatite dike strikes N. 50° W. It consists chiefly of feldspathic pegmatite with rather heavily reeved green mica. Some is moderately spotted, and the degree of staining appears to increase with depth. The deposit has not been fully explored.

EASTERN CLEVELAND COUNTY

J. L. FOSTER PROSPECT

Several northeastward-trending pegmatite dikes occur on the J. L. Foster property, $8\frac{1}{2}$ miles N. 83° E. of Shelby (location 65, pl. 19). Fragments of mica and beryl are exposed in several shallow prospect pits.

SWEETZ MINE

A mine on the W. P. Sweezy property, 8 miles N. 82° E. of Shelby (location 64, pl. 19), was worked in 1943 and 1944. Two shafts about 15 ft apart are said to be connected by a tunnel at a depth of 20 ft. All the workings have been filled, and the attitude of the

deposit is not known. In a nearby outcrop the mica schist country rock strikes N. 60° E. and dips 35° SSE. The mine dumps contain fragments of reddish-brown mica. Although the books are small, many would yield punch and small-sheet material.

J. NORTH SMITH PROSPECTS

Several large quartz "veins" crop out on the J. North Smith farm 7 miles S. 61° E. of Shelby (location 75, pl. 19). Shallow pits and cuts demonstrate that these are the cores of pegmatite dikes. The feldspathic wall zones appear to contain scattered small and lousy books of muscovite, but no mica-rich shoot has been disclosed.

W. H. FORTENBERRY PROSPECT

A prospect on the W. H. Fortenberry property, near a church $2\frac{1}{2}$ miles due north of Grover (location 76, pl. 19), consists of a pit 15 ft long and 10 ft deep that was dug in the fall of 1942. The pegmatite dike, which is about 4 ft thick, strikes N. 30° E. and dips 80° ESE. in pegmatitic granite. A core of massive gray quartz contains crystals of aquamarine beryl as much as an inch in diameter. The quartz pinches out at a depth of less than 15 ft. Small, badly fractured books of pinkish-buff mica are scattered through the wall-zone pegmatite, which is rich in kaolinized plagioclase. The mica is free from mineral stains and is not heavily clay-stained, but the books are so small that they yield little but scrap material.

OTHER MINES AND PROSPECTS

The information in the following descriptions of other mines and prospects in eastern Cleveland County was obtained from the Colonial Mica Corporation:

J. A. Beam prospect.—A 50-ft shaft was sunk during 1944 on the J. A. Beam property, $1\frac{1}{2}$ miles southwest of Waco (location 56, pl. 19). The deposit strikes N. 40° E. and contains scattered books of clay-stained mica.

M. P. Harrelson prospect.—A prospect on the M. P. Harrelson farm, $1\frac{1}{2}$ miles west of Waco, was opened by Lee Braddy, the farm tenant. Both small flat books of reddish-brown mica and larger "A" books of green mica are present but are not particularly abundant.

Sherrill prospect.—A deposit on the Herbert Sherrill property, $1\frac{1}{2}$ miles south-southeast of Waco (location 57, pl. 19), yielded broken and lousy books of reddish-brown mica in the summer of 1944.

Rhyne deposit.—Float fragments of mica occur on the H. B. Rhyne property north of Bethel Church in eastern Cleveland County (location 63, pl. 19).

Borders mine.—An open-cut 45 ft long, 20 ft wide, and 9 ft deep was dug in 1942 on the C. C. Borders

property, about 6 miles east-northeast of Shelby. The pegmatite dike strikes northeast and contains little sheet mica. Several tens of tons of grade 2 feldspar was recovered during the mining operations.

J. W. Cornwell deposit.—A deposit on the J. W. Cornwell property, near U. S. Highway 74 and 6 miles east of Shelby, contains grade 1 feldspar but little book mica that would yield usable sheet material.

Mayes prospect.—A pegmatite dike that contains beryl and coarse, blocky feldspar occurs on the James Mayes property, $5\frac{1}{4}$ miles east of Shelby (location 66, pl. 19). Very little book mica was exposed during prospecting operations.

D. M. Falls prospect.—Reddish-brown mica was obtained during the spring of 1944 in a pit on the D. M. Falls property, $3\frac{1}{2}$ miles northwest of Kings Mountain (location 67, pl. 19).

NORTHWESTERN CLEVELAND COUNTY

CLYDE WARLICK MINE

The Warlick mine, on the west outskirts of the village of Casar (location 80, pl. 19), is in a pegmatite dike that extends from the Clyde Warlick property on the north to the Bracket property on the south. A 20-ft pit was dug many years ago on the Bracket property, and in 1943 Warlick sank two 27-ft shafts a few tens of feet north of the Bracket pit. A 13-ft drift was driven north from the northern shaft.

The country rock is garnetiferous mica schist. Its attitude varies greatly near the pegmatite contacts. The foliation strikes N. 50° E. and dips 80° SE. in the Bracket pit but strikes N. 10° W. and dips 80° E. in the Warlick workings. The pegmatite dike trends N. 30° E., dips 10° ESE., and is 3 to 4 ft thick. It contains a 1-ft core of massive quartz and a plagioclase-rich wall zone. Book muscovite occurs in both the core and the wall zone but is most abundant along the footwall of the deposit, where it is accompanied by biotite. The muscovite is pinkish buff, hard, free splitting, and not heavily clay-stained. Most of the books are small, and the largest recoverable trimmed sheets are about 2 by 3 in.

MULL MINE

The Mull mine is 2.4 miles east-southeast of Casar (location 78, pl. 19). Small-scale prospecting has been done. The workings comprise a cut 30 ft long and 15 ft wide and several caved shafts, probably 30 to 40 ft deep. All are grouped within a strike distance of 80 ft.

The poorly exposed pegmatite dike strikes N. 70° E. and dips 70° NNW. in mica gneiss. The country-rock foliation strikes N. 30° W. and dips 60° WSW.

The deposit is at least 20 ft thick and contains several masses of quartz as much as 2 ft thick. These may be segments of a discontinuous core. Some flat mica books are scattered through the feldspathic wall zone, but most of the mica in the deposit is strongly marked by "A" structure. The dumps contain abundant scrap mica.

LEDFORD MINE

The Ledford mine is a short distance east of North Carolina Highway 26 at a point 2 miles south-southwest of Casar (location 82, pl. 19). It is owned by Mrs. Lona Ledford and was opened by her husband many years ago. The old open-cut was cleaned out in December 1942 by the Schmidt brothers of Rutherfordton, was reopened in May 1944 by Boyd Whistnant and Fonza Benfield, and was worked in August 1944 by Mrs. Ledford and her son. The cut, which trends N. 20° E., is 30 ft long, 20 ft wide, and 23 ft deep. Its north end is undercut about 10 ft.

The garnetiferous mica gneiss exposed in the walls of the cut strikes N. 20° W. and dips 65° ENE. The pegmatite dike, which strikes N. 20° E. and dips 85° WNW., is 2 to 3 ft thick at the ends of the cut but bulges downward to 8 ft or more. It appears to be thicker at the north than at the south end of the cut floor and hence may plunge north. A core of massive quartz is exposed at the north end of the cut, where it is about a foot thick. The large size of the quartz blocks on the dump suggests that the core was several feet thick near the middle of the cut. The wall zone consisted of kaolinized plagioclase, interstitial quartz, and muscovite. The feldspar is said to be only slightly weathered at the bottom of the cut.

Two types of book muscovite occur in the deposit. Flat, pinkish-buff mica is scattered through the wall-zone pegmatite, and flat-A books appear to fringe the quartz core. Many of the books are small and many are badly cracked, so that most of the recoverable sheet material probably is 2 by 3 in. or smaller.

HASTINGS MINE

Mica was mined 2 miles south-southeast of Casar (location 81, pl. 19) by Frank Hastings and Levi Bibby about 1893, and the old pit was cleaned out during the fall of 1943 and spring of 1944 by John B. Stroud and Clyde Warlick. A 25-ft shaft also was sunk and a short drift driven to the southwest. The deposit is owned by Wade Hastings.

The pegmatite dike is about 8 ft thick. It contains a 14-in. core of massive quartz surrounded by feldspathic pegmatite. The deposit pinches out at the end of the drift. Flat books of pinkish-buff mica are said to have been abundant within 2 ft of the wall-rock contacts and to a depth of 22 ft in the shaft. They are

less abundant in the bottom of the shaft and in the drift. The books are moderately large, and some trimmed sheets as much as 5 in. in diameter were recovered.

The pegmatite bodies in the neighboring Ledford mine and in the mines east of Polkville plunge northeast. This suggests that the southwest drift may have been driven toward, rather than away from, the keel of the Hastings deposit and that unmined mica-bearing pegmatite may lie northeast of the shaft. This could be tested by trenching north of the shaft collar.

L. R. ELLIOT MINE

The Elliot mine is on a hilltop in front of the L. R. Elliot residence, 3½ miles southwest of Casar (location 83, pl. 19). It was worked many years ago for beryl, and a little mica was obtained from it during 1942. The largest opening is a cut 15 ft long, 6 to 8 ft wide, and 18 ft deep. Another, smaller hole lies about 500 ft to the southwest.

The pegmatite dike strikes N. 20° E. in mica gneiss whose foliation strikes N. 5° E. and dips 55° W. It is about 6 ft thick, and its contacts with the wall rock are marked by many thin apophyses. The core of the deposit is coarse-grained perthite-quartz pegmatite, and no large mass of quartz is exposed. The wall zone probably is rich in kaolinized plagioclase. Crystals of beryl and lightly reeved books of pale-greenish mica occur in the core, and clear, flat, pinkish-buff to cinnamon-brown books occur with biotite in the wall zone. The muscovite of best quality occurs near the west wall of the deposit, especially where biotite is abundant.

