STRATIGRAPHIC IMPLICATIONS FROM CORE DRILLING IN THE VICINITY OF THE ROYAL-VINDICATOR GOLD MINE, HARALSON COUNTY, GEORGIA

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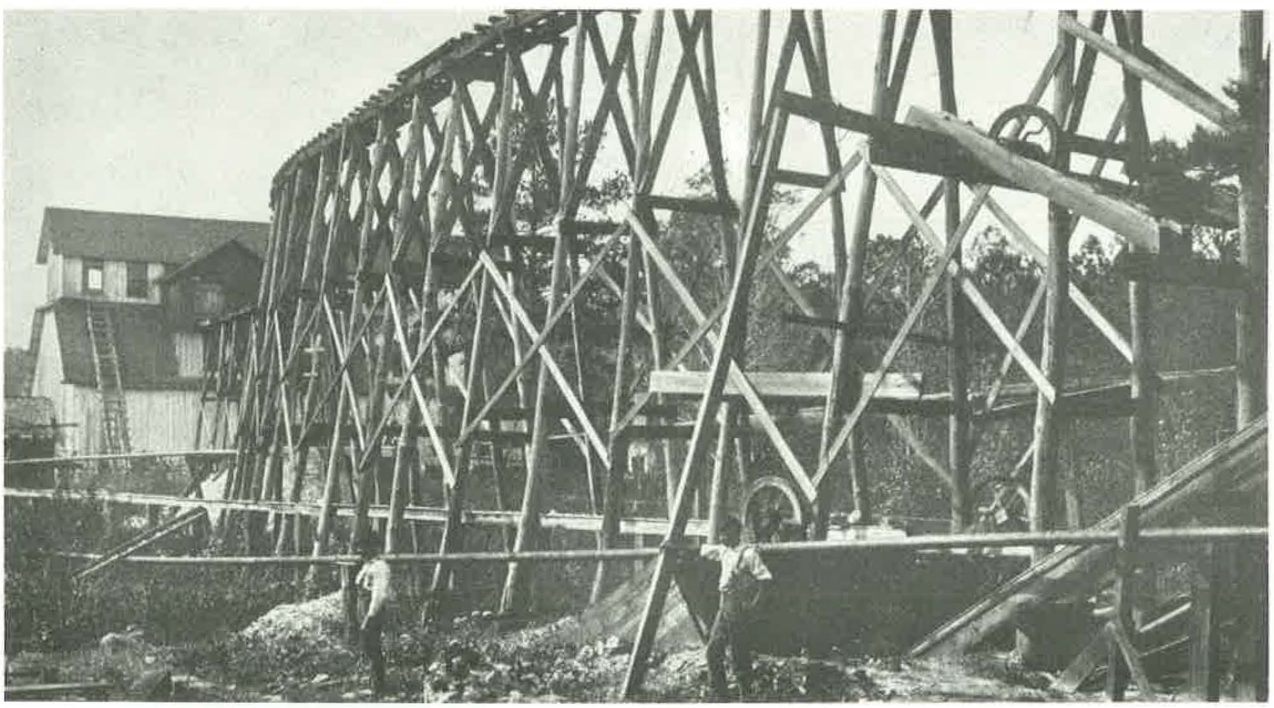

DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION
GEORGIA GEOLOGIC SURVEY

INFORMATION CIRCULAR 84

Cover Photo: The Royal Gold Mine and Mill, near Tallapoosa, Haralson County, Georgia, showing inclined and elevated railroad, used for conveying ore from mine to mill.

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ABSTRACT

Two core holes were drilled in Haralson County in the vicinity of the currently inactive Royal-Vindicator gold mine. These two holes, completed to depths of 425 feet (127.5 meters) and 500 feet (150 meters), were drilled to examine the nature of the contact between metavolcanic host rocks of the inactive Royal-Vindicator gold mine and metasediments of the Talladega belt. This boundary in Alabama and Georgia has been interpreted both as a fault and as a conformable stratigraphic contact. Drilling began in a mafic-felsic metavolcanic sequence (Royal-Vindicator sequence) and was completed in metasediments of the Talladega belt.

Rocks of the Royal-Vindicator sequence consist of mafic phyllites and quartzofeldspathic gneisses. Their protoliths most likely were mafic and felsic tuffs and flows extruded in a back-arc basin environment. In this area, metasediments of the Talladega belt consist of phyllites with minor amounts of quartzite (metachert?) and marble, which probably are metamorphosed continental margin sediments. In the core holes metavolcanics of the Royal-Vindicator sequence and metasediments of the Talladega belt are interlayered throughout a zone 130-165 feet (39-49.5 meters) in thickness. The interlayering of these two rock units at their contact strongly suggests that the contact between the metavolcanics and the metasediments is conformable in this area of Georgia.

The Royal-Vindicator sequence bears some similarities to the Pumpkinvine Creek Formation to the northeast but is most likely correlative with the Hillabee Greenstone in Alabama, since the two units occupy identical stratigraphic positions and are lithologically and chemically similar. Metasediments of the Talladega belt, near the contact with the Royal-Vindicator sequence, may be correlative with the Jemison Chert/Chulafinnee Schist, also in Alabama. The correlation of the Royal-Vindicator sequence with the Hillabee Greenstone places the Royal-Vindicator sequence within the Talladega belt and places the Talladega belt-northern Piedmont boundary at the contact between metavolcanics of the Royal-Vindicator sequence and graphitic schists of the western belt of the Sandy Springs Group. The correlation of the Royal-Vindicator sequence and the Hillabee Greenstone, also, strongly suggests that similar mafic phyllite/sericite schist units on strike in eastern Haralson and western Paulding Counties also should be included within the Talladega belt province.

Samples from both cores were assayed for the presence of gold, silver, copper, lead and zinc. No economic concentrations of these metals were found.

INTRODUCTION

In Georgia the contact between metavolcanic rocks near the northern boundary of the northern Piedmont (also called eastern Blue Ridge) and metasediments of the Talladega belt is poorly exposed, and most interpretations about the nature of this contact have been based on indirect evidence. The primary purpose, therefore, of this study was to obtain core across this important boundary in order to more fully understand its nature. A secondary purpose was to evaluate the economic potential for precious and base metal production in the vicinity of the boundary. The portion of the boundary examined in this report is the contact in Haralson County between a mafic/felsic metavolcanic sequence at the currently inactive Royal-Vindicator gold mine and metasediments of the Talladega belt. Recent core drilling for this study at this site has provided continuous core across this contact.

Interpretations of the nature of this contact in Georgia have been based primarily on the collective evidence from rocks on either side without the benefit of exposures of the contact itself. In Haralson and western Paulding Counties there are no known exposures of the contact. In these two counties, most evidence suggests that this contact is conformable (McConnell and Abrams, 1984; German, 1988); whereas, northeast of western Paulding County, where similar rocks are exposed, the contact is believed to be a fault (McConnell and Abrams, 1984; German, 1985, 1988) (Plate 1). To the southwest in Alabama, where this contact is locally exposed, the locally gradational nature of this contact has been described, and it is considered conformable (Tull and others, 1978; Tull and Stow, 1979, 1980; Tull, 1982). Higgins and others (1988), on the other hand, interpret the contact between the mafic/felsic metavolcanic sequence and the metasediments of the Talladega belt in Alabama as a thrust fault or series of imbricate thrust faults.

