FRIENDS OF MINERALOGY
Pennsylvania Chapter

NEWSLETTER

Spring, 1995 **Vol. 23, No. 1** **Page 1**

PRESIDENT'S MESSAGE

As your newly elected Chapter President, I would like to take time out ,and thank those of you who kept things running smoothly in the past, and also give special thanks to those of you who agreed to stay on. Anyone who has worked within a group, such as our F.M. Chapter, realizes that much of the work is done by a very small percentage of people.

I would also like to encourage anyone with an interest to step forward and help us continue with the quality tradition which has typically characterized Chapter activities. Our new Board members and officers are probably well known to most of you. I would ask all of our members to help out, if we ask for assistance. We are planning a number of activities for the upcoming year, including a Fall Symposium and field trip, and, if things go right, a "Swap and Sell." The Board is currently editing and planning to publish a manuscript, written for collectors by Dr.Arthur Montgomery, author of "The Mineralogy of Pennsylvania, 1922-1965" (1969), which is still available from our editor.

Shortly after my election by the Board, I was invited to attend the national F.M. Board meeting. Since I was in Tucson, anyway, I, along with Andrew Sicree, National and Pa. Board member, represented our Chapter. The National Board is currently engaged in reviewing and updating F.M.'s bylaws, so we may soon see some changes. The Board is also looking for someone to spearhead mineral locality indices from the following states: Alaska, Arizona, Delaware (I volunteered for this one), Illinois, Iowa, Kansas, Maryland, New York, North Dakota, Pennsylvania, South Carolina, South Dakota, Tennessee, and West Virginia.

Nationally, there is a drive on to increase membership. Beau Gordon (of Jendon Minerals) is personally leading this drive through the F.M. Dealer's Association and activities at the shows he attends. A small get-together was held in Tucson, and further social events are planned for both the Springfield, Massachusetts, and Denver, Colorado, shows. Speakingof the Tucson Show, next year's Mineralogical Symposium, partially sponsored by F.M., will be on "Fluorescence and Luminescence of Minerals."

The next F.M., Pa. Chapter, Board meeting will be in early June. Anyone with business may contact a Board member, and we will try to deal with it. By the way, the theme of the Fall Symposium will be on "Phosphates." George Rambo, with some difficulty due to conflicting schedules, is trying to set a date, which will be announced as soon as possible.

Thank you for your support.

Roland Bounds
315 Stamford Drive
Newark, DE 19711-2723

DUES

The National organization requires payment of dues from Chapter members early in the year. If you have not paid your 1995 dues, $10 or $8.00 for seniors over 62 and students, please do so at once. Dues 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). Summer, 1995, "Newsletters" will be held for members who have not yet paid their dues. Check your address label for a reminder. Thanks to those members who paid promptly.

MEMBERSHIP INFORMATION

Editor's Note: The "Abstract" and "Introduction of the following article appeared as Part I, in the "Fall, 1994" issue of the "Newsletter"; the "Geology," and "Veinlet Mineralogy and Paragenesis" sections appeared in the Winter, 1994 issue, as Part II.

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 III

Wallrock Mineralogy and Assemblages

The wallrock anthophyllite gneiss contains an assemblage of anthophyllite-brown to hornblende-brown biotite, with local hypersthene, plagioclase (andesine), almandine garnet, and quartz. Minor phases are ilmenomagnetite, titanite, and an apatite species.

The wallrock gneiss amphiboles vary greatly in alumina content. All hornblendes, regardless of composition, have a maximum optical absorption color of brown. Hornblende varies from tschermakite (defined as having silica molecule under 6.25, high aluminum, and the

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

Wallrock Mineralogy and Assemblages (cont'd)

total sodium and potassium in "A" position less than 0.50 formula molecule (Leake, 1978), through tschermakite hornblende to magnesio-hornblende (silica molecule 6.50 or more). All hornblendes have Mg greater than Fe in the wallrock samples. Up to 0.5 weight % of chlorine was observed in some of the hornblendes (this is discussed later on).

Anthophyllites generally have only 3-4% alumina by weight, but one aluminian anthophyllite contains 9.25% alumina by weight. It approaches, but does not equal the formula molecule of gedrite.

Representative analyses of tschermakite and magnesio-hornblende (new minerals for Pennsylvania), aluminum anthophyllite, and anthophyllite are given in Table V (p 5).