LATTIMORE MINE

The Lattimore mine, a short distance west of Duncans Creek, is 3¾ miles northwest of Polkville (location 84, pl. 19). The main opening is a slumped and partly filled cut 30 ft long and 15 ft deep. The old dumps are rather large. A little prospecting was done at the deposit in May 1943.

The country rock is garnetiferous mica gneiss that appears to differ lithologically on the two sides of the pegmatite dike. Tourmaline is locally abundant near the pegmatite contacts. The gneissic structure trends N. 50° E. and dips 70° SE. It is somewhat contorted near the pegmatite, which trends N. 20° E. and dips 80° WNW. The deposit is slightly curved in outcrop plan and thins from 6 ft near the middle of the cut to 6 in. at the north end and 3 ft at the south end. It consists of quartz, feldspar, tourmaline, muscovite, and perhaps beryl. The muscovite is pinkish buff, and some is slightly wavy and lightly clay-stained. Cracks, ruling, and reeves are not common.

T. C. STROUD PROSPECTS

Two prospects were opened on the property of T. C. Stroud, a short distance northwest of Hinton Creek and 2¾ miles west of Polkville (location 90, pl. 19). The country rock at both places is mica gneiss that strikes N. 30° W. and dips 80° WSW. At one prospect a 14-ft pit in a field exposes a pegmatite dike that is 1½ to 3 ft thick, strikes N. 20° E., and dips 65° WNW. It appears to pinch out at the northeast end of the pit. The book mica is pinkish buff and of good quality, but the total amount of mica-bearing pegmatite is small.

The other prospect pit is 12 ft deep and exposes a pegmatite dike 4 to 8 ft thick. This deposit also strikes N. 20° E. but dips more steeply west-northwest. The pegmatite is fine- to medium-grained and contains small mica books of good quality.

CLIPPARD PROSPECT

A prospect beside a farm road on the Clara Clippard property, 1½ miles southeast of Casar (location 79, pl. 19), was opened by Joe Price, who recovered small, broken books of pinkish-buff mica from a pegmatite dike that strikes N. 80° E.

EASTERN RUTHERFORD COUNTY

LAX STROUD MINE

The Lax Stroud mine, 1½ miles ESE. of Hollis (location 91, pl. 19), was opened in the fall of 1942 by V. V. Wallace, of Rutherfordton, who excavated a pit and sank a 25-ft shaft. The pegmatite dike strikes N. 32° W. and dips 85° WSW. in mica schist. The country-rock foliation strikes N. 57° W. and dips 50° SW. The deposit is 8 ft thick and is exposed for a strike distance of 30 ft. It consists chiefly of kaolinized plagioclase with minor quantities of biotite and pinkish-buff muscovite in very small books. Some of the muscovite is slightly stained and some is locky.

DYCUS MINE

The Dycus mine is near the west bank of Sandy Creek 3.2 miles north-northeast of Ellenboro (location 158, pl. 19). The surface rights to the property are owned by C. O. Dycus, and the mineral rights are held by Dr. L. L. Williams, of Spruce Pine. Linzley Pendley and others worked the deposit intermittently for many years by means of shafts, and in the spring of 1943 Frank Watson and Williams drove a 230-ft adit westward into the hillside. It was abandoned when the bottom of an old muck-filled opening was encountered. During the fall of 1943 and the spring of 1944 M. W. Thomas, of Spruce Pine, sank a 60-ft shaft, drove a 63-ft crosscut northwestward from it, and then deepened the shaft to 80 ft. He is said to have

abandoned work because of a strong flow of ground water.

The country rock is mica schist with minor inter-layered hornblende gneiss and quartz-mica-sillimanite schist. The foliation strikes slightly east of north and dips moderately to steeply east. A mass of granitic intrusive rock is exposed in the tunnel 48 ft west of the adit portal (fig. 102), where it strikes N. 20° to 30° E. and dips 80° ESE. A 5- to 7-ft layer of medium-grained quartz monzonite that lies west of the contact consists of microcline, plagioclase, muscovite, biotite, and quartz. Along the contact with the schist is a fairly continuous 1- to 2-in. layer of feldspar and quartz, and between it and the main quartz monzonite mass is a fringe of biotite books $\frac{1}{4}$ to 1 in. across. The feldspar-quartz rock also forms a tongue that extends eastward into the schist.

Irregular layers and pods of coarse-grained quartz-feldspar-muscovite pegmatite are enclosed in the quartz monzonite. The very irregular contact between the quartz monzonite and the main pegmatite mass trends north-northeast, and its general position is shown in figure 102.

The main pegmatite body is very large. Its total thickness is not known, but if it is a symmetrically zoned dike it must measure about 240 ft from wall to wall. It appears to contain at least four zones that are complicated by many large septa and inclusions of schist. The outer zone exposed in the adit is about 10 ft thick and consists chiefly of plagioclase and quartz. West of it is a 15- to 20-ft zone of plagioclase-perthite-quartz-muscovite pegmatite. Flat books of mica occur with both the potash feldspar and the plagioclase, and some are associated with masses of white quartz a foot or less in length. Most of the books are less than 2 in. across, and some are intergrown with biotite.

West of the mica-bearing pegmatite is an 80- to 90-ft zone of medium-grained plagioclase-perthite-quartz pegmatite that contains minor amounts of muscovite in very small books. Slabby inclusions of schist and quartz monzonite as much as 10 ft long are abundant. Still farther west is a zone of blocky perthite and massive quartz. Some of the perthite crystals are 5 ft in diameter. Most of the quartz bodies are surrounded by 1- to 1½-in. layers of plagioclase, and brown books of flat-A mica are locally abundant. Some of these are as much as 8 in. in diameter. If exposures were more complete, it might be possible to subdivide this inner zone into a discontinuous quartz core and an intermediate zone rich in very coarse, blocky perthite. Medium-grained plagioclase-perthite-quartz pegmatite is exposed in the inner 13 ft of the adit.

The general concordance of the contacts, between quartz monzonite and schist and between quartz mon-

zonite and pegmatite, the detailed irregularity of the contact between quartz monzonite and pegmatite, and the close association and mineralogic similarity of the quartz monzonite and pegmatite suggest that these igneous rocks are genetic associates. The granite may have been only partly crystallized when the pegmatite was emplaced.

The mica that occurs in the outer zone is pale to dark cinnamon brown, flat, hard, and almost free from ruling and cracks, but the books exposed in the adit are rather small. The mica in the inner zone is distinctly larger and is marked by "A" structure. Many of the books would yield trimmed sheets 2 by 2 in. or larger. They are brown, locally with gratinglike patterns of yellowish-olive and brown bands, and most are not badly ruled or cracked.

Most of the mining from the old shafts apparently was done in the blocky perthite zone. It is possible that a shoot rich in large, flat books of mica may occur in plagioclase-rich pegmatite near either the east or the west wall of the deposit. The mica-bearing zone near the east wall could be explored from the adit without much difficulty.

MAURICE MINE

The Maurice mine, on the northern outskirts of Ellenboro (location 159, pl. 19), was opened prior to 1941 by Frank Harrell. In the spring of 1942 E. M. Grindstaff sank two 35-ft shafts and connected them with a 35-ft tunnel. The Schmidt brothers, of Rutherfordton, are said to have deepened both shafts to 50 ft in the fall of the same year.

The vertical pegmatite dike strikes N. 5° E. in garnetiferous mica gneiss. The country-rock foliation strikes N. 55° W. and dips 35° to 55° NE. The dip along the east wall of the deposit appears to be less steep than that along the west wall. The deposit is about 2 ft thick at the surface but thickens downward. All the pegmatite exposed above water level (14-ft depth) is kaolinized plagioclase with interstitial quartz and a little book mica. A few small blocks of granular quartz are present in the dump, but the dike is not known to contain a massive quartz core. A little tourmaline is the only observed accessory constituent.

The mica is pinkish buff. Much is fractured and reeved, and some is typical wedge-A mica. The books remaining on the dump are small, but one 1,500-lb book is said to have been obtained during the mining operations. The recovery of sheet material from the mine-run mica probably was fairly low. According to Grindstaff, the dike continues beneath the drift but appears to be virtually barren of mica in this part of the mine.