METHODS

Core drilling was done in February and March 1986. Two vertical holes were drilled in Haralson County in the vicinity of the currently inactive Royal-Vindicator gold mine. Core drilling began in the footwall of the ore body at the Royal-Vindicator Mine and was completed approximately 290 feet (87 meters) into metasediments of the Talladega belt. Hole #1 was drilled to 425 feet (127.5 meters), and hole #2 was drilled to 500 feet (150 meters). Total recovered footage was 804 feet (241.5 meters) of NX core (Appendix A). Drilling for this study followed gold exploration drilling by U.S. Borax and Chemical Corporation which was completed in November 1985. Permission to drill on this property was obtained by an agreement between U.S. Borax (lease holder) and the State of Georgia. Core drilling was done under contract by Longyear Company using a conventional wire line core rig.

The drill sites were chosen because of the somewhat obscure nature of the contact between the metasediments of the Talladega belt and the mafic/felsic metavolcanic sequence in this area and because of the availability of core from the remainder of the mafic/felsic metavolcanic sequence, which had been drilled previously by U.S. Borax. Logged core from two holes (GGHr-6D6 and 6D30) drilled by U.S. Borax,subsequently, was donated to the Geologic Survey and is available for examination. Core hole # GGHr-6D30 penetrated the structurally upper contact between the mafic/felsic metavolcanic sequence and the western belt of the Sandy Springs Group. This upper contact relationship is described by Paris (in press).

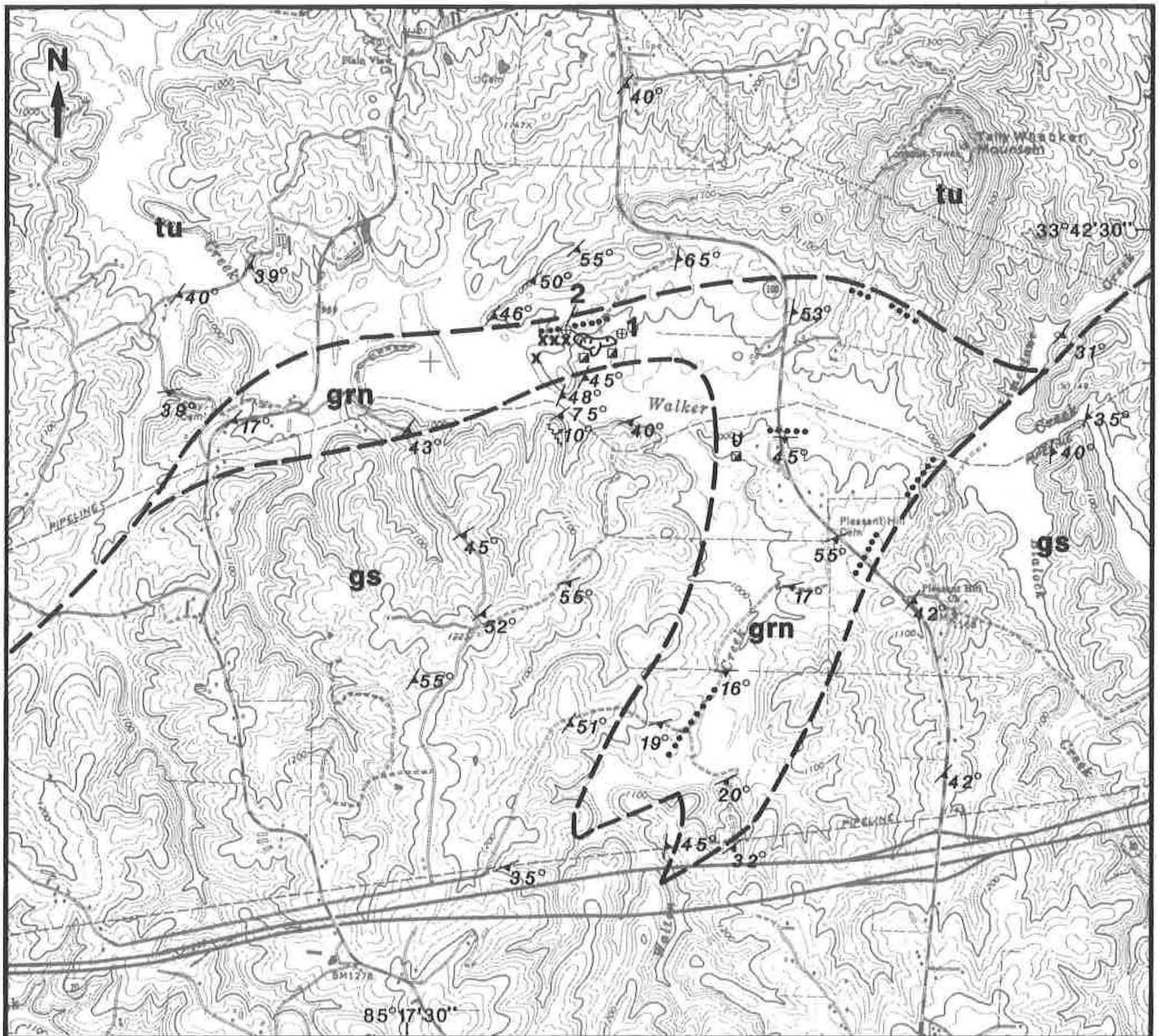
Field mapping in the area delineated several thin units of oxide facies iron formation that crop out within 75 feet (22.5 meters) of the contact between metasediments of the Talladega belt and mafic/felsic metavolcanic sequence (Figure 1). The trace of the iron formation was used to locate the approximate trace of the contact. A ground magnetic survey of the area was conducted to aid in delineating the iron formation where exposure was very poor. The magnetic survey, however, proved to be of little value, probably due to the presence of magnetite in some of the other lithologies and the presence of discarded iron objects in the vicinity of the mine. Both drill holes were located down-dip from iron formation float. A thin unit of iron formation was encountered in each hole. Judging from the depth each unit was intersected, the iron formations are either two separate units or one folded unit.

The core was logged within a month after drilling was completed. Macroscopic features (lithology, color, texture, etc.) were described, and representative lithologies were sampled for petrographic and geochemical analysis. Thirty thin sections were made and examined, and twenty samples were analyzed chemically.

