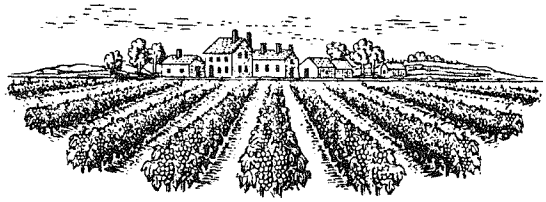
Johnson ESTATE Wines



Grown, Vinified & Bottled in the Chateau Tradition

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April 21, 1982

Mr. G. R. Dickerson
Bureau of Alcohol, Tobacco and Firearms
U. S. Treasury Department
1200 Pennsylvania Avenue
Washington D. C. 20226

RE: Lake Erie Viticultural Area Petition per 27 CFR 4.25 (e)(2)

Dear Director Dickerson:

The largest and one of the oldest and finest grape growing areas in the East is to be found on the lake plain bordering the southern and eastern shores and on the island archipelago of Lake Erie. Combined here to produce classic winegrowing conditions are a northern latitude resulting in long hours of summer sunlight, numerous and diverse soil associations on which grapes prosper, and, most importantly, a climate moderated by an adjacent large body of water - Lake Erie. Indeed this "lake-effect" on the local climate is the salient factor that distinguishes the Lake Erie viticultural area from its otherwise harshly continental climatic surroundings.

It should be stated at the outset of this petition that it is felt that there are recognizable subdivisions within the Lake Erie viticultural area, and that these viticultural subareas merit recognition and designation in their own right. However, these subareas are simply local geographic modifications of the common denominator of commercial viticulture in this area - the climatic influence of Lake Erie.

Per the requirements of 27 CFR 4.25 (e)(2), the following information is presented for consideration with respect to the Lake Erie viticultural area:

(i) Evidence that the name of the viticultural area is locally and/or nationally known as referring to the area specified in the application;

As will be seen, Lake Erie is the geographical feature that defines this viticultural area. Its name dates from the earliest written history of this continent, and Lake Erie is universally known as such.

While reference is frequently made to specific subareas of the Lake Erie district such as the Lake Erie Islands or the Chautauqua-Erie Grape Belt, or to the political subdivisions of the area, the Lake Erie viticultural area is also often recognized as a single entity (1, 2, 3, 4, 7, 10, 12, 19, 26, 37). Grossman (1977), for example, states

> When discussing eastern wine-producing areas, we feel that it is better to discuss geographic areas of similar climate and geology than to group areas by states. Many wine-producing areas cross political boundaries. The Chautauqua area of western New York, for example, lies in New York State, but the wines realistically should be grouped with those around neighboring Lake Erie.

Further on Grossman specifically defines this region with the term "Lake Erie."

> Lake Erie - Lake Erie is bordered on its eastern and southern shores by many vineyards that actually lie in Pennsylvania, Ohio and western New York. The Pennsylvania wineries are mostly around the city of North East. The Ohio wineries stretch from the eastern border of Ohio and Pennsylvania all the way west to Sandusky. In New York the Chautauqua area extends westward from Buffalo to Pennsylvania. Grapes are often sold among these states, and winemakers enjoy a cooperative spirit.

Likewise, Abel (1979), at the opening of his discussion of the Chautauqua region in New York, observes that "This section on the shores of Lake Erie really forms part of a single New York-Pennsylvania-Ohio-Lake Erie region."

Ruth Ellen Church (1982), in Wines of the Midwest, goes further and notes that "All of these establishments (wineries) - Ohio's, Pennsylvania's and New York's - lie close to the southern shores of Lake Erie and thus qualify for a federal Lake Erie wine district designation; they may achieve it in the early 1980's."

A number of current tourist-oriented publications similarly use the designation "Lake Erie" in reference to this area. For example, The Association of American Vintners in its "Wine Tour Guide" (1982) employs the designation "Lake Erie Region (Western New York, Pennslyvania, Northern Ohio)" and proceeds to break the region down as "Lake Erie East", "Lake Erie West", and "Lake Erie Central". Likewise, the Pennsylvania Wine Association refers to the "Lake Erie Area" in its "1981 Wine Trails of Pennsylvania" guide.