Discussion and Conclusions

It is suggested that, during veinlet formation, boron, water, silica, potash (used in formation of wallrock biotite), and some alumina were supplied by veinlet fluids. However, most alumina, calcium, magnesium, and iron necessary for tourmaline, dumortierite, and aluminosilicate formation were supplied by the partial breakdown of amphiboles from tschermakite to magnesio-hornblende and aluminian anthophyllite to anthophyllite, and to a lesser degree, of plagioclase in the adjacent gneiss wallrock.

During the late stages of formation of Tourmaline I, dumortierite (Dumortierite I) and quartz were permitted to crystallize after magnesium, iron, calcium, and sodium were largely used up by tourmaline and plagioclase crystallization. Some overlap of Tourmaline I and dumortierite crystallization may have occurred, since analyses indicate that the cores of certain larger tourmaline prisms in the center portion of the veinlet and the cores of certain tourmaline fracture fillings are Fe-poor and MgO-rich. The predominance of dumortierite and quartz indicated that the components alumina-silica-boron-water were then in excess.

During veinlet formation, metamorphic conditions may have been retrograded from high-amphibolite to middle-amphibolite conditions, as indicated by the presence of what is probably kyanite in the veinlet and retrograde hornblende from tschermakite to magnesio-hornblende in the wallrock. See Figure 3 (Part II, p. 7, Winter, 1994).

Shearing, during the later stages of dumortierite formation, resulted in formation of acicular needles of dumortierite (Dumortierite II), and shearing and slickensiding of dumortierite, quartz, and earlier tourmaline. Rims of large tourmaline prisms, and much of the extension- fracture fillings of tourmaline within dumortierite, all contain dark schorl (Tourmaline II), indicating the availability of ferromagnesian, alumina, and alkali constituents in the presence of excess boron. Finally the depletion of boron and ferromagnesian constituents, while excess of silica and alumina were still available, allowed minor aluminosilicate to develop around tourmaline and dumortierite prisms, while conditions were still in the amphibolite facies range. Chlorine from hornblendes or biotites in the wallrock may have been scavenged into veinlet solutions to produce mineral "X-Si-Al-CaFe--Cl" via chlorine-rich solutions. Some late shearing of tourmaline and dumortierite, and sericite formation, is probably of Paleozoic age.

Greenschist facies assemblages of talc, chlorite, and rarer saussurite occur as patches in the wallrock, and retrograde sericite occurs in both wallrock and veinlet assemblages. These may have been produced in the final stages of metamorphism.

It is believed that most, or all, of the dumortierite-tourmaline assemblages, from tourmaline geochemistry and aluminosilicate evidence, probably developed during Grenville time, but part may have developed during Taconic time (Paleozoic), if conditions nearby at depth were hot enough in the Mine Ridge Uplift area, as favored by one of the co-authors. The nearby Coatesville Pegmatite likely intruded either later in Grenville time, or, more likely, in Paleozoic time. Pegmatite schorl geochemistry (TiO_2 and F content) is much more similar to that of Glenarm

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

Discussion and Conclusions (cont'd)

schorl-bearing pegmatites (Eyerman, Analysis B, "tourmaline," 1911, in Gordon, 1922) than to that of the dumortierite veinlet schorl, which is lower in TiO_2 and F. However, host rock composition (schist and gneissic quartzite in Coatesville pegmatite versus anthophyllite gneiss for the veinlet) could also play a role, as the dravites in pyrrhotite and pyrite-bearing schist are also richer in TiO_2 and F. The geologic occurrence and mineral assemblage of the Coatesville Pegmatite is also similar to pegmatites intruding Cambrian-age Chickies quartzite in the Atglen and Gap region to the west, as well as the Glenarm Series pegmatites in Chester and Delaware Counties, Pennsylvania. We suggest, therefore, that the schorl in the Coatesville Pegmatite is of separate origin and age from the veinlet tourmaline-dumortierite occurrence, and may well be of Paleozoic age. However, this question can only be resolved by whole-rock isotopic age dates for the Coatesville Pegmatite.

Acknowledgments

Thanks go to Professors George R. Stevens, formerly of Lafayette College, and to the late Edward H. Watson, formerly of Bryn Mawr College, for many favors and for helpful discussions on the regional geology; to the late Professor Anatol Sementsov for translation of a Russian paper on dumortierite; and to John and Genevieve Matter for generous gifts and loans of dumortierite specimens, as well as their unselfish interest in furthering this mineralogical study. Thanks also go to Joe Southern, who donated specimens from another boulder find. Acknowledgments also go to David Lange of Harvard University and the Hoffmann Laboratory, Cambridge, Massachusetts, for the helpful microprobe analyses given in this paper, and to Harold Thompson for his excellent microprobe work and polished sections. Sam W. Berkheiser, of the Pennsylvania Geologic Survey assisted with the magnetometer survey. Lastly, we thank Connie Fairchild, Vicki Akers, Dawn Redding, and Nicole Neumann, Western Illinois University, for typing this manuscript.