STRATIGRAPHY AND STRUCTURE

Drilling began in the footwall of the ore horizon at the abandoned Royal-Vindicator gold mine. Gold was produced from this mine intermittently from 1840 to 1920 (Jones, 1909; Paris, 1986). The mine is located within a siliceous quartzofeldspathic gneiss which is part of a mafic/felsic metavolcanic sequence consisting of interlayered mafic phyllite, greenstone and quartzofeldspathic gneiss (Paris, 1986). The sequence is overlain by graphitic schist of the western belt of the Sandy Springs Group (McConnell and Abrams, 1984) and overlies metasediments of the Talladega belt. The mafic/felsic metavolcanic sequence (grn, Figure 1) consists of fine-grained mafic phyllite (epidote-plagioclase-actinolite phyllite ± calcite, chlorite, quartz and/or biotite), fine- to medium-grained quartzofeldspathic gneiss (muscovite-biotite-plagioclase-quartz gneiss ± epidote and/or garnet) and iron formation (magnetite quartzite) (Table 1) and will be referred to informally in this report as the Royal-Vindicator sequence.

Metasediments of the Talladega belt consist of biotite-chlorite-quartz phyllite (± muscovite and/or epidote) and minor amounts of biotite-muscovite quartzite (metachert) (± chlorite, magnetite, epidote and/or plagioclase) and calcite marble. The biotite-muscovite quartzite is a dense, very fine-grained rock that resembles a metamorphosed chert in hand sample. In thin sections, the quartzite is composed of alternating very fine- and fine-grained bands separated by streaks of biotite and muscovite. This texture may reflect metamorphosed original sedimentary features or may indicate subsequent shearing.



Base map from U.S. Geological Survey, Tallapoosa South, GA.–ALA., 1:24,000, 1980.

EXPLANATION

tu	Talladega belt metasediments	50°	Strike and dip of foliation
grn	Royal–Vindicator sequence	10°	Trend and plunge of crenulation axes
gs	Graphite schist	——	Contact
x	Pit	••••••••	Iron formation
	Open cut	⊕2	Drill site
	Shaft		0 — 2000 feet; 0 — 660 meters
	Adit		

Figure 1. Geologic map of the vicinity of the Royal–Vindicator Mine.

TABLE 1

Representative Modal Analysis of Major Lithologies*

	63-1**	85-1	104-2	107-2	92-1	121-1	137-1	125-2	140-2	167-2	197-2	460-2	275-1	263-2
Quartz	48	47	42	39		5	5	2	15	25	50	65	92	73
Albite			35	35						34				
Oligoclase	25													
Albite/Oligoclase		30			10	25	35	20	15		10			20
Actinolite					45	45	50	63	25	15				
Calcite			1			15	3			1				1
Chlorite		<1	<1	<1					30	20		20	<1	1
Epidote	6	10	5	10	45	10	7	10	15	5	10		1	3
Muscovite	10	3	7	10								5	3	
Biotite	10	10	10	6				2	<1	<1	30		2	
Garnet	1	<1												
Microcline				<1										
Opaques							<1	3	<1			10	2	2

*Visual estimates
**Sample numbers represent core depth in feet and hole number.

Samples 63-1, 85-1, 104-2, 107-2 - Quartzofeldspathic gneiss

Samples 92-1, 121-1, 137-1, 125-2, 140-2, 167-2 - Mafic phyllite

Samples 197-2, 460-2 - Phyllite

Samples 275-1, 263-2 - Quartzite

The mafic phyllite and quartzofeldspathic gneisses of the Royal-Vindicator sequence are most likely metamorphosed mafic and felsic flows and tuffs. Relict volcanic textures have been observed from this sequence (Travis Paris, personal comm. 1986). Whole rock and trace element chemistry of the mafic phyllites indicate an abyssal tholeiite affinity (German, 1988) (Table 2, Figures 2 and 3), suggesting an origin at a mid-oceanic ridge or in a back-arc basin (Rogers, 1982). Quartzofeldspathic gneisses are dacitic in composition (Figure 4). Because of the association of the metavolcanics with metasediments of the Talladega belt that contain shallow marine fossils (Tull, 1982), the metavolcanic rocks probably were deposited in a back-arc basin environment in close proximity to a primitive arc system (See German, 1988, Figure 19).

The geologic map of the area (Figure 1) indicates that rocks of the Royal-Vindicator sequence have been folded into a northeast-plunging antiform which is overturned to the northwest. Foliations within the mapped area appear to be axial planar to the antiform. The occurrence of garnets in quartzofeldspathic gneisses of the Royal-Vindicator sequence indicates that metamorphic grade is middle to upper greenschist facies.

CONTACT RELATIONSHIPS

Although the contact between the Royal-Vindicator sequence and metasediments of the Talladega belt is poorly exposed, the core reveals that mafic phyllites and quartzofeldspathic gneisses of the Royal-Vindicator sequence and phyllite and quartzite of the Talladega belt metasediments are interlayered throughout a zone 130-165 feet (39-49.5 meters) in thickness (Figure 5). The contact between the Royal-Vindicator sequence and metasediments of the Talladega belt is drawn on Figure 5 as the structural top of the biotite-muscovite quartzite. The interlayering of the metavolcanics and the metasediments (Figure 6), locally on a scale of 1-5 cm, strongly suggests that their contact is conformable.

REGIONAL CORRELATIONS

The Royal-Vindicator sequence is most likely correlative with the Hillabee Greenstone to the southwest in Alabama (Plate 1). Both units lie between metasediments of the Talladega belt on the northwest and rocks of the northern Piedmont on the southeast, and both are lithologically and chemically similar (Tull and Stow, 1980; Tull, 1982; Stow, 1982). The biotite-muscovite quartzite in the gradational zone between the Royal-Vindicator sequence and the Talladega belt metasediments may be correlative with the phyllitic facies of the Jemison Chert (Tull, 1982).

The Royal-Vindicator sequence also may be correlative with the Pumpkinvine Creek Formation (McConnell, 1980; McConnell and Abrams, 1984; German, 1985, 1988) to the northeast. Although the two units do occupy similar stratigraphic and structural positions adjacent to metasediments of the Talladega belt, the Pumpkinvine Creek Formation/Talladega belt sequence is not identical to the Royal-Vindicator/Talladega belt sequence in Haralson County. The major difference is that northeast of western Paulding County, the Canton Formation (McConnell and Abrams, 1984; German, 1985, 1988) is present between rocks of the Pumpkinvine Creek Formation and metasediments of the Talladega belt, but is not present in Haralson County between the Royal-Vindicator sequence and the Talladega belt metasediments.

Most workers, mainly in Alabama (See Tull, 1982 for a discussion of previous investigations), have generally defined the Talladega belt as a sequence of low-grade metamorphic rocks consisting, predominantly, of metasediments with minor metavolcanics that is in fault contact with unmetamorphosed Valley and Ridge sediments on the northwest and higher grade metamorphic rocks of the Piedmont on the southeast. Applying these same criteria to rocks examined in this report would place the Royal-Vindicator sequence within the Talladega belt and would place the northern Piedmont-Talladega belt boundary at the contact between the Royal-Vindicator sequence and graphitic schists of the western belt of the Sandy Springs Group (Figure 1). The correlation of the Royal-Vindicator sequence with the Hillabee Greenstone and the above placement of province boundaries, also, strongly suggests that low-grade mafic phyllite/sericite schist on strike to the northeast (Plate 1) also are correlative with the Hillabee Greenstone and are part of the Talladega belt. Recent mapping has extended some of the Talladega units into Georgia (Heuler and Tull, 1988, 1989).