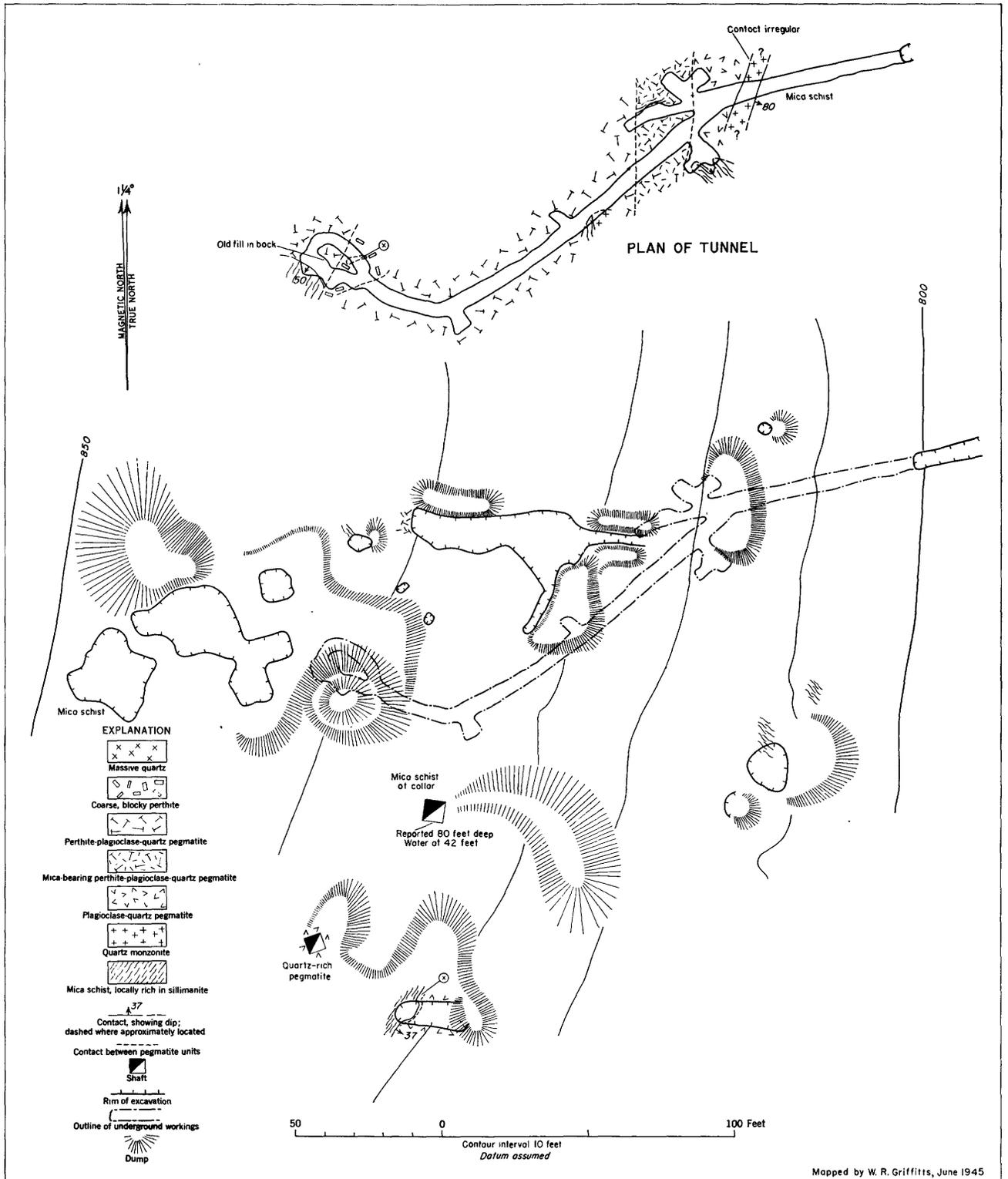


FIGURE 102.—Geologic map and plan of the Dycus mine, Rutherford County.

OTHER MINES AND PROSPECTS

Information on the following additional mines and prospects in eastern Rutherford County was obtained from the Colonial Mica Corporation:

Huckleberry Mountain mine.—A small pit exposes pegmatite on the property of the Wright-Bachman Lumber Co., near the top of Huckleberry Mountain, 8¼ miles north of Hollis (location 153, pl. 19). The dump contains mica books of moderately large size and good quality, and large sheets are said to have been recovered during the mining operations.

Lisenberry Mountain prospect.—A small pit is said to have been dug on the side of Lisenberry Mountain, on property owned by the Wright-Bachman Lumber Co., 4¼ miles north of Hollis (location 154, pl. 19). It is in back of the Gray Panther residence. A few small mica books were found.

Price prospect.—A mica deposit on the property of Mrs. V. V. Price, behind Duncans Creek Church 3¼ miles north of Hollis (location 155, pl. 19), was prospected in 1944 by W. P. Padgett. A 15-ft pit exposes a 3-ft pegmatite dike that contains scattered books of reddish-brown mica.

Cherry Mountain mine.—The Cherry Mountain mine, on the top of Cherry Mountain about 4¾ miles northeast of Sunshine (location 156, pl. 19) was opened in 1895 by V. A. Smith, of Golden. P. J. Elliot, the present owner, cleaned out some of the old workings about 1941, and in the spring of 1944 he cleaned out an old open-cut, lengthened it to 60 ft, and deepened it to 22 ft. He later sank a 15 ft shaft and drove a 12-ft drift northward from it.

The pegmatite dike is about 2 ft thick, strikes N. 15° E., and dips 70° to 80° WNW. It contains a quartz core surrounded by a wall zone rich in kaolinized plagioclase. Scattered small books of pinkish-buff mica occur near the walls.

Joe Lovelace prospect.—A mica deposit behind the Joe Lovelace residence, 2 miles south of Sunshine (location 157, pl. 19), was prospected by R. E. Newton in 1942. The lease was transferred in 1943 to J. Sprunt Wortham, of Asheville. A 12-ft pit exposes feldspathic pegmatite and abundant small books of "A" mica.

Sunshine prospect.—A little mica was recovered in 1942 from a pegmatite dike on the S. U. Lovelace property, 2 miles south of Sunshine (location 157, pl. 19).

The deposit, which is 7 ft thick, was prospected by J. Sprunt Wortham, of Asheville.

D. G. McKinney prospect.—A prospect on the D. G. McKinney property, 5 miles northeast of Ellenboro, was opened about 1932 by a Mr. Hamilton, of Rutherfordton. The pegmatite body contains beryl and books of reddish-brown mica.

W. H. Bailey deposit.—Pegmatite is exposed in a creek bed on the property of W. H. Bailey, 2¾ miles southwest of Bostic (location 160, pl. 19). It is said to contain quartz, feldspar, and biotite but little or no book muscovite.

J. M. Mayes prospect.—A 2- to 3-ft pegmatite dike on the J. M. Mayes property, 2½ miles southeast of Forest City (location 161, pl. 19), was prospected in 1943 by Dick Shehan and E. L. Walker, who drove a drift into the hillside. The deposit is said to contain mica of moderately good quality.

Doc Lovelace prospect.—A 6-ft prospect hole on the R. Thomas Lovelace property 2¾ miles southeast of Forest City (location 162, pl. 19), exposes a pegmatite dike that contains mica of good quality. The deposit pinches out at the bottom of the hole.

REFERENCES CITED

- Hess, F. L., 1940, The spodumene pegmatites of North Carolina: *Econ. Geology*, vol. 35, pp. 942-966.
- Hess, F. L., and Stevens, R. E., 1937, A rare-alkali biotite from Kings Mountain, N. C.: *Am. Mineralogist*, vol. 22, pp. 1040-1044.
- Keith, Arthur, and Sterrett, D. B., 1931, U. S. Geol. Survey Geol. Atlas, Gaffney-Kings Mountain folio (no. 222).
- Kesler, T. L., 1942, The tin-spodumene belt of the Carolinas: *U. S. Geol. Survey Bull.* 936-J.
- 1944, Correlation of some metamorphic rocks in the central Carolina Piedmont: *Geol. Soc. America Bull.*, vol. 55, pp. 755-782.
- Palache, Charles, Davidson, S. C., and Goranson, E. A., 1930, The hiddenite deposits in Alexander County, N. C.: *Am. Mineralogist*, vol. 15, pp. 280-302.
- Pratt, J. H., 1902, The mining industry in North Carolina in 1901: *North Carolina Geol. Survey Econ. Paper* 6.
- Sterrett, D. B., 1911a, North Carolina mica deposits, in Pratt, J. H., and Berry, H. M., *The mining industry in North Carolina during 1908, 1909, and 1910*: *North Carolina Geol. Survey Econ. Paper* 23, pp. 32-70.
- 1911b, Monazite deposits of the Carolinas, in Pratt, J. H., and Berry, H. M., *The mining industry in North Carolina during 1908, 1909, and 1910*: *North Carolina Geol. Survey Econ. Paper* 23, pp. 72-82.
- 1923, Mica deposits of the United States: *U. S. Geol. Survey Bull.* 740.

PART 6. OUTLYING DEPOSITS IN NORTH CAROLINA

By WALLACE R. GRIFFITTS

ABSTRACT

The outlying mica deposits of North Carolina occur mainly in three general areas: a northeastern Piedmont area, the Milton area in Caswell County, and a western Piedmont area. Few of the mica-bearing pegmatites have been worked to any great extent, and many have not even been prospected. Deposits in the Milton area have been worked for feldspar, and other pegmatites there and in the northeastern Piedmont area might be satisfactory sources of feldspar. The future of the western Piedmont area, however, appears to lie in the production of small to moderate quantities of stained sheet mica.

INTRODUCTION

Many bodies of mica-bearing pegmatites are scattered through parts of Wake, Warren, Franklin, and Caswell Counties in the eastern North Carolina Piedmont, as well as through Yadkin, eastern Wilkes, western Caldwell, western Burke, central Rutherford, and Polk Counties farther west. In addition, mica occurs in the feldspar deposits of the Milton district in northeastern Caswell County. For purposes of description the pegmatites can be grouped into three areas: a northeastern Piedmont area, the Milton area, and a broader western Piedmont area.

Few of the pegmatites have been worked on a large scale, and many have not even been prospected. Most have received little attention from geologists. Investigations on behalf of the Geological Survey include the examination and description of several deposits by Sterrett (1923, pp. 188, 261-263, 268, 271-273) many years ago and the examination of six deposits by W. R. Griffitts in 1945. Also the geology of western Wake County has been studied during recent years by J. M. Parker III, who examined several prospects in this and adjacent areas. Additional information concerning deposits that were mined or prospected during the period of World War II was obtained from examination reports written by D. J. Smith, field engineer for the Colonial Mica Corp.

WARREN, FRANKLIN, AND WAKE COUNTIES: NORTHEASTERN PIEDMONT AREA

GEOGRAPHY

Most of the pegmatite deposits in the northeastern Piedmont area occur in western Franklin County, about

4 miles west of Franklinton, and in Franklin and Warren Counties, 2 to 8 miles south of Inez (fig. 103). Others are scattered through northern and eastern Wake County. None of the known deposits lies more than 3 miles from a paved State or Federal highway. The main line of the Seaboard Airline Railway extends northward from Raleigh through Franklinton, and from Norlina a branch line extends eastward through central Warren County. Another branch extends southward to Warrenton, which is 16 miles by paved highway from the center of the group of deposits south of Inez.

