FRIENDS OF MINERALOGY
Pennsylvania Chapter

NEWSLETTER

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BOARD OF DIRECTORS' MEETING

Winter, 1994

The Board of Directors held a meeting on the 14th of January, 1995, at the home of Vince and Marge Matula, in Walnutport, Pa., near scenic Lehigh Gap and Blue Mountain, seen through pouring rain. However, the warm hospitality, good food, and a beautifully displayed and organized mineral collection brightened up an otherwise dreary day.

Getting down to business, the Board elected Roland Bounds as President, Jay Lininger as Vice-President, and Arnold Mogel as Treasurer. George Rambo was named as Symposium Chairman. Juliet Reed, Heyward Wharton, and Arnold Mogel will continue on the Memorial Grant Committee, with the addition of Roland Bounds. Marge Matula is still the invaluable membership chairman. Douglas Rambo and Andrew Sicree, write-ins on the election ballots, were named to fill empty Board slots until the next election, in accordance with the By-Laws.

Plans for a spring field trip and a summer swap with other groups were discussed, as well as a Symposium, which will probably take place in late October or early November, hopefully at West Chester State University. The theme will be "Phosphates of the East Coast."

The Board voted to publish a manuscript by Dr. Arthur Montgomery, professor emeritus of geology at Lafayette College. Dr. Montgomery, well-known mineralogist and field collector, and the author of "The Mineralogy of Pennsylvania, 1922-1965," published by the Mineralogical Society of Pennsylvania in 1969, has written a book combining his aim of an interesting and understandable introduction to mineralogy for beginners with reminiscences of his own mineral collecting and field experiences.

Juliet Reed, who worked with Dr. Montgomery on the "Mineralogy of Pennsylvania" volume, will be the editor. Readers include the Board members, as well as Dr. Allen Heyl and Dr. David Hess, Chapter members. Jay Lininger, publisher of "Matrix," who has been responsible for type-setting and design of several F.M., Pa. Chapter, and M.S.P. books, has generously offered to do the same for the new Montgomery volume. The publication date has yet to be set (early 1996?); however, there will be a pre-publication offer publicized in the "Newsletter" and other publications.

MEMBERSHIP INFORMATION

Dues for the Pennsylvania Chapter are $10 or $8.00 for seniors over 62 and students. They include $5.00 for the National organization. Please send a check or money order to the Chapter, c/o Marge Matula, 10231 Honeysuckle Drive, Walnutport, PA 18088 (610-767-8056).

President: Roland Bounds, 3125 Stamford Dr., Newark, Del. 19711.

Treasurer: Arnold Mogel, 15 Oak Rd., Schuylkill Haven, PA 1792-9330.

Symposium Chairman: George Rambo, P.O. Box 126, Claymont, DE 19703.

Editor: Juliet C. Reed, 336 Rockland Rd., Wayne, PA 19087

Memories of a Scientist and Collector

Frederick Keidel, 68, lifelong mineral collector and chemist of note, passed away on January 3, 1995, at Christiana Hospital, Delaware. In spite of the difficulties of daily kidney dialysis for years before his death, Dr. Keidel continued his many activities, including mineral collecting, and stayed, as he was determined to do, out of the hospital until shortly before his death of a heart attack..

As Dr. Keidel of the DuPont Company, in Wilmington and at other DuPont laboratories, he was a well-known chemist, a specialist in electrochemistry, the science of the effect of electronic circuits on chemicals, according to an obituary in the Wilmington News Journal" by John Ward. He was a fellow of the American Institute of Chemists, and was honored by the Franklin Institute with the Longstreth Medal in 1960 for his invention, one of several patents, of a device to detect as little as a drop of water vaporized in a room. This invention has been important in refrigeration, to control wind tunnel atmosphere, and in checking rocket fuel quality.

Fred, as he preferred to be known in private life, anjoyed many activities. He kept the refrigeration unit running at the Wilmington Skating Club, tracked Echo I for the Wilmington News Journal in the early 1960's, taught astronomy at the YMCA in Wilmington, and co-founded the Delaware Mineralogical Society. He was an avid field collector, and acquired a second home, well located for collecting, near Burnside, North Carolina.