CONCLUSIONS

Core from two drill sites in Haralson County at the currently inactive Royal-Vindicator gold mine has revealed that interlayering occurs at the contact between metavolcanic rocks of the Royal-Vindicator sequence and metasediments of the Talladega belt. These units are interlayered

TABLE 2

Major element, trace element and normative analysis of mafic phyllites and quartzofeldspathic gneisses from the Royal-Vindicator sequence

Major	Mafic phyllites					Quartzofeldspathic gneiss		
Oxide	92-1	121-1	156-1	132-2	140-2	85-1	104-2	107-2
SiO_2	48.9	41.7	50.0	47.0	48.0	75.8	71.6	72.5
Al_2O_3	14.8	13.9	16.1	15.2	14.2	13.0	14.1	14.6
Fe_2O_3	3.5	3.3	4.2	4.0	4.1	1.2	1.8	1.5
FeO	7.5	7.8	5.3	7.1	8.7	1.3	1.5	1.7
MgO	8.0	6.6	6.6	7.7	8.0	0.51	0.9	0.81
CaO	11.9	13.9	9.5	12.8	9.6	2.0	2.6	2.5
Na_2O	2.5	3.4	4.2	2.3	3.0	5.2	4.7	4.4
K_2O	0.2	0.17	0.08	0.12	0.26	0.84	2.0	1.1
TiO_2	1.1	1.6	1.0	1.3	1.4	0.23	0.25	0.24
MnO	0.19	0.22	0.27	0.22	0.22	0.06	0.06	0.07
P_2O_5	0.13	0.2	0.12	0.11	0.16	<0.02	0.04	0.04
LOI	1.8	7.5	3.0	1.9	2.3	1.1	1.5	1.2
Total	100.52	100.29	100.37	99.75	99.94	101.26	101.05	100.66
Trace element (ppm)								
Ti	6900	9400	6100	7100	8700	1300	1500	1400
Zr	65	80	45	55	70	145	75	75
Y	18	20	20	25	20	25	<10	14
CIPW Norms								
q						36.86	29.62	35.51
c								1.72
or	1.18	1.0	0.47	0.71	1.54	4.96	11.82	6.50
ab	21.16	6.75	35.54	19.46	25.39	44.00	39.77	37.23
an	28.57	22.16	24.84	30.80	24.51	9.65	11.47	12.14
ne		11.93						
di	16.96	24.70	13.54	18.90	12.20	0.07	0.68	
hd	6.99	12.26	3.67	6.87	5.70	0.05	0.26	
en	8.72		4.00	4.91	8.11	1.24	1.92	2.02
fs	4.12		1.24	2.05	4.35	1.10	0.83	1.62
fo	2.35	3.50	4.32	3.86	4.32			
fa	1.22	2.19	1.48	1.77	2.55			
mt	5.07	4.78	6.09	.80	5.94	1.74	2.61	2.17
il	2.09	3.04	1.90	2.47	2.66	0.44	0.47	0.46
ap	0.31	0.47	0.28	0.26	0.38	0.05	0.09	0.09
Total	98.73	92.80	97.38	97.86	97.65	100.16	99.55	99.46

Analyses performed by Skyline Labs, Inc.
Ferrous iron analyses by wet chemical methods, all others by ICP.

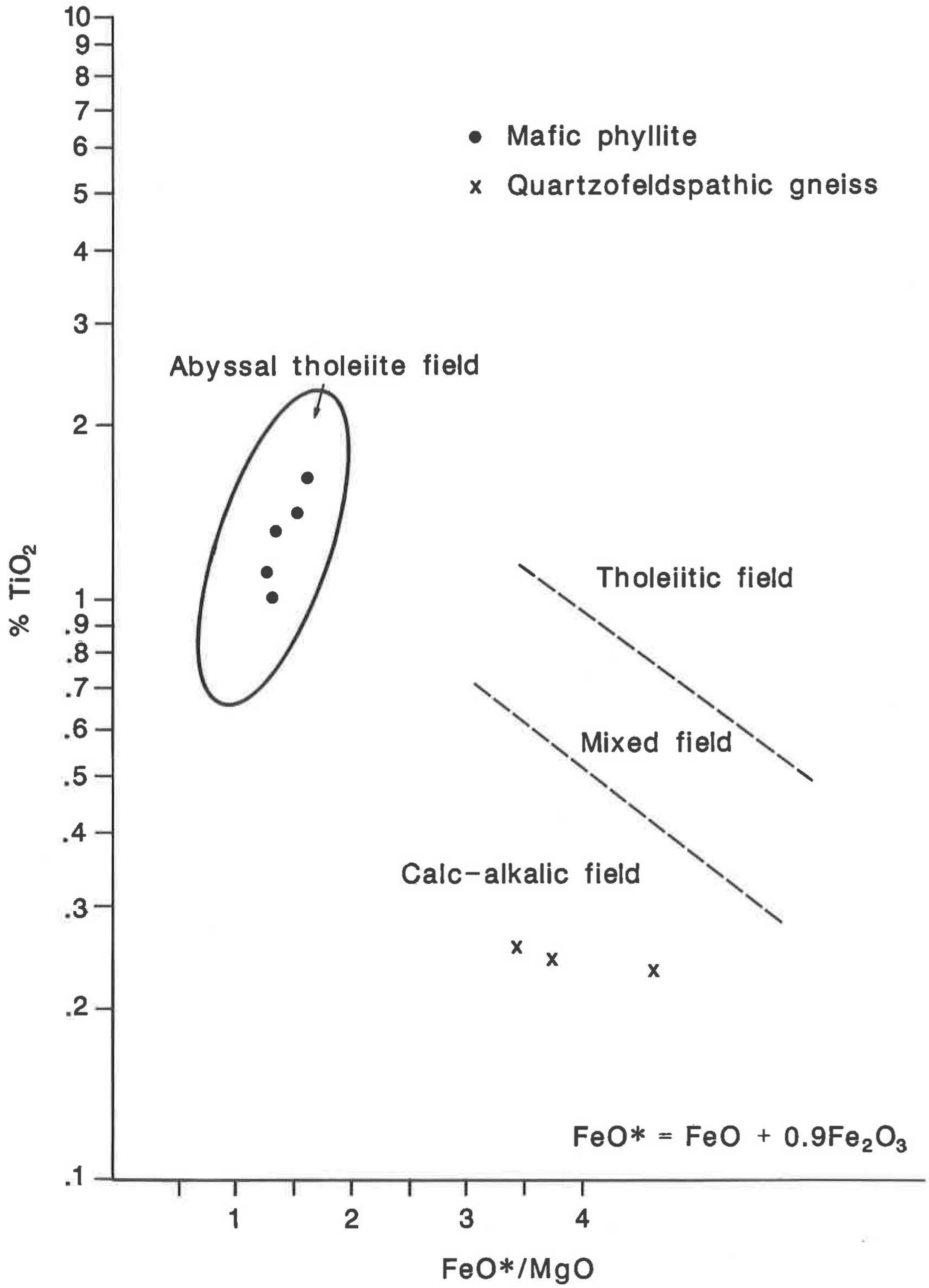


Figure 2. Discrimination of metavolcanic rocks of the Royal-Vindicator sequence based on % TiO_2 and FeO*/MgO (after Miyashiro and Shido, 1975).