The eastern Carolina Piedmont is very gently rolling to nearly flat. It is slightly dissected by streams, so that most of the valley floors lie 80 to 130 ft below the neighboring hilltops. The maximum relief is about 300 ft. The altitudes of the larger streams, the Neuse and Tar Rivers, range from 170 to 200 ft, and their gradients are only a few feet per mile. The larger tributaries to these rivers trend northeast and locally are in close conformity with the structure of the underlying rocks. The imperfect trellis drainage pattern developed by the smaller streams is well shown on the topographic map of the Raleigh quadrangle.

GEOLOGY

A large mass of granite trends slightly east of north through eastern Wake County, eastern Franklin County, and central Warren County. Through a part of Wake County its outcrop breadth is as much as 17 miles, and the exposure is still broader in Johnston County to the south. The area east of the granite is underlain by mica schist, phyllite, and gneiss, and west of the granite is a series of slaty to gneissic rocks that vary greatly in composition from place to place. Some of the rocks in both belts may be metamorphosed volcanic flows and clastics. Their structure is intricate and complex. A broad belt of gneiss that lies immediately west of the granite body is thoroughly impregnated with granitic material.

A few pegmatite bodies, those in Wake County, are west of the granite, but most lie east of it in Warren and Franklin Counties. Some are in schist, injection gneiss, or granite very close to the contact of the main

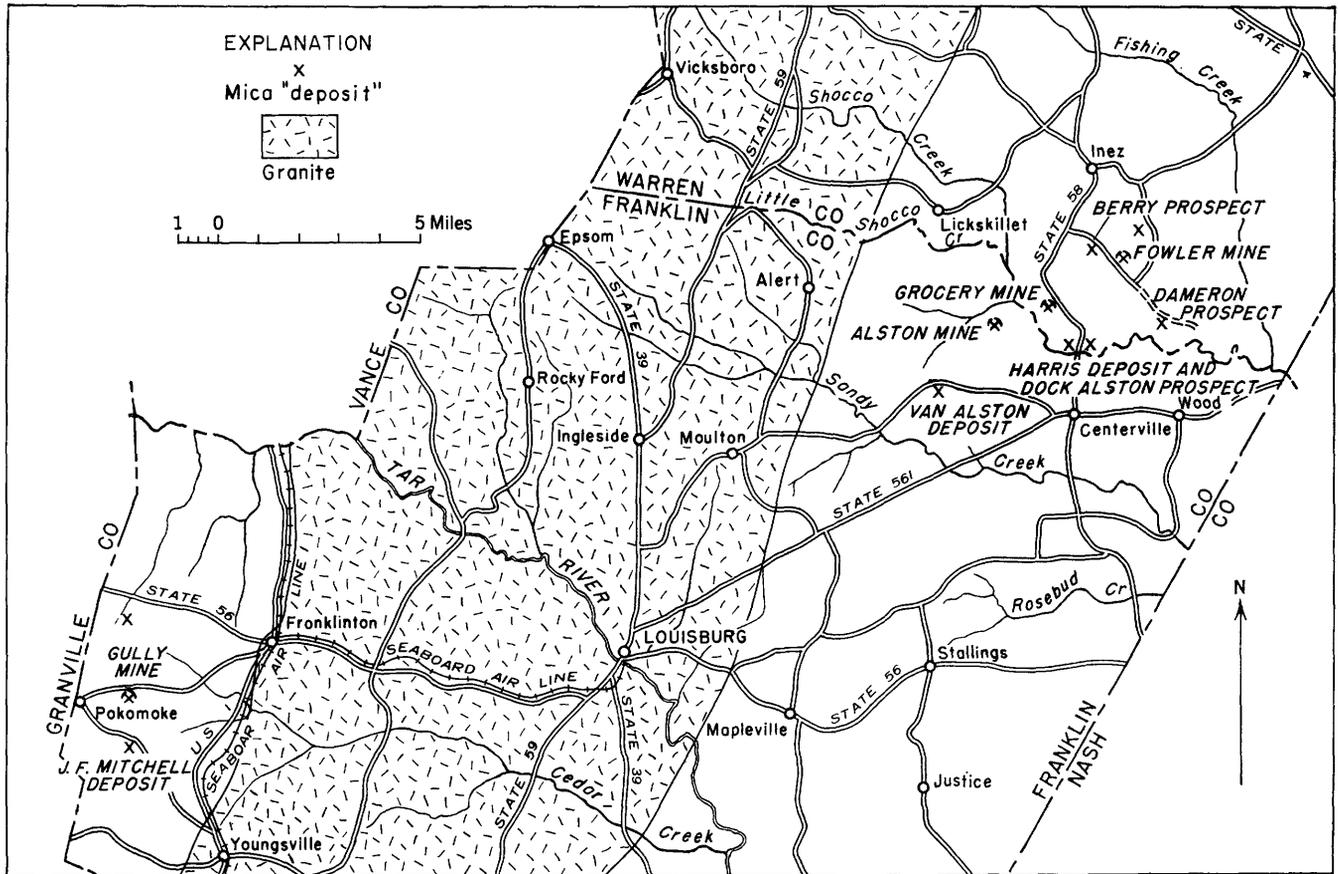


FIGURE 103.—Index map of Warren and Franklin Counties, showing the location of the mica deposits.

intrusive body, and others are in schist and gneiss several miles east of it. Most of the pegmatite bodies strike north to northeast. Those in schist and gneiss tend to be discordant, whereas those in the distinctly foliated granite are concordant.

In describing a prospect three miles southwest of Wake Forest, in Wake County, Sterrett (1923, p. 268) states: "The country rock is granite, slightly gneissic in places. The mass of pegmatite exposed in the walls of the pit is from 1 ft to 3 ft thick, and is very irregular in size and shape. It grades into the surrounding granite by diminishing coarseness of texture." This gradation appears to be characteristic of many of the pegmatites that lie within the boundaries of the main intrusive mass. That the pegmatites probably are genetically related to the granites is further suggested by their restricted occurrence in fairly narrow belts alongside and parallel to the granite contacts.

PEGMATITES

The pegmatite bodies consist of perthite, plagioclase, quartz muscovite, and accessory garnet and beryl. In some bodies the quartz is segregated into massive ribs or cores, and in others it occurs with feldspar or mica

to form rather uniform granitoid aggregates. A massive quartz core occurs at the Dock Alston prospect in Warren County, and a body of quartz-muscovite pegmatite at the Gully prospect in Franklin County. An occurrence of lepidolite was visited by C. S. Ross and J. J. Glass a few miles southeast of Inez, on property adjoining the Fowler farm. Microcline perthite is the most abundant feldspar in many of the deposits, and in general the pegmatites contain a much higher proportion of potash feldspar than those in the Blue Ridge province of North Carolina.

The occurrence of the book mica varies with the composition of the host pegmatite and the internal structure of the body. In quartz-muscovite pegmatites large books of mica are characteristically scattered through fine-grained quartz-mica rock (burr rock). Mica is generally concentrated along the walls of dikes that consist chiefly of quartz and feldspar, especially in those with a higher proportion of perthite. Books of muscovite are commonly disseminated through masses of quartz-plagioclase pegmatite.

Most of the book muscovite is brownish olive, commonly of a very dark shade. Much is specked or more heavily stained, and many books are seriously marred

by reeves and other structural imperfections. The average proportion of sheet material recovered from the mine-run books probably is very low.

MINING AND PRODUCTION

Mica mining in the northeastern Piedmont probably was started about 1880 (Sterrett, 1923, p. 268), when a little work was done on the William Connell property, about 2½ miles southeast of Inez. Little prospecting or mining was done between 1880 and 1943, although in 1916 J. E. Coggins, of Raleigh, opened a deposit 3 miles south of Wake Forest, in Wake County, and in 1918 a Mr. Cauley dug a pit on the Fowler property in Warren County. William Silver mined intermittently and on a small scale during the middle thirties on property of a Dr. Thompson, in north-central Wake County, and also in southwestern Franklin County. Prospecting in all three counties was stimulated by high prices during World War II, and at least 12 occurrences of mica were brought to the attention of the Colonial Mica Corporation in 1943 and 1944. Most mining activity ceased early in the summer of 1944.

The amount of mica produced prior to 1943 is not known but probably was not more than a few hundred pounds. Production during World War II was less than 150 lb. Few of the deposits worked during recent years are said to be rich enough to justify further mining. The reported high perthite content of several pegmatites and their easy accessibility, however, suggest that some might be satisfactory sources of commercial feldspar.

DESCRIPTIONS OF DEPOSITS

The information on the following deposits, all in Warren County, was obtained from the Colonial Mica Corporation:

Fowler mine.—The Fowler mine, 2.5 miles south-southeast of Inez (location 2, fig. 103), was opened in 1918 by a Mr. Cauley, who dug a pit 15 ft deep. It was last operated during the spring of 1944 by Southgate Jones, of Durham, who excavated six pits and open cuts. The pegmatite dike trends N. 15° E. and was opened to a depth of about 20 ft. It consists of kaolinized feldspar, massive quartz, and sparsely scattered book mica. The mica is dark green, and some is heavily stained. All the books are small, and most are of the flat-A type.

Grocery mine.—The Grocery mine, 3½ miles south-southeast of Inez (location 3, fig. 103), was opened about 1885 or 1890, when two holes were dug to a depth of 20 ft. It is owned by the Warrenton Grocery Co. and was leased in the spring of 1944 to Southgate Jones. Little pegmatite is exposed in the caved openings, but

the dumps contain abundant large fragments of green mica.