Mineral collecting from his boyhood in New Jersey, and acquisition of a fine mineral collection which will go to the University of Delaware, became more than a hobby. He was lead author of a paper on "Calcian Ancylite from Pennsylvania: New Data," with A. Montgomery, of Layfayette College, C.W. Wolfe, of Boston University, and R.P. Christian, of the U.S.G.S., published in an early issue of the "Mineralogical Record" (Vol. 2, No. 1, Jan.-Feb., 1971, p. 1825, and 36). The cover features a micromount of a tiny pink ancylite crystal from the Keystone Traprock Quarry, Cornog, Chester County, Pa., from his own collection. As a chemist, Dr. Keidel was able to measure the absorption spectra for visible light of ancylite, which appears pink in daylight or under incandescent light, and pale bluish gray under ordinary fluorescent light. The results attested to the presence of the lanthanide (rare earth) group in the mineral, and explained the variations in color seen by the human eye. Dr. Keidel also provided more than a thousand hand-picked the tiny ancylite crystals for X-ray fluorescence spectroscopic analysis.

Fred, a member of F.M., Pa. Chapter, as well as several other mineral societies, is remembered fondly by his fellow collectors as an enthusiastic collector and very good friend, who will be much missed.

COMING EVENTS

Feb. 9-12: Tucson Show and Friends of Mineralogy National Meeting, Tucson, Arizona.

February 25 (Snow Date, March 17): Open House, Dept.of Geology, Bryn Mawr College, 11 a.m.-5 p.m: Mineral and Fossil Exhibits; Socializing; Program at 2 p.m. (bring specimens for a "Show and Tell" and "What's New" session, after a tape on old mineral localities). Ample parking at the B.M.C. Science Center on Gulph Rd., between Morris Ave, andRoberts Rd., or walk from the Bryn Mawr Station. For map, contact Juliet C. Reed, Assoc. Curator of Minerals (610-688-6180, eves.)

March 4-5: Delaware Mineralogical Society's Gem and Mineral Show, Brandywine Terrace, 1314 Philadelphia Pike, Claymont, Del.; Sat., 10 a.m. to 6 p.m, Sunday, 11 a.m-5 p.m.

March 11: Micromount Swap and Sell, sponsored by the Rock and Mineral Club of Lower Bucks County, at the Emilie United Methodist Church, 7300 New Falls Rd., Levittown, Pa, 10 a.m.-4 p.m.

June 3: Pennsylvania Earth Sciences Association Spring Mineralfest at Macungie Park, Macungie, Pa. Call Dale Richards for information at (610)395-5138.

Editor's Note: The "Abstract" and "Introduction" of this article appeared as Part I, in the Fall, 1994, issue of the "Newsletter." Part III will appear in the Spring, 1995, issue. Note that tschermakite, an amphibole, is a new mineral for Pennsylvania.

DUMORTIERITE, TOURMALINE, TSCHERMAKITE, AND MINERAL X-Si-Al-Fe-Ca-Cl FROM COATESVILLE, CHESTER CO., PENNSYLVANIA:

Geologic History of a Veinlet Occurrence and Surrounding Wallrock

David F. Hess, Western Illinois University; Arthur Montgomery, Lafayette College; Robert C. Smith, II, Pennsylvania State Geologic and Topographic Survey

PART II

Geology

Geologic investigations of this area (Fig. 1, p. 5; Fig. 2, p. 6) have been conducted by Bascom and Stose (1932, 1938), Montgomery (1964, 1969), Smith (1978, 1988); and Crawford and Hoersch (1982, 1985). Hornblende-andesine ("gabbroic") gneisses may have intruded or been dropped into Pickering gneiss and schist, including graphitic varieties near the prospect, and surround the latter to the north, west, and south. The dravite-bearing assemblages found at the prospect, in association with pyrrhotite and pyrite in schist (Smith, 1978) may be linked with mafic intrusions, pneumatolytic action, and chimney formation in oceanic crust, and may or may not be coeval with formation of the dumortierite--tourmaline veinlets cutting anthophyllite gneiss. Higher Cr, V, and Ti in the dravites suggest a connection with fluids from basic melts, which is not the case with the dumortierite veinlet tourmalines, perhaps later in origin. Dravite-pyrrhotite-pyrite assemblages are common elsewhere in the Grenville Province. Dravite forms in preference to schorl, because the iron is taken up in the sulfide phases. The anthophyllite gneiss is thought to be an aluminous pyroxenite intruded or tectonically placed into the Pickering gneiss and schist, which are largely metasediments. It too, was regionally, and, perhaps, contact-metamorphosed under high temperature-medium pressure conditions, probably during Grenville Precambrian time. All of these rocks were thoroughly deformed in Grenville and Paleozoic time, and lie off on the south limb of an antiform.