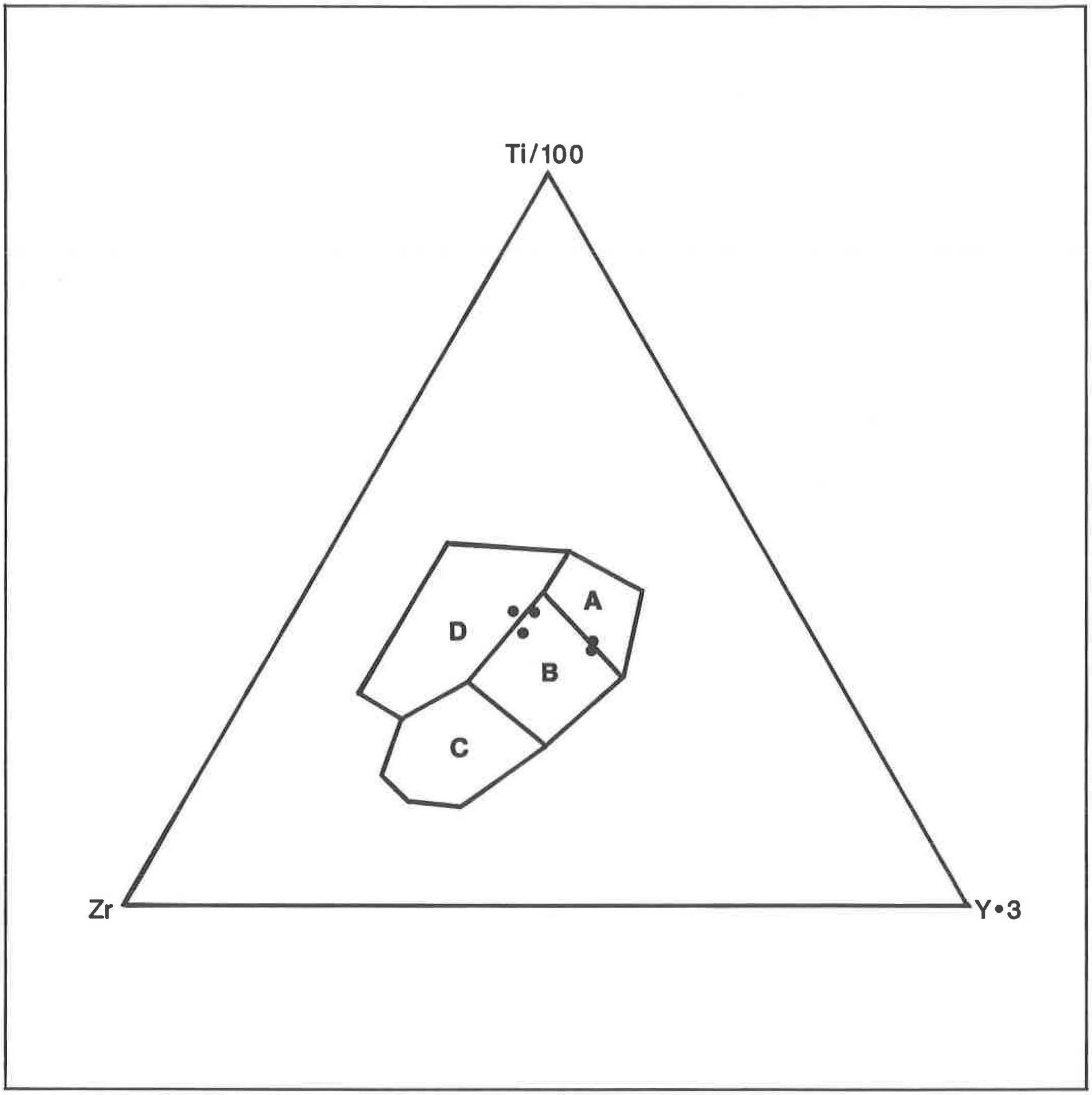


Figure 3. Discrimination of mafic phyllites from the Royal-Vindicator sequence based on ppm Ti, Zr and Y (after Pearce and Cann, 1973). Ocean islands or continental basalts - D, ocean floor basalts (abyssal tholeiites) - B, low-potassium tholeiites - A and B, and calc-alkalic basalts - C and B.