Berry prospect.—Mica-bearing pegmatite was first prospected about 1890 on the road between the Harris and Fowler residences, 2 miles south of Inez (location 1, fig. 103). The mica is dark brownish to yellowish olive, and some of it is stained.

Dameron prospect.—Two prospect openings were made on the property of Mrs. Wills Dameron, 3 miles southeast of Inez (location 4, fig. 103). Some of the mica is said to contain black spots.

Dock Alston prospect.—An old shaft 20 ft deep exposes mica-bearing pegmatite on the Dock Alston property, north of Shocco Creek and 1¼ miles north of Centerville (location 5, fig. 103). The deposit can be traced on both sides of North Carolina Highway 58. It contains a core of massive quartz that is fringed by book mica. Some of the books are stained.

Harris deposit.—Pegmatite that contains stained mica is exposed on both sides of North Carolina Highway 58 north of Shocco Creek (location 5, fig. 103). The deposit is owned by Ernest Harris, of Warren County.

The following deposits are in Franklin County. Data on them were obtained from the Colonial Mica Corporation.

Alston mine.—The Alston mine is near Isinglass Creek and Shocco Creek, 3 miles northwest of Centerville (location 6, fig. 103). It was last worked early in 1944 by Southgate Jones, of Durham. The pegmatite dike strikes N. 25° E. and dips 65° WNW. in coarse-grained granite. It consists of quartz, perthite, greenish muscovite, and beryl. Some of the perthite contains graphically intergrown quartz. Beryl and muscovite are associated with pods of massive quartz, none of which were found to be greater than 12 ft in vertical dimension. Most of the mica obtained was sold as scrap, and the rest was recovered as electric-grade sheet material.

Gully mine.—Mica-bearing pegmatite on the property of Dr. N. Y. Gully, 5 miles northwest of Youngsville (location 8, fig. 103), was prospected early in 1944 by E. A. Hughes, of Durham. Three pits that were sunk to depths of 8, 13, and 14 ft expose a 2- to 4-ft pegmatite dike. The deposit strikes north and dips 70° E. in quartz-mica schist that strikes east. Quartz and fine-grained mica are the principal pegmatite minerals, but the deposit also contains a few masses of coarse-grained feldspar and scattered large books of dark-green mica. Some of the mica is stained.

J. F. Mitchell deposit.—The Mitchell deposit, 2 miles southeast of Pokomoke and 4 miles northwest of Youngsville (location 9, fig. 103), was leased by E. A.

Hughes in 1943. The pegmatite contains slightly spotted and stained books of greenish mica.

Van Alston deposit.—A pegmatite body that contains abundant coarse feldspar, massive quartz, and small books of stained mica is exposed on the Van Alston property south of Shocco Creek, west of North Carolina Highway 58, and $3\frac{1}{2}$ miles west-northwest of Centerville (location 7, fig. 103).

Two prospects are known in Wake County. Information of these deposits, also, was obtained from the Colonial Mica Corporation.

Coburn prospect.—Several prospect pits were sunk prior to 1941 on the R. T. Coburn property, half a mile east of U. S. Highway 15A and 5 miles south of Raleigh. The pegmatite dike strikes N. 5° E. and contains flat-A books of spotted, dark-green mica.

Wakefield prospect.—The Wakefield deposit is 3 miles west of Wake Forest, 2 miles south of North Carolina Highway 264, and 16 miles by road east of Durham. It was prospected in 1942 by E. A. Hughes, who recovered abundant small "A" books of stained mica. The mica is most abundant near the walls of the dike, which contains much very coarse grained feldspar and many pods of massive quartz.

CASWELL COUNTY: MILTON AREA

GENERAL FEATURES

The Milton area, in northeastern Caswell County (fig. 78; see p. 210), is one of low hills and fairly broad valleys. The larger streams, such as Country Line Creek near Yarbro, locally flow through steep-sided valleys, but the maximum relief in the district probably is little more than 200 ft. A line of the Southern Railway passes through or near the towns of Blanch, Milton, and Semora at the north and east edges of the area. None of the deposits worked during recent years is more than 3 miles from this railroad. The area is further served by dirt and gravel roads.

Most of the region is underlain by mica schist and gneiss, although a large batholith of granite extends to Yanceyville from the southwest and several large areas of light-tan soil south of Milton probably are underlain by masses of granite. A medium- to coarse-grained granite consisting of microcline, plagioclase, and quartz is exposed in the barnyard near the Slaughter residence and may be part of a large intrusive mass. A large body of diorite and other hornblendic rocks lies south of the pegmatites (fig. 78). Through much of the district the rocks are so deeply weathered that they are very poorly exposed.

PEGMATITES

The pegmatites are composed of perthite, plagioclase, quartz, and muscovite. The deposit at the Yar-

boro No. 1 mine also contains biotite, sugary albite, and garnet. Two dikes on the Slaughter property contain biotite, and allanite also occurs in one. Most of the microcline is fresh and hard at the surface, whereas the plagioclase and biotite are weathered and softened to depths of 10 ft or more. The proportion of microcline in most of the deposits appears to be moderately high.

All the mica in the district is brownish olive to yellowish green. Much is seriously reeved or contains heavy mineral stains, and few books yield sheets larger than 2 by 3 in. Most of the book mica occurs along the edges of massive quartz ribs, lies near the walls of the dikes, or is disseminated through plagioclase-rich pegmatite.

The total production of mica from the area is not known, but it cannot be large. Moreover, most of the recoverable sheet material is of rather poor quality. Coarse-grained perthite is exposed at many places in the district, and the large size of the pegmatite dike being worked at the Yarboro No. 1 mine suggests that other operations for feldspar might be considered in the future. Stained sheet, punch, and scrap mica might well be obtained as byproducts.

DESCRIPTION OF DEPOSITS

J. G. SLAUGHTER PROSPECT

The J. G. Slaughter property, $3\frac{3}{4}$ miles S. 15° W. of Milton (fig. 78), was prospected during 1943 and 1944 by the Clinchfield Sand and Feldspar Corp. Float blocks of perthite and massive quartz are widespread on the property, but owing to a labor shortage the prospecting was stopped before the commercial value of the deposits was determined.

The largest pit exposes pegmatite that consists chiefly of coarse, blocky perthite. Several masses of quartz 2 to 8 ft long are fringed with books of greenish muscovite. Nearly half the mica is stained, and much is severely reeved. The size and attitude of the pegmatite body are not known.

The other pits also expose perthite-rich pegmatite, which in general contains less quartz and mica than that in the largest opening. A little weathered biotite occurs in two of the deposits, and long, pencil-like crystals of allanite are exposed in one of them.

O. W. BARKER PROSPECT

The Barker prospect, near the north side of a gravel road half a mile east of Yarbro (fig. 78), was opened in 1944 by a Mr. Hylton, of Danville, Va. The mineral rights on the property are owned by the Consolidated Feldspar Corp., of Trenton, N. J. A quartz core about 2 ft thick and 4 ft long trends nearly east across a small pit. South of the quartz is a perthite-

rich zone about 5 ft thick, and farther south a zone of plagioclase-quartz pegmatite contains scattered small books of yellowish-green mica. Some are marked by "A" structure. No country rock appears in the pit, but mica gneiss that is exposed in a road cut 100 ft to the west trends N. 30° E. and dips 25° WNW.

YARBORO NO. 1 (OLD MILTON) MINE

The Yarboro No. 1 mine, 0.8 mile S. 35° E. of Yarboro (fig. 78), was worked for mica many years ago and was reopened in 1943 by the Consolidated Feldspar Corp. The main workings are two large cuts on the sides of a small valley and a stripped area on the hill-top south of the valley. All the openings are in the same pegmatite dike.

The pegmatite strikes N. 20° E. and dips 75° WNW. to vertically in somewhat contorted dark-gray mica schist. Most of the country-rock foliation lies nearly flat, but it appears to have been dragged downward near the west contact of the deposit. The pegmatite dike is about 30 ft wide, and from its east margin large apophyses extend upward into the country rock at an angle of about 40°. These are 10 to 15 ft thick at their bases.

The pegmatite in the stripped area consists chiefly of perthite with little or no mica. That in the open-cuts is composed of perthite, plagioclase, quartz, mica, and garnet. The dump contains blocks of quartz several feet long that are fringed with flat-A books of brownish-olive to yellowish-green mica. In one block a mass of fine-grained albite appears to have been formed by replacement of a large perthite crystal. Several blocks of perthite that are fringed and veined by albite probably represent intermediate stages in this process.

Muscovite is said to be most abundant near the east wall of the deposit. Most is yellowish green. Many stained books are closely associated with biotite in feldspathic pegmatite, whereas most of the books along the margins of quartz masses are clear. Much of the mica is reeved, some is cracked, and a little is ruled. Clay stains are common at and near the surface.

OTHER MINES AND PROSPECTS

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

Yarboro No. 2 mine.—The Yarboro No. 2 mine, about a mile south of the No. 1 (fig. 78), also is owned by the Consolidated Feldspar Corp. The open-cut exposes a vertical pegmatite dike that strikes nearly north. It is about 18 ft thick and contains coarse perthite, plagioclase, quartz, and scattered books of green mica. Much of the mica is ruled and broken and would yield little sheet material.

Harris and Satterfield prospects.—Several pits were dug about 1910 on the properties of Moss Harris and Lewis Satterfield, about 2 miles south of Blanch. The largest pit, on the Satterfield property, is at least 30 ft long and 4 ft deep. The deposits contain quartz, greenish book mica, and perhaps coarse perthite.