Pegmatites with a northeast trend (including the Coatesville Pegmatite) intrude the mafic gneisses and Pickering schists and gneissses. These pegmatites are probably Paleozoic in age. The relationship of the dumortierite-bearing pegmatitc veinlets to that of the Coatesville pegmatite is unclear, but is believed to be mostly earlier in origin and different because of the following: (1) presence of aluminosilicate of higher metamorphic grade in the veinlets (no such association occurs in the Coatesville Pegmatite); and (2) differences in tourmaline geochemistry between dumortierite-bearing veinlets and the Coatesville Pegmatite. All these will be discussed subsequently. Maximum metamorphic rank is considered to be upper amphibolite facies (sillimanite zone, as evidenced by wallrock, regional mineralogy, and preservation of orthopyroxene locally in the anthophyllite gneiss, perhaps also recrystallized by contact metamorphism. Maximum temperatures may have declined somewhat within the amphibolite facies during veinlet emplacement, as indicated by: (1) presence of late aluminosilicate (presumed to be kyanite) in the veinlet; and (2) magnesio-hornblende with lower aluminum content than in the associated tschermakite, perhaps indicating retrograde metamorphism and scavenging of aluminum from amphibole for veinlet assemblages of tourmaline, dumortierite and aluminosilicate (see Figure 3).

As evidenced by regional assemblages in the Coatesville area, maximum conditions during Paleozoic metamorphism appear to have been upper greenschist facies conditions. Minor chlorite is associated with the Coatesville Pegmatite, and in retrograde minerals of wallrock assemblages. However, there is a possibility that the core of the Mine Ridge Uplift was a bit

DUMORTIERITE, ETC., FROM CHESTER CO., PA. (Part II, cont'd)

Geology (cont'd)

hotter at depth, and within the lower amphibolite facies at some point during Paleozoic time, perhaps during the Taconic Orogeny.

Veinlet Mineralogy and Paragenesis

The veinlet itself is zoned into: (1) a tourmaline-sodic plagioclase-rich border (An_7-A_{15}) adjacent to wallrock gneiss; and (2) a central zone with a dumortierite-quartz assemblage, which exhibits abundant evidence of later shearing. Dumortierite is richest and shearing most evident where the veinlet is widest. In zone (1), the wallrock border is enriched in brown biotite, and in the adjacent early-crystallized tourmaline (Tourmaline I), which formed as dark to dusky blue-green to olive-green rosettes growing towards the center of the veinlet. Terminations, outer zones, and separate tourmaline crystals, are here a darker, inky blue-black, enriched in iron relative to cores and wallrock border zone crystals. Tourmaline I has low-to-medium FeO content and medium-to-high MgO content; rims on some are higher in FeO and MgO than the core, and lower in Al_2O_3. TiO_2 is low, but higher in wallrock tourmaline (Tourmaline I) than those crystals farther out in the veinlet.

The second stage of mineral crystallization is exhibited in zone (2) as bright royal-blue, TiO_2-poor dumortierite prisms (Dumortierite I) and dumortierite-capping Tourmaline I terminations. Quartz began to crystallize more abundantly. The prisms of dumortierite have been drawn out into acicular needles, which penetrate quartz, and have been locally sheared and slickensided within the thicker parts of the veinlet (Dumortierite II). There is very little variation in chemistry between Dumortierite I and Dumortierite II, except that the needles of Dumortierite II are slightly less MgO-rich. Fractures crossing the dumortierite prisms were associated with an early stage of FeO-poor, MgO-rich tourmaline. This event were followed by a late stage of dark inky, blue-black schorl (Tourmaline II), which crystallized as prisms in epitaxial or stress-field relation to the dumortierite. This Tourmaline II occurs also in extensional fractures cutting the dumortierite prisms. Such tourmaline (Tourmaline II) is FeO-rich and MgO poor, and is characterized as schorl. The prisms are somewhat richer in fluorine and Al_2O_3 than the schorl of the fractures.