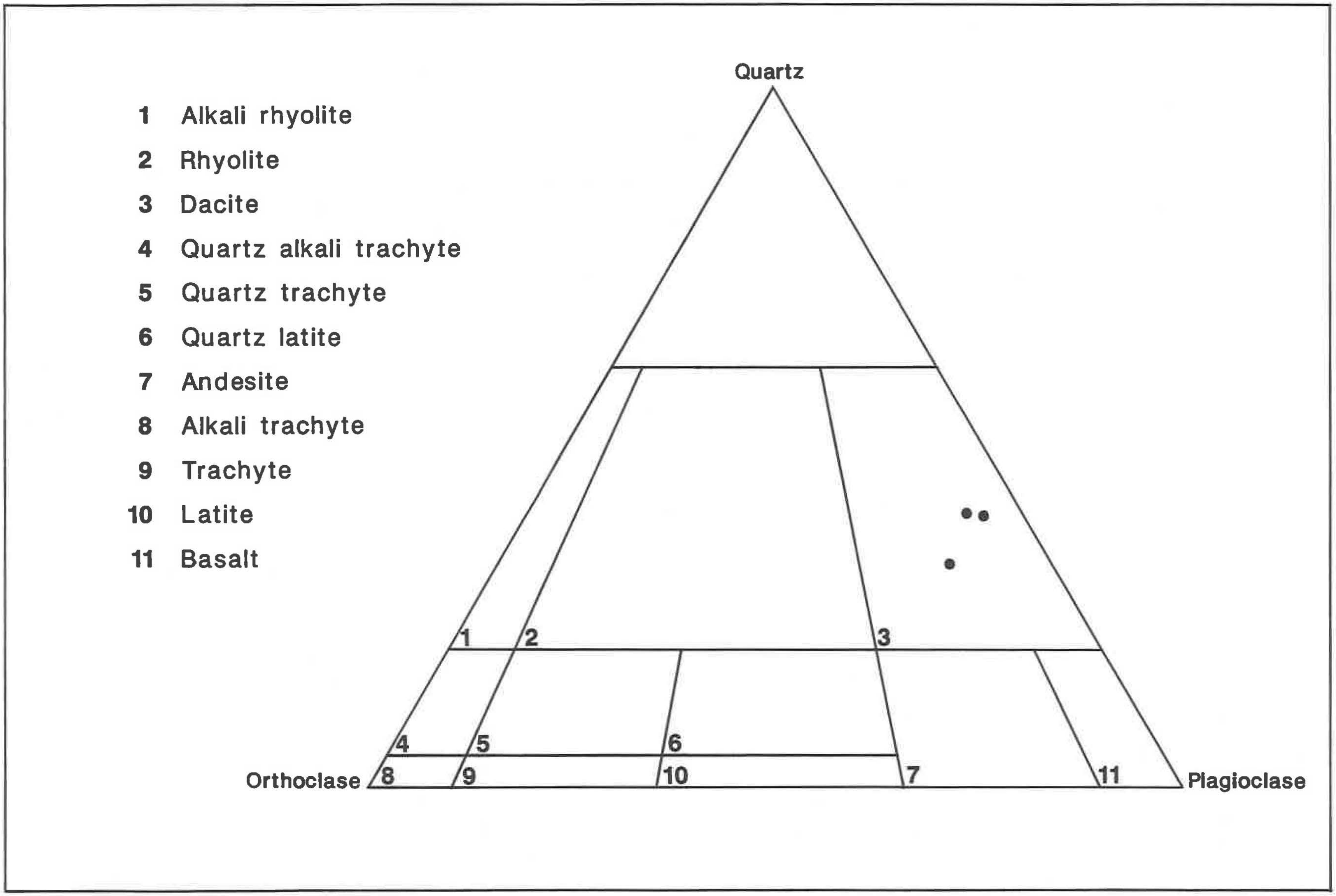


Figure 4. Plot of normative analyses of quartzofeldspathic gneisses from the Royal–Vindicator sequence. Classification modified after Streckeisen (1979).

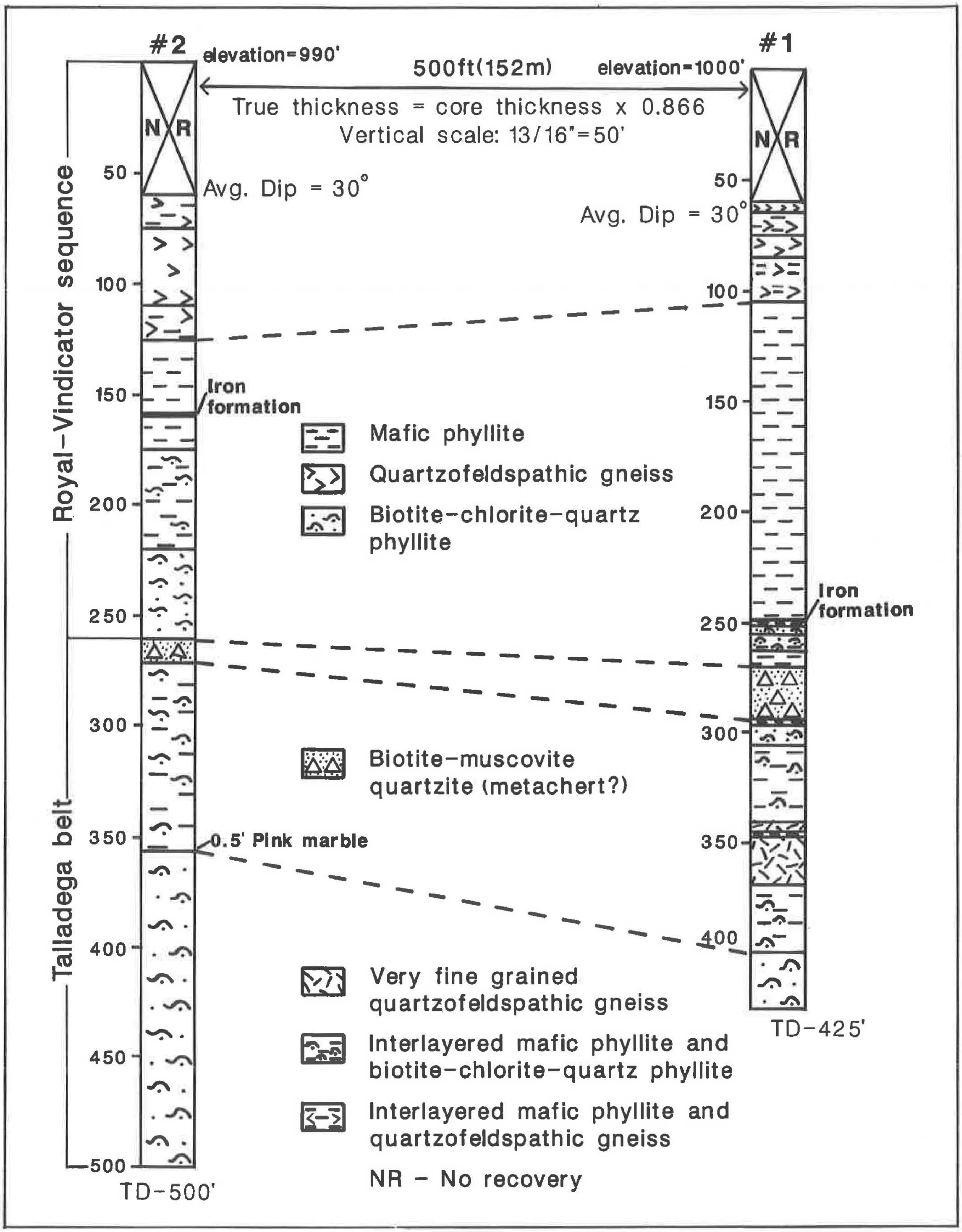


Figure 5. Correlation of stratigraphic units.