Angle prospect.—Several large blocks of quartz that contain small flakes of brown mica are present on the M. S. Angle property, 100 ft from the high school in Milton (fig. 78). As determined from two small pits and from the distribution of float, the pegmatite dike strikes west of north.

YADKIN, WILKES, CALDWELL, CATAWBA, BURKE, McDOWELL, RUTHERFORD, AND POLK COUNTIES: WESTERN PIEDMONT AREA

GENERAL FEATURES

Many mica-bearing pegmatites are scattered over a large area southwest of the Ridgeway-Sandy Ridge district, northeast and southeast of the Wilkes district, and north, northwest, and west of the Shelby-Hickory district (fig. 78). Most are dikes, sills, and podlike masses enclosed by hornblende gneiss or mica gneiss, and some of those in Yadkin County occur in schistose diorite. In general, the pegmatite bodies strike north to northeast and dip steeply. Many contain well-defined cores of massive quartz, which commonly are fringed by coarse books of mica. Beryl and garnet are the two most widespread accessory minerals.

Both clear and specked brownish-olive mica occur in the Yadkin deposits, and both clear pinkish-buff and stained green mica occur in the Burke deposits. The Wilkes County mica is typically green, and some of it is stained. Many of the books in this part of the Piedmont are severely reeved, particularly in deposits that contain cores of massive quartz. Other common defects are clay stains, warping, and ruling.

The largest amount of sheet mica has been obtained from deposits in central Rutherford County. Several are reported to have yielded 5,000 lb or more of prepared electric (stained) sheet mica. Clear mica occurs at the Kay mine west of Thermal City and on the Elman Williams property 15 miles west of Rutherfordton. The proportion of clear material in the other deposits is very low. "A" and flat-A books are abundant, particularly in the mica shoots adjacent to quartz cores and irregular lenses of massive quartz.

The Kay dike contains a poorly defined central unit of perthite-rich pegmatite, but it is so thoroughly weathered to the levels reached by mining that no feldspar has been obtained as a byproduct. Several attempts have been made to mine kaolin from the Isinglass Hill dike north of Rutherfordton, but all were unsuccessful. The future of the district appears to lie

in the production of small to moderate quantities of stained sheet mica.

DESCRIPTIONS OF DEPOSITS

ISINGLASS HILL MINE

The Isinglass Hill deposit, about 3½ miles north of Rutherfordton in Rutherford County, extends across U. S. Highway 221 and trends nearly due north to the tracks of the Southern Railway. It has been opened by means of many shallow shafts, pits, open-cuts, and irregular gopher-hole drifts. Most of the workings are north of the highway.

The country rock is hornblende gneiss that locally is much contorted. The deposit strikes a few degrees east of north and is nearly vertical. It consists either of a single body many feet thick that contains numerous septa and tabular inclusions of country rock or of two or more parallel bodies that are separated by layers of gneiss a few feet thick. The deposit fingers out north of the railroad tracks, where only a few thin layers of pegmatite are exposed.

Most of the pegmatite is kaolinized plagioclase. Pods and thin layers of massive quartz occur in the thickest parts of the deposit. Mica is locally plentiful, especially near the margins of the quartz masses. Many of the books are as much as 8 in. in diameter, but most are marked by "A" or wedge-A structure. Nearly all contain spots and irregular blotches of magnetite and hematite. Good kaolin is exposed in some of the workings, but little is known concerning the tonnage available for mining. An analysis of the kaolin is quoted by Sterrett (1923, p. 262), and ceramic tests were made by Watts (1913, p. 148).

KAY MINE

The Kay Mine, 7 miles west of Thermal City in Rutherford County, is owned by Taylor and Buchanan and was worked during the summer of 1943 by G. C. McGimsey and W. J. Coffee. The openings are a 92-ft drift that extends S. 20° W. into the hillside and a small irregular stope from the west side of the drift.

The country rock is feldspathic biotite gneiss with some layers of contorted mica schist. The axial planes of the small folds in the schist strike N. 20° E. and dip 45° SE. The axes of these folds plunge about 15° NE. The pegmatite body is 5 to 10 ft thick, strikes N. 20° E., and dips 45° ESE. In general it is concordant, but its contacts cut across the wall-rock structure in many places. Both the pegmatite and the country rock are unevenly weathered, especially where they are cut by fractures. The cores of many fracture blocks are hard or only slightly weathered, whereas the surrounding material is thoroughly altered.

At the portal of the drift the central part of the deposit is rich in perthite and the wall zone consists of plagioclase with abundant biotite and a little muscovite and tourmaline. The muscovite books are scattered rather evenly through the rock. They are cinnamon brown, flat, and somewhat lumpy. Most of the books are small. The biotite is dark red brown, occurs in very thin sheets, and is fairly hard, flat, and exceptionally free splitting.

OTHER MINES AND PROSPECTS

Two deposits in Yadkin County are worthy of special mention:

Hauser mine.—The Hauser mine is on the southwest side of a small creek approximately 6 miles east of Yadkinville. (See Sterrett, 1923, from which report this description has been extracted.) It was opened about 1905, and large quantities of mica were obtained from extensive shallow groundhog workings during a period of several years. The openings comprise numerous pits, trenches, and cuts and a 40-ft shaft, all within an area 250 yd long and 200 ft wide.

The country rock is a schistose hornblende diorite or gabbro, in which a distinct foliation strikes north-west and dips steeply northeast to vertically. The pegmatite body appears to be very irregular, with numerous branches. One of these branches is exposed in a pit northeast of the creek, where it is vertical and strikes northeast. Most of the branches, however, appear to dip gently northeast. The mine dumps contain large blocks of white, gray, and smoky quartz, some of which are fringed by books of mica. Partly kaolinized feldspar appears to be abundant near the walls of the deposit, and an outcrop of pegmatite along the stream contains crystals of perthite 18 in. in maximum diameter.

Mica seems to have been fairly plentiful in the mined pegmatite. Most of the books in the dumps are small but of good quality, with a clear, brown color and excellent cleavage. Some are slightly specked. The books that lie against massive quartz generally have sharp crystal outlines. Some 4-by-6-in. books are badly crushed and ruled and are distinctly lumpy. A few are tied by smaller crystals of mica that project into them. Much "A," wedge, and herringbone mica is exposed in two pits northwest of the main workings. All this material is of scrap grade.

Another prospect about a quarter of a mile southeast of the mine is on the point of a low ridge near a creek. A cut 20 ft long and 6 ft deep exposes a 10-ft pegmatite dike that strikes N. 70° W. and dips steeply south-southwest in schistose diorite or gabbro. It contains bunched masses of flat-A and wedge-A mica. Some of

the books are slightly specked. The deposit also contains feldspar crystals a foot in diameter.

Another mass of pegmatite crops out on the hillside about 100 ft north of the prospect and on the opposite side of the stream. The deposit is very coarse grained and contains abundant crystals of mica 2 to 3 in. across.

J. C. Styers prospect.—Mica-bearing pegmatite has been prospected on the Styers property, 1 mile south of a point on U. S. Highway 421 at a point 4 miles east of Yadkinville (location 1, fig. 78). All the books are very small and specked according to the Colonial Mica Corporation, which furnished data on the deposit.

The information on the following deposits, in Wilkes County, also was obtained from the Colonial Mica Corporation:

Crouch deposit.—Stained mica occurs in pegmatite on the Lettie Crouch property, which is near a dirt road 2 miles north of Ronda. The deposit has not been prospected.

Kilby prospect.—The Kilby prospect, 12 miles north-east of North Wilkesboro, was opened in 1943 by the owners, Silas Johnson and W. G. Benton. The deposit contains sparsely scattered books of green mica.

Yorke prospect.—A small pit on an eastward-facing hillside about 20 airline miles north of Statesville was dug in 1943 by W. D. Yorke, of Concord. It can be reached from Statesville over 23 miles of North Carolina Highway 115, two miles of a dirt road that extends west, and 1½ miles of trail. The deposit contains clear books of flat-A mica.

Lowe prospect.—Several pits on the property of P. R. Lowe are 200 ft from North Carolina Highway 18, a mile from Kirby Gap, and 8 miles south of Wilkesboro (location 2, fig. 78). These openings, near a creek, have been filled, but the dump material contains abundant small flakes of mica.

In Caldwell County, according to Colonial Mica Corporation data, there are two known deposits:

Broyhill deposit.—Float fragments of mica occur on the T. H. Broyhill property, 2 miles northwest of North Carolina Highway 268 and 5 miles from North Carolina Highway 321. The deposit is said to be about 1,000 ft south of a productive mica mine, and it may be within the edge of the Wilkes district in the Blue Ridge nearby.

Paul Oliver prospect.—Clear, flat books of brown mica occur in weathered pegmatite on the Paul Oliver property in the town of Hartland (location 4, fig. 78). A little prospecting was done many years ago.

The following deposit is in Catawba County. Information on it was furnished by the Colonial Mica Corporation.

Wike prospect.—A prospect on Black Oak Ridge, 6 miles north of Taylorsville (fig. 78), is owned by J. J. Wike and was leased to Ray Jennings and A. H. DeVier in 1943. The main opening is a cut 50 ft long, 10 ft wide, and 10 to 20 ft deep. It trends N. 15° E., and all the walls are in pegmatite. The deposit contains kaolinized plagioclase, clear quartz, beryl, biotite, and books of pale reddish-brown muscovite.

Deposits in Burke County, with information furnished by the Colonial Mica Corporation, are as follows:

Grill prospect.—A mica deposit owned by Philip Grill is 1 mile south of U. S. Highway 70 and 4 miles east of Morganton. It was prospected in 1943 by Sam Cook. A quartz core is flanked by pegmatite rich in kaolinized plagioclase and small, clay-stained books of reddish-brown mica.