Overall, the schorl (Tourmaline II) is less Fe-rich than schorl from the Coatesville Pegmatite nearby, which is also more TiO_2-rich and fluorine-rich than either Tourmaline I or Tourmaline II from the veinlets. This suggests a separate genesis for the schorl from the Coatesville Pegmatite, versus that in the dumortierite-bearing veinlets cutting the anthophyllite gneiss wallrock.

The veinlets, especially the Oak Tree samples, contain late minor kyanite associated with, and surrounding, dumortierite and Tourmaline II. The prisms are dusky in color and show maximum Z inclined to C (extinction angle) of 30 degrees, but lack good kyanite cleavage, and may be pseudomorphous after an earlier aluminosilicate.

A pleochroic green to brownish-blue mineral called Mineral "X-Si-Al-Fe-Ca-Cl" occurs in very small amounts associated with tourmaline in the Oak Tree sample, and is a chlorine-rich silicate. Identification of this phase is incomplete. As shown in Table III, it has tourmaline-like ratios except for: (1) the necessity of putting 3 Fe into the Al site and (2) the apparent lack of enough room in the analysis for adequate boron. It may be an unusual chlorine analogue of tourmaline.

Representative analyses of veinlet minerals (dumortierite, tourmaline, schorl, kyanite, and the "X-Si-Al-Fe-Ca-Cl" silicate phase are given here for reference in Table I (p. 8), Table II (p. 9), and Table III (p. 10). Analyses of schorl from Coatesville Pegmatite dravite tourmaline from the "pyrrhotite prospect" are also given for comparison in Table IV (p. 11).

To be Continued

DUMORTIERITE, ETC., FROM CHESTER CO., PA. (Part II, cont'd)