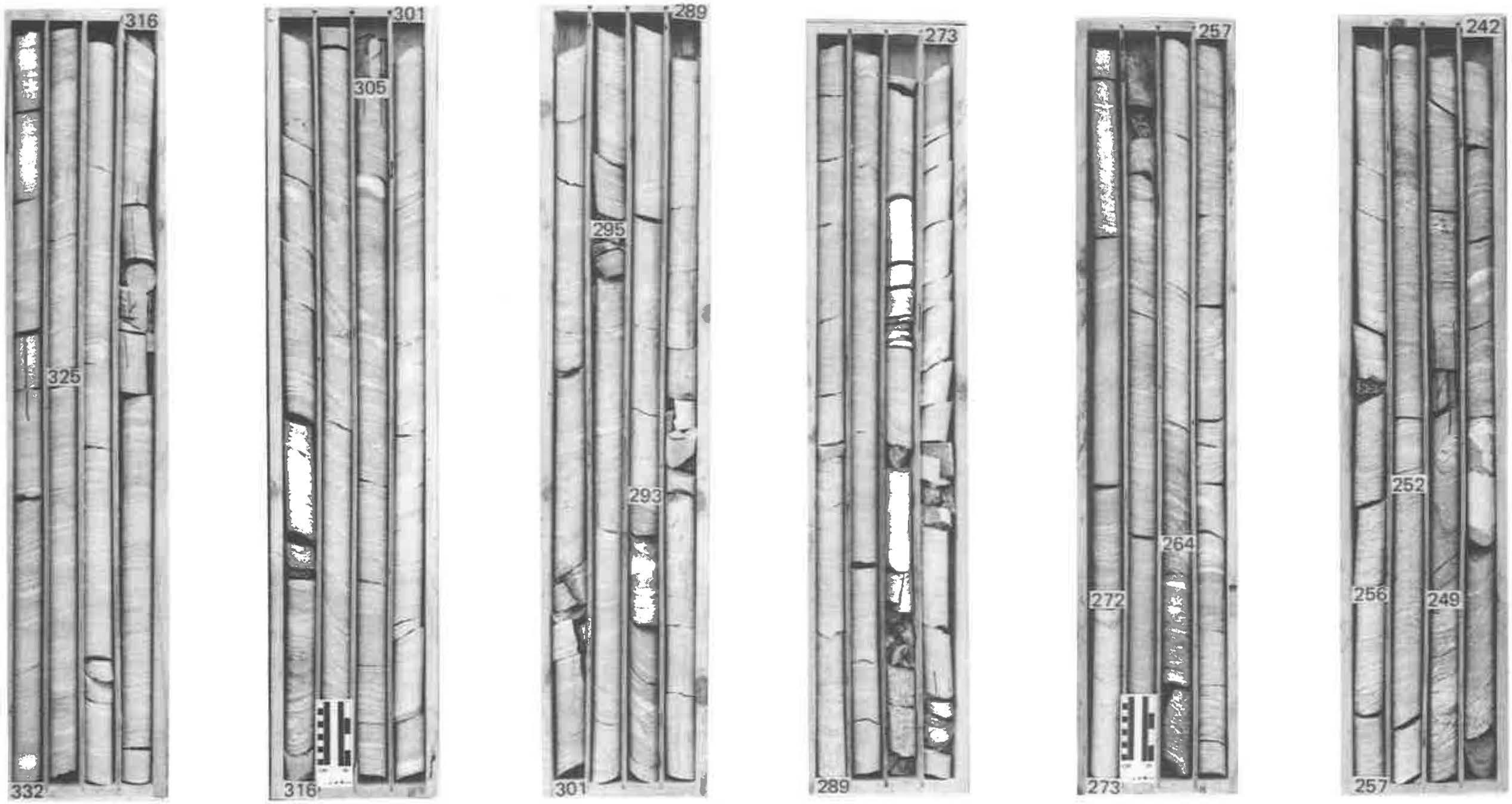


Figure 6. Photograph of core from the contact zone in Hole #1. (Reading from right to left and from top to bottom). 242' - 249': mafic phyllite, note folded iron formation in bottom foot; 249' - 252': finely interlayered mafic phyllite and biotite-chlorite-quartz phyllite; 252' - 256': biotite-chlorite-quartz phyllite; 256' - 264': biotite-chlorite-quartz phyllite with minor mafic phyllite; 264' - 272': mafic phyllite; 272' - 293': biotite-muscovite quartzite (metachert); 293' - 295': mafic phyllite; 295' - 305': biotite-chlorite-quartz phyllite; 305' - 325': mafic phyllite with minor biotite-chlorite-quartz phyllite; 325' - 332': mafic phyllite.

throughout a zone 130-165 feet (39-49.5 meters) in thickness. Even though the occurrence of a fault (or faults) at this contact cannot be totally ruled out, the interlayering at the contact strongly indicates that the metavolcanics are in conformable contact with the metasediments in this area of Georgia.

The Royal-Vindicator sequence is most likely correlative with the Hillabee Greenstone in Alabama, since the two units occupy identical stratigraphic positions and are lithologically and chemically similar. Such a correlation places the Royal-Vindicator sequence within the Talladega belt and places the Talladega belt-northern Piedmont boundary at the contact between metavolcanic rocks of the Royal-Vindicator sequence and graphitic schists of the western belt of the Sandy Springs Group. The correlation of the Royal-Vindicator sequence and the Hillabee Greenstone, also, strongly suggests that similar mafic phyllite/sericite schist units on strike in eastern Haralson and western Paulding Counties, also, may be part of the Talladega belt province. Metasediments of the Talladega belt near the contact with the Royal-Vindicator sequence may be correlative with the Jemison Chert/Chulafinnee Schist also in Alabama (Bearce, 1973; Tull, 1982).

Protoliths of mafic and felsic metavolcanic rocks of the Royal-Vindicator sequence are metamorphosed mafic and felsic flows and tuffs, probably deposited in a back-arc basin environment in close proximity to a primitive arc system. The phyllites and quartzites of the Talladega belt are most likely metamorphosed continental margin sediments.

Assays for gold, silver, copper, lead and zinc did not reveal the presence of any of these metals in economic quantities in either of the core holes. However, since the mine property was under an exploration lease by U.S. Borax and Chemical Corporation at the time of the drilling, the Survey's drill sites were purposely sited to avoid penetrating any ore body. Published (Paris, 1986) and unpublished (Travis Paris, personal comm., 1987) data on the remainder of the Royal-Vindicator sequence indicate the presence of minable gold deposits.

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APPENDIX A

APPENDIX A

CORE LOG DESCRIPTION

Location: Royal-Vindicator Mine
Haralson County
Date Drilled: February, 1986

Hole: #1 (GGS 3561)
Depth: 425'

Angle: Vertical

Depth (ft)	Description
0-60	Saprolite and soil; no recovery.
60-65	Tan, medium-grained garnet-epidote-muscovite-biotite quartzofeldspathic gneiss (badly weathered).

	oz/T Au	oz/T Ag	ppm Cu	ppm Pb	ppm Zn*
63-64'	<.005	<.01	10	105	65

65-75 — Fine- to medium-grained plagioclase-epidote-actinolite phyllite (mafic phyllite) (80%) with minor interlayered medium-grained muscovite-epidote-biotite quartzofeldspathic gneiss (20%) (weathered).

75-85 — Fine-grained muscovite-epidote-biotite quartzofeldspathic gneiss (slightly to badly weathered). Very light-colored zones 0.5 to 2' thick.

85-95 — Fine-grained muscovite-epidote-biotite quartzofeldspathic gneiss (80-90%) with minor interlayered fine-grained plagioclase-epidote-actinolite phyllite (mafic phyllite) (10-20%).

	oz/T Au	oz/T Ag	ppm Cu	ppm Pb	ppm Zn*
85-86'	<.005	<.01	30	45	55
92-93'	<.005	<.01	50	<5	25

95-105 — Fine-grained plagioclase-epidote-actinolite phyllite (mafic phyllite) (90%) with minor interlayered fine-grained muscovite-epidote-biotite quartzofeldspathic gneiss (10%). Mafic phyllite contains meta-amygdules(?) of calcite, epidote and quartz.

105-248 — Fine-grained quartz-epidote-calcite-plagioclase-actinolite phyllite (mafic phyllite), locally crenulated, contains disseminated pyrite and pyrrhotite, 3" brecciated zone at 142.5', local small-scale folds (amplitude approx. 0.5'), local quartzbodies 0.5-6" thick.

	oz/T Au	oz/T Ag	ppm Cu	ppm Pb	ppm Zn*
121-122'	<.005	<.01	35	445	255
156-157'	<.005	<.01	35	<5	45
246-248'	<.005	<.01	15	55	85

248-249 — Folded oxide facies banded iron formation infolded with chlorite schist (1" thick).