The term "Lake Erie" is also used incidentally throughout the literature in conjunction with the various subdivisions of the area, and these subdivisions are always defined with respect to the lake. Witness Adams (1978), "From Sandusky eastward to the Pennslyvania border, a ten-mile-wide strip of land facing Lake Erie is dotted with vineyards ..." (p.97) and on page 146 "The Chautauqua-Erie Grape Belt, the sixty-mile-long stretch of New York's Lake Erie shore . . . extend(s) inland from Lake Erie only three to sixteen miles".

Lastly, the BATF itself has in the past recognized the validity of the appellation "Lake Erie" with the granting of approvals for its use as the stated appellation of origin on the labels of at least two wineries (Cedar Hill Wine Co. and Markko Vineyard) located in the area.

(ii) Historical or current evidence that the boundaries of the viticultural area are as specified in the application;

The Lake Erie viticultural area has a 150 year history of grape growing and wine-making (well described by Adams (1978)), and trial and error over the years has proven viticulture in areas bordering the proposed area to be generally uneconomical.

As indicated by the quotations above, the approximate boundaries of the Lake Erie viticultural area have long been recognized. Hedrick (1908) describes the Chautauqua portion of the Lake Erie viticultural area thusly:

> The Chautauqua grape belt lies along the southeastern shore of Lake Erie. It averages about three miles in width and is about fifty miles long. Its northeastern boundary is in Erie County but not far from the line dividing Erie and Chautauqua Counties; its western boundary, in New York, is the Pennsylvania line, and arbitrary division, for the district passes into Pennsylvania.

Likewise, the Lake Erie viticultural area is often illustrated in the literature on several small-scale maps as a band paralleling the shore of Lake Erie. Good examples are Grossman's (1977) map on page 229 or the USDA's map of Generalized Types of Farming (1962).

That the Lake Erie area is a distinct and contiguous viticultural district is beyond doubt. Current orchard and vineyard surveys conducted by the states of New York, (1976) Pennsylvania, (1978) and Ohio (1976) report that, except where interrupted by urban development, there are approximately 40,000 acres of commerical vineyards scattered throughout the lake area. Indeed, these surveys report commercial vineyards of one acre or more located in every county (except Sandusky County) along the lakeshore from near Toledo, Ohio to south of Buffalo, New York. Very little or no commercial viticulture is indicated in surrounding inland counties.

Likewise, there are more than 30 commercial wineries, some dating from well before the turn of the century, distributed rather evenly throughout the Lake Erie area. None of these wineries are located more than ten miles inland from the lake. Their distribution, along with that of other grape processors, is illustrated on a map in the Eastern Grape Grower and Winery News 1981 Directory.

The specific boundaries proposed have been developed in consultation with many of the persons involved in viticultural research, extension, and the industry in the Lake Erie area, whose help is acknowledged at the conclusion of this petition. It must be clearly recognized that many sites within the proposed boundaries are wholely unsuitable for commercial viticulture due to soil, (Dahlberg, 1961) physiographic, (Haskins, 1950 and Morrison, 1936) or economic (urban development) considerations, and that any specific boundary, no matter how useful, will be somewhat arbitrary.

It is believed, however, that the proposed boundaries reflect with reasonable accuracy the extent of the area that contains sites which can justifiably be said to be suitable for commercial viticultural within the beneficial climatic influence of Lake Erie. The following outlines the considerations employed in selecting the specific boundaries proposed.

Cazenovia Creek is proposed as the northeastern boundary of the viticultural area. It generally represents the location where viticulture is terminated by the urban development of Buffalo and an unsuitably flat topography which results in poor drainage of air.

A line 12 miles inland from the lake running from Cazenovia Creek near Colden, New York to the 1300 ft. contour near Dayton, New York, marks the general limit of grape growing in Erie County, New York. Viticulture further inland is prohibited by the highlands of the "Boston Hills".

From near Dayton, New York to Goddard, Pa. the 1300 ft. contour line delimits commercial viticulture. This contour is the highest contiguous line that follows the crest of the escarpment of the Allegany Plateau in this section, and while very occasional Concord vineyards can be found above this elevation, they are almost never what could be described as commercial entities.

From Goddard, Pa., west to the intersection of Ohio Rt. 45 and Interstate 90, a line six miles inland from Lake Erie is proposed as the boundary. Areas further inland in this section are generally too high and too level to enjoy adequate air or water drainage for grape growing (cf. Haskins, 1950). Currently, there appears to be no commercial viticulture south of this line.