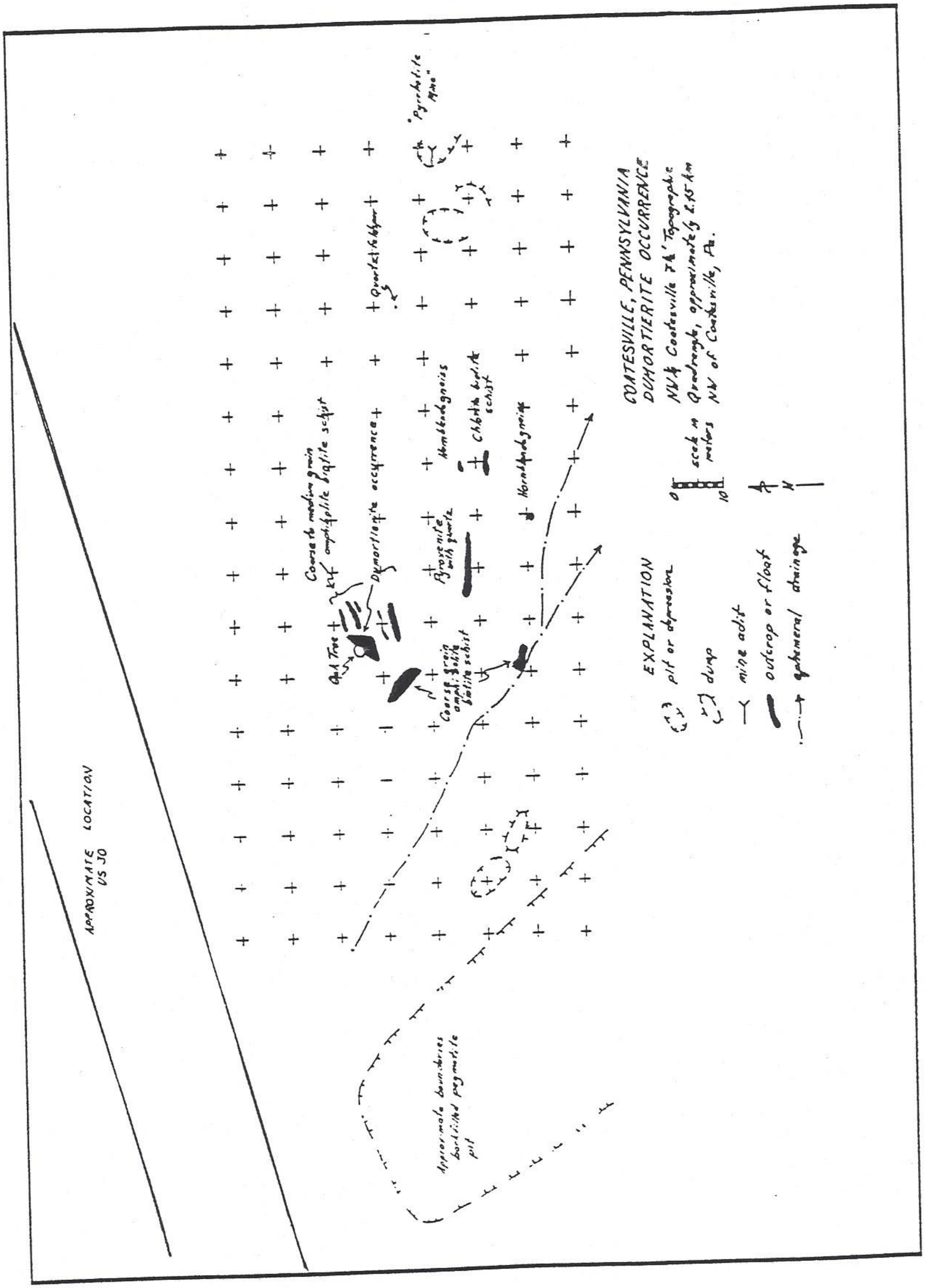
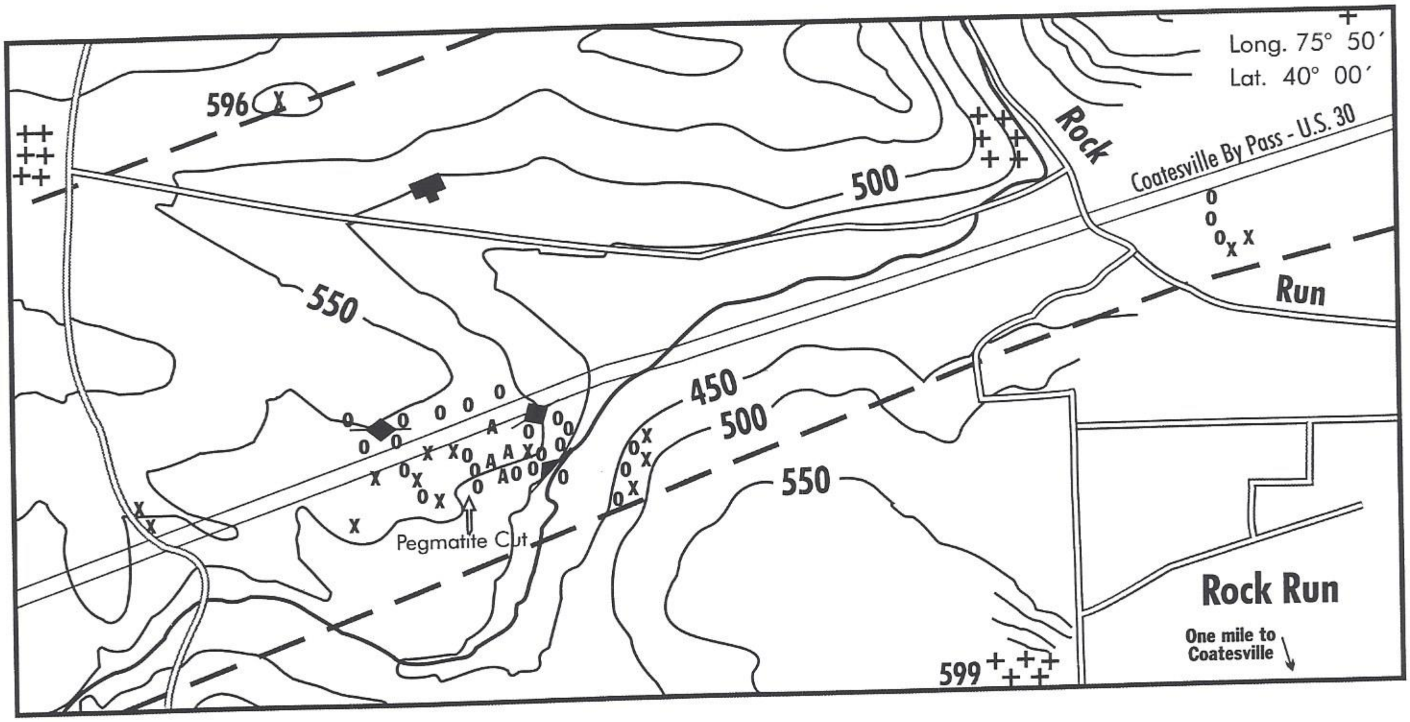