References Cited

Bascom, F. and Stose, G.W., 1932, Geologic Atlas of the United States: Coatesville-West Chester Folio, Pennsylvania-Delaware. United States Geological Survey, No. 223.

Bascom, F. and Stose, G.W., 1938, Geology and Mineral Resources of the Honey Brook and Phoenixville Quadrangles, Pennsylvania. United States Geological Survey, Bull. 891.

Crawford, W. and Hoersch, A., 1982, The Geology of the Honey Brook Upland, SE Pennsylvania (abstr..), Abstracts with Programs, Geological Society of America, Northeastern and Southeastern Sections, v. 14. p. 12.

Crawford, W. and Hoersch, A., 1985, A Re-examination of the Mine Ridge, SE Pennsylvania (abstr.)., Abstracts with Programs, Geological Society of America, Northeastern Section, v. 17, p. 24.

Gordon, S., 1922, The Mineralogy of Pennsylvania. Academy of Natural Sciences of Philadelphia, Special Publication No. 1, 255 pp.

Leake, B.E., 1978, Nomenclature of Amphiboles, American Mineralogist, v. 63, p. 1023-1052.

Montgomery, A., 1964, Dumortierite at Coatesville, Pa., Pennsylvania Minerals column, Mineralogical Society of Pennsylvania Newsletter, Oct., p. 6.

Montgomery, A, 1969, The Mineralogy of Pennsylvania, 1922-1965, Academy of Natural Sciences of Philadelphia, sponsored by the Mineralogical Society of Pennsylvania. Special Publication No. 9, 104 pp.

Smith, R.C. II, 1978, The Mineralogy of Pennsylvania, 1966-1975, sponsored by Friends of Mineralogy, Pennsylvania Chapter. Science Press, Ephrata., Pa., 304 pp.

Smith, R.C.., II, 1988, Open File Report on a Geologic and Magnetic Survey. Pennsylvania State Geologic and Topographic Survey, Harrisburg, Pa.

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

TABLE V

Tschermakite (Z - 3)* Wt%		Formula Molecule (23 oxygens)	
SiO_2	41.39	Si	6.2202
TiO_2	0.04	Ti	0.0044
Al_2O_3	16.37	Al	2.9005
FeO	15.33	Fe	1.9270
MnO	0.25	Mn	0.0319
MgO	9.89	Mg	2.2164
CaO	9.96	Ca	1.6044
Na_2O	2.62	Na	0.7635
K_2O	0.40	K	0.0758
F	0.15	F	0.0711
H_2O	3.59	H	3.5946
	(Df.)		
	100.00%		19.4104

Magnesio-Hornblende (Z - 1) Wt%		Formula Molecule (23 oxygens)
SiO_2	44.13	6.5221
TiO_2	0.05	0.0052
Al_2O_3	13.84	2.4115
FeO	14.66	2.1374
MnO	0.37	0.0459
MgO	12.74	2.8058
CaO	8.47	1.3411
Na_2O	2.04	0.5840
K_2O	0.33	0.0623
F	0.07	0.0323
H_2O	3.31	3.2643
	(Df.)	
	100.00%	18.8866

Aluminian Anthophyllite (Z - 3) Wt%		Formula Molecule (23 oxygens)
SiO_2	48.30	6.9957
TiO_2	0.14	0.015
Al_2O_3	9.25	1.5787
FeO	17.92	2.1707
MnO	0.65	0.0801
MgO	19.24	4.1550
CaO	0.25	0.0384
Na_2O	1.18	0.3312
K_2O	0.00	0.0000
F	0.20	0.0932
H_2O	2.87	2.77509
	(Df.)	
	100.00%	18.2336

Anthophyllite (Z - 3) Wt%		Formula Molecule (23 oxygens)	
SiO_2	56.23	Si	7.5593
TiO_2	0.05	Ti	0.0055
Al_2O_3	4.51	Al	0.7552
FeO	18.20	Fe	2.14618
MnO	0.67	Mn	0.0806
MgO	20.65	Mg	4.3711
CaO	0.27	Ca	0.0406
Na_2O	0.60	Na	0.1648
K_2O	0.01	K	0.0010
F	0.11	F	0.0489
H_2O	1.70	H	1.6067
	(Df.)		
	100.00%		16.7955

* Also occurs in Z-1

Analyst -- David Lange, Harvard University