The proposed boundary then proceeds south along Ohio Rt. 45 to a point about a mile north of Rock Creek, Ohio, 14 miles inland from the lake, and then west along a line 14 miles inland from the lake to the Ohio-Michigan border. In this area, viticulture extends further inland first, in northeastern Ohio through Cleveland, due to the broken topography which provides several adequate sites quite far inland (Haskins, 1950, and

Morrison, 1936). Then from Cleveland to the west, the climatic moderation of Lake Erie, as shown on the charts, (e.g. Phillips and McCulloch, chart 19), extends further inland across the flat lowlands of north central and northwestern Ohio. Viticulture within the proposed boundary in this section is often limited for economic reasons by the urban and suburban development of greater Cleveland and Toledo, (indeed, the Westlake, Ohio area once was but is no longer a significant grape growing area for just this reason), and by heavy textured clay soils and competition from other types of agriculture between the two cities. It is felt, however, that a significant potential for commercial viticulture exists throughout much of this section and therefore the area in this section should not be more closely delimited.

The proposed boundary of the viticultural area then follows the Ohio-Michigan border to the international boundary and thence along the U. S.-Canada border to a point at 82° 30" west longitude which it then follows to the shore. This encompasses the Lake Erie (or Bass) Islands, whose area is almost completely devoted to the grape, and upon which the climatic influence of Lake Erie is axiomatic.

The boundary of the Lake Erie viticultural area then obviously follows the lakeshore back to the starting point.

(iii) Evidence relating to the geographical features (climate, soils, elevation, physical features, etc.) which distinguish the viticultural features of the proposed area from surrounding areas.

The geographical feature that defines and distinguishes the Lake Erie viticultural area from its surroundings is the presence of the Lake. Proximity to Lake Erie and the influence that it exerts on the local climate is the fundamental factor that permits commercially successful viticulture in this area. Soils, elevations, and other physiographic features within the area are diverse and through most of the area do not directly form the basis of the Lake Erie area's viticultural distinction.

Authorities agree that temperature, especially in terms of length of frost-free growing season, freeze hazzard at a given site (Haskins, 1950) and especially winter minimums, is the determining consideration with regard to the commercial viability of a vineyard in the northeast (6, 13, 15, 18, 31, 32, 38). T. D. Jordan et al.(1981) state in their bulletin on "Cultural Practices for Commercial Vineyards" that

> Temperature is the first consideration in selecting the location of a vineyard. It involves length of growing season, as well as magnitude and frequency of winter minimums. Temperature requirements must be satisifed for a site to be considered.

They go on to note that for commercial viticulture in this region a growing season of 165 days is considered minimal and 180+ days is preferable, and that winter minimum temperature should infrequently fall below -10° F. and almost never below -15° F.

Keeping these parameters in mind, let's examine in detail the nature and extent of the climatic influence of Lake Erie.

Visher (1954), in his Climatic Atlas of the United States, well summarizes the general climatic effect of the Great Lakes on their surroundings.

> Although the effect of a lake is chiefly to the leeward, in the Great Lakes region winds are so varied in direction that effects are evident on all sides. On the average, the Lakes raise the January average temperature of their surroundings about 5°. The absolute minimum temperatures about 10°, and the annual minima about 15°. . . . They increase the average length of the frost-free season about 30-40 days on their eastern and southern sides. They have a slight negative total influence upon precipitation, decreasing it appreciably in summer, largely by reducing convectional thunderstorms, . . . The lakes produce an average decrease of about five thunderstorms per year, and decrease the violence of many of those which do occur. . . The south shore of Lake Erie, with only five dense-fog days a year, has less fog than any other coastal area except southern Florida.

It should be noted that Visher's comments concerning the lake's effect on the summer moisture regime are significant (Morrison, 1936). As a rule, the successful culture of grapes requires a relatively dry and sunny growing and ripening period. That condition is locally promoted during those seasons by the Lake, together with generally reduced cloudiness and therefore significantly greater insolation than in surrounding areas. Likewise, while viticulture in the area no longer stands or falls on it, the reduced summer rainfall and few fog days (which typically occur only in late winter and early spring), combined with almost continuous lake breezes, serve to considerablely reduce problems with grape diseases in the lake area. Lastly, by reducing thunderstorm vigor and activity, Lake Erie shelters this area to some degree from the potential devastation of hail.