Figure 1: Map of the Dumortierite Veinlet Area (Arthur Montgomery)

DUMORTIERITE, ETC., FROM CHESTER CO., PA. (Part II, cont'd)

Figure 2: Dumortierite Veinlet Area Outcrop Map



- x x Granitic Pegmatite
- + + Amphibolite (metagabbro)
- A A Anthophyllite Rock (metapyroxenite)
- o o Pickering Gneiss and Schist (metasediments)
- Strike and Dip of Foliation
- Strike of Vertical Foliation

DUMORTIERITE, ETC., FROM CHESTER CO., PA. (Part II, cont'd)

Dots with circles refer to amphiboles from the Seria Abuzo Zone (Western Alps) evolving from pre-Alpine compositions [SL1185 and SL1160, p=8-10 kb, T@750°C] to higher P (~15 kb); lower T (@550°C) compositions (SL155, SL1188, SL1141) dependant upon bulk chemistry. Circles refer to amphiboles (hornblendes) from Tobacco Root Mountains, southwestern Montana. Dots indicate Coatesville, PA. samples. A+M4 is compared on y-axis with AlIV on x-axis. Coatesville, PA. tschermakites equilibrated at higher temperatures (700° - 750°C) and magnesio-hornblende under retrograde amphibolite conditions.