249-251 — Approximately equal amounts of interlayered epidote-calcite-plagioclase-actinolite phyllite (mafic phyllite) and fine-grained, light green to gray biotite-chlorite-quartz phyllite. Layering 1-6" thick.

251-255 — Fine-grained, light green to gray biotite-chlorite-quartz phyllite.

255-263 — Fine-grained, light green to gray biotite-chlorite-quartz phyllite (80%) with minor interlayered fine-grained calcite epidote-plagioclase-actinolite phyllite (mafic phyllite) (20%).

263-270 Fine-grained calcite-epidote-plagioclase-actinolite phyllite (mafic phyllite).

270-293 Very fine-grained, light gray biotite-muscovite quartzite (metachert?).

293-295 Fine-grained calcite-epidote-plagioclase-actinolite phyllite (mafic phyllite).

295-305 Fine-grained, gray biotite-chlorite-quartz phyllite. Disseminated magnetite at base.

305-340 Fine-grained epidote-calcite-plagioclase-actinolite phyllite (mafic phyllite) (90%) with minor interlayered biotite-chlorite-quartz phyllite (10%).

340-344 Very fine-grained, light gray epidote-biotite quartzofeldspathic gneiss.

344-346 Fine-grained epidote-calcite-plagioclase-actinolite phyllite (mafic phyllite).

346-369 Very fine-grained, light gray biotite quartzofeldspathic gneiss.

369-400 Fine-grained calcite-epidote-plagioclase-actinolite phyllite (mafic phyllite) (85%) with minor interlayered biotite-chlorite-quartz phyllite (15%).

400-425 Fine-grained, light gray biotite-chlorite-quartz phyllite, numerous quartz bodies throughout (1-6" thick).

Location: Royal-Vindicator Mine
Haralson County
Hole: #2 (GGS 3562)
Angle: Vertical
Date Drilled: March, 1986
Depth: 500'

<u>Depth (ft)</u> <u>Description</u>

0-60 Saprolite and soil; no recovery.

60-75 Approximately equal amounts of interlayered fine-grained quartz-epidote-biotite-plagioclase-actinolite phyllite (mafic phyllite) and fine-grained epidote-biotite-muscovite quartzofeldspathic gneiss (badly weathered).

75-110 Fine- to medium grained, light gray epidote-biotite-muscovite quartzofeldspathic gneiss, top 10' badly weathered.

	oz/T Au	oz/T Ag	ppm Cu	ppm Pb	ppm Zn*
104-105'	<.005	<.01	<5	<5	30
107-108'	<.005	<.01	10	55	60

110-125 Fine-grained quartz-biotite-epidote-plagioclase-actinolite phyllite (mafic phyllite) (95%) with minor interlayered fine-grained biotite-epidote quartzofeldspathic gneiss (5%).

125-158 Fine-grained chlorite-plagioclase-epidote-actinolite phyllite (mafic phyllite).

	oz/T Au	oz/T Ag	ppm Cu	ppm Pb	ppm Zn*
132-133'	<.005	<.01	165	<5	40
140-141'	<.005	<.01	135	100	310

158-160 Equal amounts of fine-grained chlorite-biotite-plagioclase-quartz-actinolite phyllite (mafic phyllite) and oxide facies iron formation (magnetite quartzite).

160-175 Fine-grained epidote-actinolite-chlorite-quartz plagioclase phyllite (mafic phyllite?).

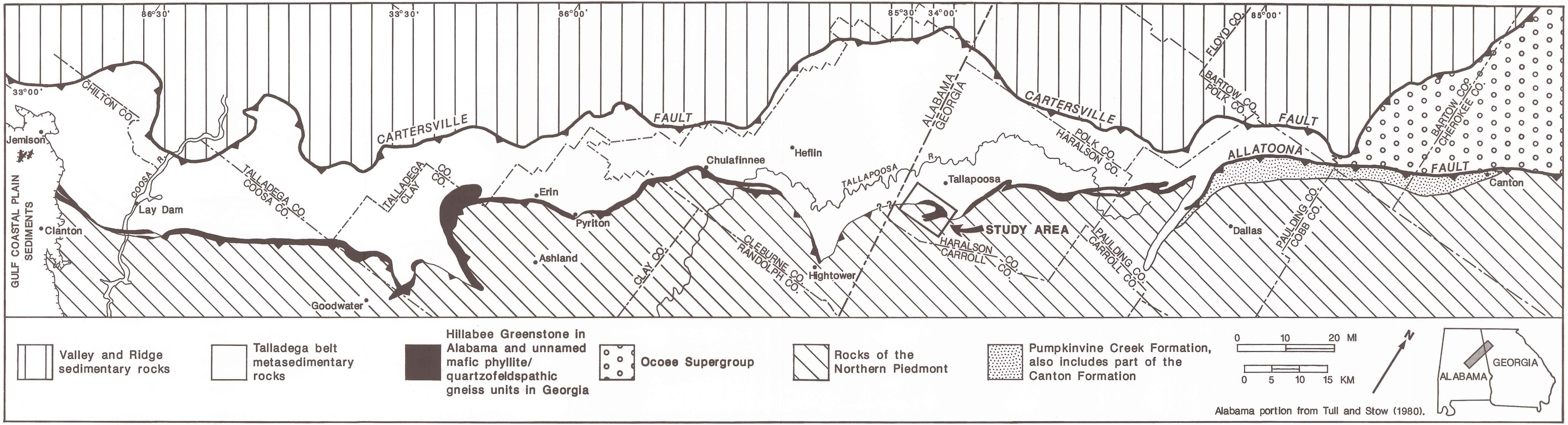
175-220	Fine-grained epidote-chlorite-quartz-actinolite-plagioclase phyllite (mafic phyllite) (85%) with minor interlayered biotite-chlorite-quartz phyllite (15%), locally folded.
220-261	Fine-grained, light green to gray biotite-chlorite-quartz phyllite, locally folded.
261-271	Very fine-grained, light gray biotite-muscovite quartzite (metachert?), local drag folds, disseminated magnetite and garnet.

	oz/T Au	oz/T Ag	ppm Cu	ppm Pb	ppm Zn*
263-264'	<.005	<.01	20	50	55

271-357	Approximately equal amounts of fine-grained epidote-quartz-actinolite-plagioclase phyllite (mafic phyllite) and interlayered fine-grained biotite-chlorite-quartz phyllite; individual layers 1' to 10' thick.
357-357.5	Fine- to medium-grained, pink calcite marble.
357.5-500	Fine-grained biotite-chlorite-quartz phyllite, disseminated pyrite, 1.5' quartz body at 476-477.5'.

*Analyses performed by Skyline Labs, Inc.
Au and Ag by fire assay
Cu, Pb and Zn by ICP.

DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION
GEORGIA GEOLOGIC SURVEY



REGIONAL SETTING OF THE STUDY AREA