Most important, though, are the temperature effects of the lake. The Lake Erie area enjoys what has been termed a "lacustrine climate" lacking the temperature extremes otherwise inherent in a continental location (Dahlberg, 1961). The region benefits generally by being lower in latitude than and downwind from the other Great Lakes. The great stretches of Lakes Superior and Huron to the northwest considerably moderate arctic air masses moving across these lakes to the Lake Erie area. This effect is then locally enhanced by Lake Erie, thereby producing a climate adjacent to the Lake that has a lower mean daily range of temperatures. This results both in less growth-stimulating high temperatures and tissue-freezing low temperatures. These temperature effects are then diluted and gradually diminish as one proceeds inland from the Lake.

Lake Erie has by far the largest surface to volume ratio of any of the Great Lakes, with an average depth of only 58 feet and one-thirtieth of the volume of Lake Superior against a surface area of nearly 10,000 square miles. As a result, Lake Erie experiences by far the greatest annual temperature variation of any of the Great Lakes. It ranges from an average surface temperature of 72° F. in the late summer to 90% or more ice cover in the late winter - far more ice than typically develops on any other of the Great Lakes. (Much of the information in this discussion is derived from Phillips and McCulloch, 1972).

This wide and rapid seasonal fluctuation of the lake water temperature, and this fluctuation's lag with respect to seasonal air temperature variation, serves a very beneficial climatologic effect throughout the year. In the early spring, the accumulated ice and the very cold water of the Lake serves to cool the climate of the adjacent land against early spring warm spells which would otherwise force premature development of buds and thereby leave the grapevines vulnerable to freeze damage. In mid to late April, the Lake commences to warm rapidly and then buffers the area against late spring frost after vine development has begun. In the summer, the high water temperature achieved in Lake Erie offers less hinderance to the heat summation necessary for full grape development than any other of the Great Lakes. The summer's high temperature is then carried over into fall, warming the air adjacent to the Lake and keeping fall frosts at bay for a month or more longer than surrounding areas. This results in an average frost-free period of approximately 170-175 days with a 200 day growing season to be found in some portions of the Lake Erie area, the longest growing season in the Great Lakes region. Likewise, as noted by Visher (1954), proximity to the Lake in winter affords considerable protection against extreme minimum temperatures, with winter minima of less than -10° F. being uncommon across most of the proposed area while inland areas often experience temperature 10° - 15° lower.

These climatic effects are frequently mentioned and well documented in numerous climatological reports and charts (14, 22, 23, 29, 30, 33, 34, 36). Perhaps the most illustrative of these charts is Phillips and McCulloch's (1972) "Chart 19 - Mean Annual Frost Free Period (Days)" Here the climatic impact of Lake Erie is dramatically visible. The mean length of growing season isopleths almost exactly parallel the southeastern lakeshore, with the 160 day isopleth, the practical limit of commercial viticulture, averaging about ten miles inland over most of the area. Note how this compares with the proposed outline of the Lake Erie viticultural area. The map of hardiness zones given on page 17 of Westwood (1978) similarly shows a zone of higher winter minimum temperatures clearly outlining Lake Erie and that closely corresponds to the proposed viticultural area.

It should be noted, however, that these charts offer only a general outline. In many portions of the lake area, the air drainage of a given site greatly affects its microclimate with respect to freeze and low temperature damage. In this regard, the sloping areas found further inland have rather an advantage over the more level areas often found close to the Lake, and Lake Erie, by being at the lowest elevation, serves as a vast sink for cold air to drain to (Haskins, 1950).

The only portion of the Lake Erie area in which elevation and physical features play a direct role in delimiting viticulture is in Chautauqua County, N. Y. and Erie County, Pa. As noted by references cited above, there the high-elevation Allegheny Plateau with its too short growing season and too low winter temperatures clearly limits the grape belt to a width of as little as three miles inland.

(iv) The specific boundaries of the viticultural area, based on features which can be found on U. S. Geological Survey (U.S.G.S.) maps of the largest applicable scale;

As discussed above, the true defining aspect of the Lake Erie viticultural area is climatic, and therefore illustrated only indirectly on U.S.G.S. maps. However, reasonable boundaries for the viticultural area can be "based on features which can be found on U.S.G.S. maps". As noted, Lake Erie's climatic influence is related to proximity to the lake, and to some degree , elevation and slope. Hence, much of the proposed definition of the boundaries of the viticultural area is based on a feature that can be readily found on any map of the area - the lakeshore - and, when lacking any other reasonably representative line on the maps employed, distance from the lakeshore.