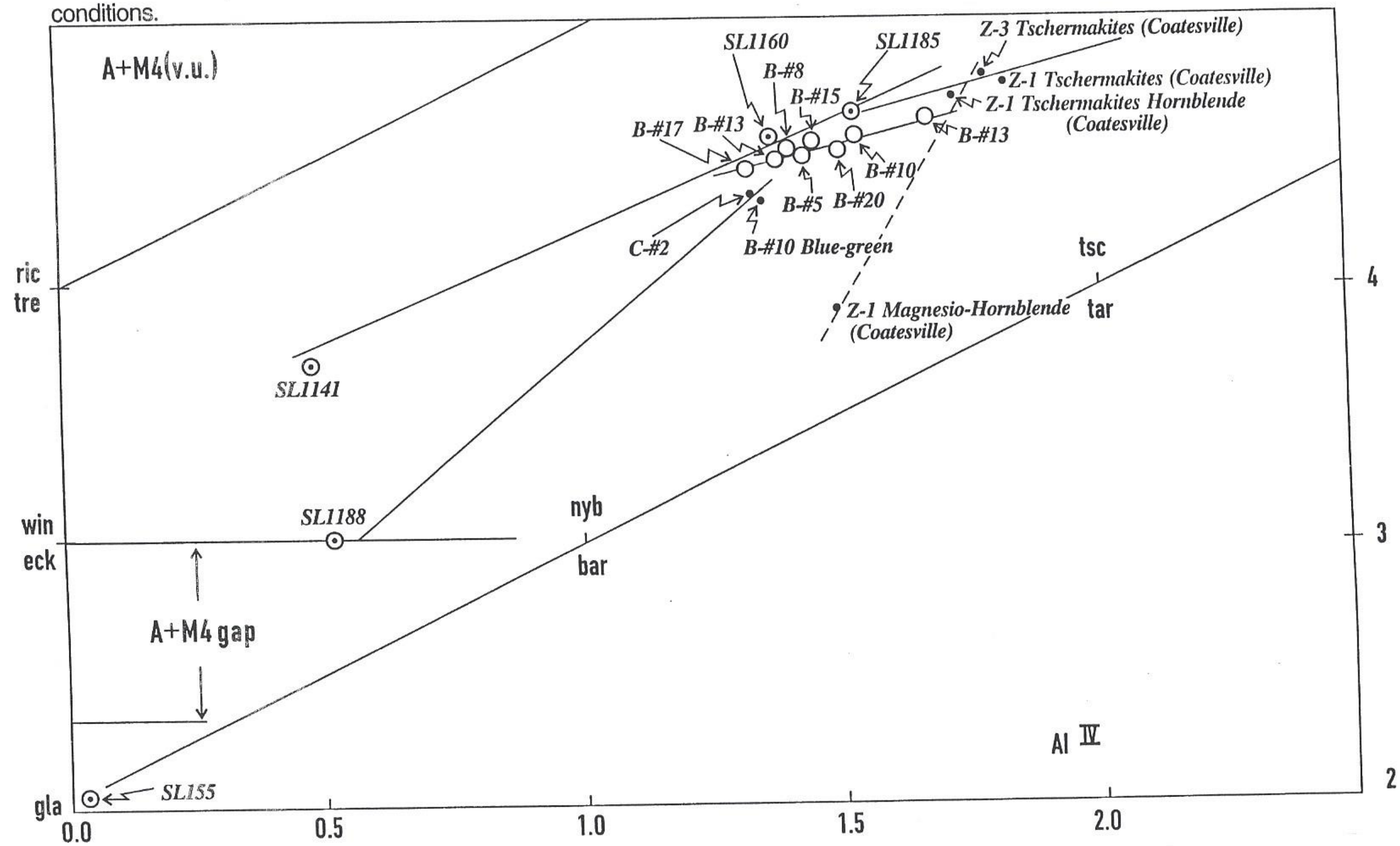


Figure 3: Geothermometric Evolution of Hornblende in Proterozoic Grenville of the Honey Brook Upland, Pennsylvania (Coatesville) based on Pre-Alpine Amphibole Evolution, Studied by Ungaretti and Ross, University of Pavia (Personal Communication to David Hess, 1984).

DUMORTIERITE, ETC., FROM CHESTER CO., PA. (Part II, cont'd)

TABLE I

Tourmaline Wallrock (Du p1386d) Wt%		Formula Molecule (6 silica normalized)		Tourmaline - Extension Vein Core (Du p1386d) Wt%		Formula Molecule (6 silica normalized)		Schorl Tourmaline - Extension Vein Rim (Du p1386d) Wt%		Formula Molecule (6 silica normalized)
SiO_2	35.85	Si	6.000	SiO_2	36.35	Si	6.000	SiO_2	34.14	6.000
TiO_2	0.11	Ti	0.014	TiO_2	0.01	Ti	0.001	TiO_2	0.01	0.001
Al_2O_3	33.42	Al	6.592	Al_2O_3	33.18	Al	6.452	Al_2O_3	34.80	7.208
Cr_2O_3	0.01	Cr	0.001	Cr_2O_3	0.01	Cr	0.001	Cr_2O_3	0.02	0.003
V_2O_3	0.00	V	0.000	V_2O_3	0.02	V	0.003	V_2O_3	0.04	0.006
FeO	6.52	Fe	0.913	FeO	4.89	Fe	0.675	FeO	11.28	1.658
MnO	0.06	Mn	0.009	MnO	0.03	Mn	0.004	MnO	0.08	0.012
MgO	6.87	Mg	1.714	MgO	8.42	Mg	2.072	MgO	2.73	0.715
CaO	0.41	Ca	0.074	CaO	0.63	Ca	0.111	CaO	0.37	0.070
Na_2O	2.51	Na	0.814	Na_2O	2.25	Na	0.720	Na_2O	1.92	0.654
K_2O	0.03	K	0.006	K_2O	0.01	K	0.002	K_2O	0.01	0.002
F	0.03	F	0.026	F	0.07	F	0.063	F	0.00	0.000
B_2O_3	10.38	B	3.000	B_2O_3	10.53	B	3.000	B_2O_3	10.60	3.000
H_2O	3.56	H	3.974	H_2O	3.58	H	3.937	H_2O	3.41	4.000
	99.76%		23.137		99.98%		23.041		98.70%	23.329

Analyst - David Lange, Harvard University

DUMORTIERITE, ETC., FROM CHESTER CO., PA. (Part II, cont'd)