Hossfeld prospect.—A mica prospect owned by F. W. Hossfeld is on High Peak near Morganton. The pegmatite dike strikes northeast and contains a core of massive quartz. The adjoining feldspathic pegmatite is rich in book mica, but most is badly warped, ruled, cracked, and clay-stained.

Wheeler Daniels prospect.—A mica deposit about 3 miles west of Glen Alpine was prospected during the summer of 1945 by Wheeler Daniels and L. D. Vance, who are said to have obtained about 2 tons of book mica from a small pit. The pegmatite consists chiefly of quartz and is enclosed by mica schist. Mica is abundant in books as much as 3 ft in diameter. Most are badly clay-stained, but some yield trimmed sheets as large as 3 by 5 in.

Lytle prospect.—Stained mica has been obtained from prospecting operations on the Thomas Lytle property, about 2½ miles southwest of Glen Alpine.

Newton prospect.—A little mica has been obtained by C. C. Newton on his property, 7 miles south of Morganton. The pegmatite dike trends N. 20° E. The mica occurs in plagioclase-rich pegmatite that flanks a core of massive quartz. The plagioclase is thoroughly kaolinized, and the mica is clay-stained.

Buzzard Roost Knob prospect.—A deposit was opened about 1900 on the ridge half a mile east of Buzzard Roost Knob in the South Mountains, 8¼ miles S. 15° W. of Morganton. The workings include an open-cut and a short tunnel. The pegmatite dike strikes north in mica gneiss that trends N. 30° E. and dips irregularly east-southeast. The deposit contains a core of massive white quartz about 2 ft thick. Light-colored sheets of clear mica as much as 2 in. across are present in the dumps.

Burkmont prospect.—A small pit exposes mica-bearing pegmatite a quarter of a mile south of the top of Burkmont Mountain and 5½ miles S. 10° W. of Mor-

ganton. Clear sheets of reddish-brown mica 3 to 4 in. in diameter are strewn around the opening.

A few small mica books of good quality were encountered in another prospect $1\frac{1}{4}$ miles S. 10° W. of Burkmont Mountain. The dumps contain beryl crystals an inch in diameter. Some are yellowish brown, and others are translucent to transparent light green and yellowish green.

Small crystals of mica were found in a deposit on the side of Ironmonger Mountain west of Mitchell Gap and $4\frac{1}{2}$ miles southeast of Morganton. The mica is of fair quality.

The following deposits are in McDowell and Rutherford Counties. The descriptions are based on data from the Colonial Mica Corporation.

Gruen No. 1 mine.—The Gruen No. 1 mine, on the Lewis farm, is southeast of Vein Mountain and $1\frac{1}{2}$ miles east of U. S. Highway 221. It was last operated in 1943 by Louise Gruenewalder, of St. Louis, Mo. The workings include an open-cut 30 ft long, a tunnel, and several pits. The deposit strikes northeast, dips 45° SE., and contains abundant stained mica in books of moderate size.

McDaniel mine.—A mica mine on the McDaniel property, 2 miles west and 1 mile north of Thermal City, was worked in 1916. It is reported to have yielded scrap and electric-grade sheet mica valued at \$12,000.

Flack mine.—The Flack mine is on the property of the G. W. McDaniel heirs, near the floor of a valley an eighth of a mile upstream from a county-road bridge and $2\frac{1}{2}$ miles west of Thermal City. The mine was opened in 1916, after several large books of stained mica were discovered in the creek. Electric mica valued at \$19,000 is reported to have been obtained. Most of the books in the deposit are of the flat-A type, and some are wedged.

Walter Barnes deposit.—Mica-bearing pegmatite is exposed on the Walter Barnes property, north of Union Mills and about 1 mile east of U. S. Highway 221. The mica books are very small, and some are stained.

Banks mine.—The Banks mine is on the Walter

Barnes property, near the Golden Valley road and 2 miles east of U. S. Highway 221. Stained mica is said to be abundant along the footwall of the weathered pegmatite body.

Allen mine.—The Allen mine, between Gilkey and Union Mills, consists of several pits, shafts, and underground workings that date back to the period 1885–95. The pegmatite body is enclosed by mica gneiss that locally is markedly feldspathic. Large blocks of massive quartz and many small fragments of stained mica are present in the dumps.

J. Odom prospect.—A prospect on the J. Odom property, near the Allen mine and between Gilkey and Union Mills, consists of several very old pits and cuts. The dumps contain fragments of stained mica.

W. T. Wilkins prospect.—Electric-grade mica was obtained prior to 1900 on the W. T. Wilkins property, $3\frac{1}{2}$ miles west of Rutherfordton.

W. H. Marville prospect.—Several old prospect openings on the W. H. Marville property, 4 miles northeast of Rutherfordton, expose kaolinized feldspathic pegmatite with abundant small books of stained mica. Many are strongly marked by "A" reeves.

Elman Williams prospect.—Small "A" mica books of scrap grade were obtained from pegmatite on the property of Elman Williams near U. S. Highway 74, at a point 15 miles by road west-northwest of Rutherfordton.

The records of the Colonial Mica Corporation contain information on the following deposit in Polk County:

North Star mine.—An old mine on the property of Minnie Russell, half a mile south of Pea Ridge, was reopened in 1943 by E. W. Monteith, of Rutherfordton. Three shafts 12, 13, and 15 ft deep expose a weathered pegmatite dike about 4 ft thick. Very small quantities of mica were obtained during the recent operations.

REFERENCES CITED

- Sterrett, D. B., 1923, Mica deposits of the United States: U. S. Geol. Survey Bull. 740.
 Watts, A. S., 1913, Mining and treatment of feldspar and kaolin in the southern Appalachian region: U. S. Bur. Mines Bull. 53.

INDEX

A

Abernathy Long Cut (Hickory) mine.....	232-233; pl. 19
Water mine.....	232; pl. 19
Acknowledgments.....	203-204
Allen mine.....	290
Alston, Dock, prospect.....	284, 285
Van, deposit.....	284, 286
Alston deposit.....	284, 285
Angle prospect.....	210, 287
Anthony prospects.....	272-273; pl. 19

B

Big Bess (M. M. Carpenter, M. S. Bess) mine.....	249-251; pl. 19
Beam, Claude, prospect.....	249; pl. 19
Bailey, W. H., deposit.....	281; pl. 19
Baker prospect.....	248; pl. 19
Bangle prospect.....	248
Banks mine.....	290
Barker, O. W., prospect.....	210, 286-287
Barnes, Walter, deposit.....	290
Bartlett, George, mine.....	231
Baxter, Frank, mine.....	248
Jack, prospect.....	247
Jack (Tom Baxter), mine.....	246-247; pl. 19
Baxter East prospect.....	247; pl. 19
Beam, J. A., prospect.....	276; pl. 19
J. M. prospect.....	148
T. A., deposit.....	248; pl. 19
Beam prospect.....	245; pl. 19
Benfield prospect.....	275; pl. 19
Berry prospect.....	284, 285
Bess mine.....	245; pl. 19
Biggerstaff (Deadman) mine.....	242-243; pl. 19
Blankenship prospect.....	227; pl. 18
Blanton, C. Robert, mine.....	268; pl. 19
Cliff, mine.....	261-262; pl. 19
Coleman, mine.....	267; pl. 19
Jim, prospect.....	259; pl. 19
Blanton prospect.....	263; pl. 19
Bobby mine.....	274
Bonnet Split (Big Hill) mine.....	235; pl. 19
Borders mine.....	276-277
Bowen mine.....	259; pl. 19
Bowen Southeast prospect.....	260; pl. 19
Bowman mine.....	231; pl. 18
Bridges, Pleaz, mine.....	266-267; pl. 19
T. A., prospect.....	274
Brittain, Floyd, mine.....	231; pl. 19
Brown, Ernest, mine.....	248
Broyhill deposit.....	289
Bumgarner mine.....	236; pl. 19
Burke Chapel area.....	231; pl. 19
Burkmont prospect.....	289-290
Buzzard Roost Knob prospect.....	289

C

Cabaniss, Alma, mine.....	266; pl. 19
Tom, mine.....	266; pl. 19
Cabaniss prospect.....	263; pl. 19
Cabaniss-Story (Cabaniss Three Sisters), mines.....	262; pl. 19
Campbell, W. A., prospect.....	226; pl. 18
Campbell mine.....	261; pl. 19
Cannon prospect.....	233
Carpenter, Mauney, mine.....	239; pl. 19
Carson prospect.....	274
Cherryville area.....	249-255
Cherry Mountain mine.....	281; pl. 19
Chrysolite mine.....	266; pl. 19
Clippard prospect.....	278; pl. 19
Coburn prospect.....	286
Conover area.....	229-231
Cook, George, prospect.....	247
Vess, prospect.....	267; pl. 19

Cooke mine.....	235; pl. 19
Cornwall, Frank (Old J. S. Blanton), mine.....	267-268; pl. 19
Cornwall, Charles, prospect.....	264; pl. 19
J. W., deposit.....	277
Lee, mine.....	273
County Home prospect.....	231; pl. 18
Crouch deposit.....	289

D

Dagenhart mine.....	227; pl. 18
Dameron prospect.....	284, 285
Daniels, Wheeler, prospect.....	289
Davis, M. V., deposit.....	273; pl. 19
Walter, mine.....	263; pl. 19
Dennard prospect.....	248; pl. 19
Drum mine.....	230; pl. 18
Dycus mine.....	278-279, 280; pl. 19

E

Eaker, Doris, mine.....	246; pl. 19
Elliot, L. R., mine.....	278; pl. 19
Ellis, E. R., mine.....	274
Ellis prospect.....	274
Estridge (A. Blanton) mine.....	274
Estridge prospect.....	273