TABLE II

Dumortierite - Prism (Du p1386d)				Dumortierite - Fiber Bundle (Du 92 - 1d)			
Wt%		Formula Molecule (3 silica normalized)		Wt%		Formula Molecule (3 silica normalized)	
SiO_2	29.62	Si	3.000	SiO_2	29.67	Si	3.000
TiO_2	0.001	Ti	0.000	TiO_2	0.00	Ti	0.000
Al_2O_3	60.86	Al	7.265	Al_2O_3	61.63	Al	7.344
Cr_2O_3	0.00	Cr	0.000	Cr_2O_3	0.00	Cr	0.000
V_2O_3	0.02	V	0.002	V_2O_3	0.01	V	0.001
Fe_2O_3	0.41	Fe	0.031	FeO	0.41	Fe	0.031
MnO	0.00	Mn	0.000	MnO	0.00	Mn	0.000
MgO	0.61	Mg	0.092	MgO	0.16	Mg	0.024
CaO	0.01	Ca	0.001	CaO	0.01	Ca	0.001
Na_2O	0.01	Na	0.002	Na_2O	0.01	Na	0.002
K_2O	0.00	K	0.000	K_2O	0.00	K	0.000
F	0.02	F	0.013	F	0.00	F	0.000
B_2O_3	5.72	B	1.000	B_2O_3	5.73	B	1.000
H_2O	1.09	H	0.737	H_2O	1.11	H	0.750
	98.37%		12.143		98.74		12.153

Analyst – David Lange, Harvard University

DUMORTIERITE, ETC., FROM CHESTER CO., PA. (Part II, cont'd)

TABLE III

Kyanite (Du 92-OT) Aluminum Silicate				Unknown Cl-rich mineral (Du 92 - OT)			
Wt%		Formula Molecule		Wt%		Formula Molecule (6 silica normalized)	
SiO_2	36.70	Si	1.000	SiO_2	38.13	Si	6.000
TiO_2	0.01	Ti	0.000	TiO_2	0.02	Ti	0.002
Al_2O_3	63.46	Al	2.038	Al_2O_3	16.85	Al	3.125
Cr_2O_3	0.00	Cr	0.000	Cr_2O_3	0.00	Cr	0.000
V_2O_3	0.00	V	0.000	V_2O_3	0.01	V	0.001
Fe_2O_3	0.51	Fe	0.010	FeO	20.36	Fe	2.679
MnO	0.01	Mn	0.000	MnO	0.24	Mn	0.032
MgO	0.00	Mg	0.000	MgO	6.22	Mg	1.459
CaO	0.00	Ca	0.000	CaO	10.05	Ca	1.694
Na_2O	0.00	Na	0.000	Na_2O	2.73	Na	0.833
K_2O	0.00	K	0.000	K_2O	0.78	K	0.157
F	0.01	F	0.001	F	0.14	F	0.070
B_2O_3	0.00	B	0.000				
H_2O	0.00	H	0.000	Cl	2.58	Cl	0.688
	100.70%		3.049		97.47%		16.720

Analyst – David Lange, Harvard University

DUMORTIERITE, ETC., FROM CHESTER CO., PA. (Part II, cont'd)

TABLE IV

Schorl Tourmaline Coatesville Pegmatite				Dravite Tourmaline Pyrrhotite Prospect			
Wt%		Formula Molecule (6 silica normalized)		Wt%		Formula Molecule (6 silica normalized)	
SiO_2	34.66	Si	6.000	SiO_2	36.55	Si	6.000
TiO_2	0.35	Ti	0.046	TiO_2	0.45	Ti	0.056
Al_2O_3	30.89	Al	6.302	Al_2O_3	31.40	Al	6.075
Cr_2O_3	0.00	Cr	0.000	Cr_2O_3	0.07	Cr	0.009
V_2O_3	0.00	V	0.000	V_2O_3	0.12	V	0.016
FeO	13.32	Fe	1.928	FeO	2.52	Fe	0.346
MnO	0.19	Mn	0.028	MnO	0.05	Mn	0.007
MgO	3.61	Mg	0.932	MgO	10.61	Mg	2.597
CaO	0.38	Ca	0.070	CaO	0.70	Ca	0.123
Na_2O	2.54	Na	0.853	Na_2O	2.49	Na	0.793
K_2O	0.07	K	0.015	K_2O	0.01	K	0.002
F	0.46	F	0.433	F	0.38	F	0.337
B_2O_3	10.04	B	3.000	B_2O_3	10.59	B	3.000
H_2O	3.09	H	3.567	H_2O	3.34	H	3.663
	99.60%		23.174		99.28%		22.974

Analyst – David Lange, Harvard University