F

Falls, D. M., prospect.....	277; pl. 19
Fred, prospect.....	258; pl. 19
Fallston area.....	233-248
Fallston prospect.....	239; pl. 19
Field work.....	203-204
Flack mine.....	290
Fortenberry, W. H., prospect.....	276; pl. 19
Foster, J. L., prospect.....	276; pl. 19
W. L. C., prospect.....	245; pl. 19
W. T. (W. A. Thompson) mines.....	240-242; pls. 19, 22
Fowler mine.....	284, 285
Fraser-English prospect.....	248
Fulton prospect.....	256

G

Gantt, B. T., prospect.....	238; pl. 19
M. H., mine.....	283; pl. 19
Gettys No. 1 mine.....	256-257; pl. 19
Gettys No. 2 mine.....	257; pl. 19
Glover, Eli, mine.....	263; pl. 19
Gold, Mary.....	260; pl. 19
Ralph, mine.....	273
W. F., mine.....	273
Green, J. F., mine.....	272; pl. 19
S. A., mine.....	274-275
S. J., mine.....	273
Zoar, prospect.....	274
Greer prospect.....	256; pl. 19
Gregg, B. H., deposit.....	274; pl. 19
Griggs mines.....	238-239; pl. 19
Grill prospect.....	289
Grocery mine.....	284, 285
Gruen No. 1 mine.....	290
Gully mine.....	284, 285
Gwaltney prospects.....	227; pl. 18

H

Hallman mine.....	240; pl. 19
Hambrick, E. C., mine.....	274
Hamrick, Lem, mine.....	239; pl. 19
Hammer prospects.....	227
Harrelson, Carl, prospect.....	246; pl. 19
M. P., prospect.....	276
Harris and Satterfield prospect.....	287

- Harris deposit..... 284, 285
Harris mine..... 259-260; pl. 19
Hastings mine..... 277-278; pl. 19
Hauser mine..... 288-289
Heavner, D. C., mine..... 248
Hefner mine..... 230-231; pl. 18
Herndon mine..... 256; pl. 19
Hibriten prospect..... 228; pl. 18
Hiddenite area..... 227
Horne prospect..... 260; pl. 19
Hossfield prospect..... 289
Howell prospect..... 256
Hoyle, A. F., mine..... 233-235; pl. 19
 Haywood, prospect..... 233; pl. 18
 Jake, prospect..... 235; pl. 19
Houser, Plato, mine..... 243-245; pl. 19
 Plato, No. 2 mine..... 245; pl. 19
Huckleberry Mountain mine..... 281; pl. 19
Hudson prospect..... 233
Hull (Rock Cut) mine..... 240; pl. 19
Humphries, Joe, mine..... 266; pl. 19
 W. H., prospect..... 269; pl. 19
Hunt mine..... 269; pl. 19
Huskins mine..... 253-255; pl. 19
- I
- Igneous rocks..... 206-208
Indian Graveyard mine..... 235-236; pl. 19
Indian (Mull) mine..... 236; pl. 19
Iredell area..... 226-227
Isinglass Hill mine..... 288
- J
- Johnson deposit..... 274
Jonas prospect..... 276; pl. 19
Jones, C. P., mine..... 170
 Odel, mine..... 170
Jones mine..... 269; pl. 19
- K
- Kay mine..... 288
Keller prospect..... 233; pl. 18
Kilby prospect..... 289
King, Jim, prospect..... 247; pl. 19
 Marvin, prospets..... 236-237; pl. 19
Kings Mountain area..... 255-256
- L
- Lail prospect..... 273; pl. 19
Land, Dollie, prospect..... 228
Land prospect..... 228; pl. 18
Lattimore mine..... 278; pl. 19
Leatherman, J. G., prospect..... 248; pl. 19
 Pink, mine..... 239-240; pl. 19
Ledford mine..... 277; pl. 19
Lincoln mine..... 245-246; pl. 19
Lisenberry Mountain mine..... 281; pl. 19
London, Ira, prospect..... 238; pl. 19
Long prospect..... 238; pl. 18
Lovelace, Doc, prospect..... 281; pl. 19
 J. A., mine..... 274; pl. 19
 Joe, prospect..... 281; pl. 19
Lovelace Hehs mine..... 274; pl. 19
Lowe prospect..... 210, 289
Lytle prospect..... 289
- M
- McCrary, L. G., prospect..... 228; pl. 18
 Olin, mine..... 228; pl. 18
McDaniel mine..... 290
McGee mine..... 228; pl. 18
McGinnis, F. G., mine..... 269; pl. 19
McIntyre mine..... 259; pl. 19
McKinney, D. G., prospect..... 281
McLelland prospect..... 226; pl. 18
McNeely prospect..... 247
- McSwain, C. B., mine..... 270-271; pl. 19
Magness deposit..... 274; pl. 19
Marlov prospect..... 226; pl. 18
Martin, J. T., prospects..... 271-272; pl. 19
Martin mine..... 264-265; pl. 19
Marville, W. H., prospect..... 290
Mattock prospect..... 227; pl. 18
Mauney, Bailey, mine..... 260-261; pl. 19
 S. S. (M. M. Mauney, Homestead) mine..... 260; pl. 19
Maurice mine..... 279; pl. 19
Mayes, J. M., prospect..... 281; pl. 19
Mayes prospect..... 277; pl. 19
Metamorphic rocks..... 204-206
Metcalf mine..... 263; pl. 19
Mill Race mine..... 271; pl. 19
Miller prospect..... 228; pl. 18
Milton area..... 286-287
Mitchell, J. F., deposit..... 284, 285-286
Mitchem deposit..... 236; pl. 19
Moose mine..... 275; pl. 18
Mull mine..... 277; pl. 19
- N
- Nebo prospect..... 256; pl. 19
Newton prospect..... 289
Niagara mine..... 268-269; pl. 19
Norman, Archie (W. H. Thompson, Wyatt), mines..... 237-238; pls. 19, 21
North, Ellis, prospects..... 274
North Star mine..... 290
Northeastern Piedmont area..... 283
- O
- Oak Hill area..... 228
Oak Hill prospect..... 228
Odom, J., prospect..... 290
Old Lutz prospect..... 247; pl. 19
Old Plantation mine..... 272; pl. 19
Oliver, Paul, prospect..... 210, 289
- P
- Patterson, Bun (Old Carroll) mine..... 225-256; pl. 19
 O. F., mine..... 227; pl. 18
Payne prospect..... 227; pl. 18
Peeler, J. B., mine..... 245; pl. 19
 S. E. prospect..... 255; pl. 19
Peeler No. 1 mine..... 258; pl. 19
Peeler No. 2 mine..... 258; pl. 19
Pharr, Wade, prospect..... 226
Philbeck mine..... 265
Polkville area..... 256-258
Powell (Sugar Barrel) mine..... 258; pl. 19
Price prospect..... 281; pl. 19
Putman mines..... 263-264; pl. 19
- R
- Railroad prospect..... 274
Randall, W. A., deposit..... 275; pl. 19
Randall (Norman) mine..... 236; pl. 19
Reed mine..... 231-232; pl. 19
Reid, Levi, prospect..... 228; pl. 18
Rhyme deposit..... 276; pl. 19
Rice mine..... 256; pl. 19
Rock types in the area..... 204-208
Ross, P. O., prospect..... 248; pl. 19
Royster mine..... 239; pl. 19
Rudasill prospect..... 266; pl. 19
- S
- Seism, Plato, prospect..... 260; pl. 19
Seism prospect..... 255; pl. 19
Self, E. R. (Old Neale), mine..... 251-253; pl. 19
Shelby area..... 258-275
Sherrill prospect..... 276; pl. 19
Shidal prospect..... 240; pl. 19
Shorty prospect..... 237; pl. 19
Shull (John Dillinger) mines..... 240; pl. 19

Sigmon mine 229-230; pl. 18
 Slaughter, J. G., prospect 210, 286
 Sloan, Wade, prospect 226
 Smith, J. North, prospects 276; pl. 19
 Smithwick prospect 231; pl. 18
 Spake prospect 233; pl. 18
 Spangler, D. H., prospects 261; pl. 19
 T. N. (Reuben Spangler) prospects 263; pl. 19
 Speagle prospect 275
 Stewart prospect 226
 Stroud, Lax, mine 278; pl. 19
 T. C., prospects 278; pl. 19
 Structure in the area 208-215
 Styers, J. C., prospect 210, 289
 Sunshine prospect 281; pl. 19
 Sweezy mine 276; pl. 19

T

Tallant prospect 233; pl. 19
 Terry mine 276
 Tolbert mine 228; pl. 18
 Travis prospect 228; pl. 18

W

Wakefield prospect 286
 Wallace mine 257-258; pl. 19

Warlick, Clyde 277; pl. 19
 Washburn, Maynard, mine 273-274
 Weathers mine 261; pl. 19
 Webb mine 269; pl. 19
 Wehunt prospect 243
 Wellman, W. H., prospects 264; pl. 19
 Western Piedmont area 287-290
 Wike prospect 210, 289
 Wilkins, W. T., prospect 290
 Williams, Elman, prospect 290
 Williams mine 276
 Williamson mine 259; pl. 19
 Wilson, I. K., prospect 248
 Withers prospect 276
 Woodrow prospects 236; pl. 19
 Wooten prospect 227
 Wright prospect 239; pl. 19
 Wyant prospect 275-276

Y

Yancey prospect 233
 Yarboro No. 1 (Old Milton) mine 210, 287
 Yarboro No. 2 mine 210, 287
 Yorke prospect 289
 Young, George P., mines 233; pl. 19
 Henry, prospect 233; pl. 18
 Noah, mine 231; pl. 19