A formal narrative description of the proposed Lake Erie viticulture area is as follows:

(a) Name. The name of the viticultural area being proposed is"Lake Erie".

(b) Maps. The maps used for determining the boundaries of the Lake Erie viticultural area are four U.S.G.S. maps titled:

(1) Buffalo (NK17-6),scale of 1:250,000 series
(2) Erie (NK17-5), " " " "
(3) Cleveland (NK17-8)," " " "
(4) Toledo (NK17-7), " " " "

(c) Boundary. The Lake Erie viticultural area is located along the shore and on the islands of Lake Erie across the states of New York, Pennsylvania, and Ohio. The boundary is as follows:

(1) The beginning point is the point where Buffalo Creek empties into Lake Erie at Buffalo Harbor.

(2) The boundary proceeds up Buffalo Creek to the confluence of Cazenovia Creek.

(3) The boundary proceeds up Cazenovia Creek and thence up the West Branch of Cazenovia Creek to a point approximately one mile north of Colden, N. Y., exactly twelve statute miles inland from any point of the shore of Lake Erie.

(4) The boundary proceeds southwestward and along a line exactly twelve statute miles inland from any point on the shore of Lake Erie to a point approximately on mile north of Dayton, N. Y. where it intersects the 1300 foot contour line.

(5) The boundary proceeds generally southwestward along the 1300 foot contour line to a point almost two miles north-northwest of Goddard, Pa., exactly six statute miles inland from any point on the shore of Lake Erie.

(6) The boundary proceeds southwestward along a line exactly six statute miles inland from any point on the shore of Lake Erie to the point where it intersects Ohio Route 45 near the intersection with Interstate 90.

(7) The boundary proceeds southward along Ohio Route 45 to a point exactly fourteen statute miles inland from any point on the shore of Lake Erie approximately one mile north of Rock Creek, Ohio.

(8) The boundary proceeds southwestward, then westward then northwestward along a line fourteen statute miles inland from any point on the shore of Lake Erie to the point where it intersects the Ohio-Michigan boundary just north of Centennial, Ohio.

(9) The boundary proceeds eastward, then northeastward along the Ohio-Michigan boundary to the United States- Canada boundary.

(10) The boundary proceeds southeastward along the United States-Canada boundary to a point at 82^{o} 30' west longitude.

(11) The boundary proceeds southward along 82^{o} 30' west longitude to the shore of Lake Erie.

(12) The boundary proceeds northwestward along the shore of Lake Erie to the beginning point at the mouth of Buffalo Creek.

It should be recognized that these boundaries exclude Pelee Island in Canada upon which there is considerable grape-growing activity. This island is, in fact, an integral part of the Lake Erie viticultural area save that it lies in another country. Its exclusion is therefore arbitrary but no doubt necessary.

One final note. That this essentially contiguous area has not been more clearly recognized as such on a market basis is due in large part to the profound and artificial fragmentation of the area resulting from the fact that it extends across the political boundaries of the states of New York, Pennsylvania, and Ohio, and even into Canada. A unified Lake Erie viticultural area would be an excellent vehicle to rectify the unnecessary discontinuity of this area. It would also greatly enhance the potential for commerce among the states, and certainly would serve to clarify and improve the consumer's understanding of the nature of viticulture in this important area.

Sincerely,

William A. Gulvin

William A. Gulvin
Secretary - Ad Hoc Committee for
the Lake Erie Viticultural Area

WAG/mj

ACKNOWLEDGEMENTS

A great number of people have, over the last two years, contributed to this petition. Outstanding among these are Dr. Nelson J. Shaulis, Professor of Viticulture Emeritus at the N.Y.S. Ag. Experiment Station at Geneva, Cornell University, Geneva, N. Y., Dr. Carl W. Haesler, Professor of Pomology and Pomology Extension at the Pa. State University Erie County Field Research Laboratory, North East, Pa., and Dr. Garth A. Cahoon, Professor of Horticulture, Extension Viticulturist at the Ohio Ag. Research and Development Center, the Ohio State University, Wooster, Ohio, all of whom were most generous with their comments, learning, and insight. Likewise Trenholm D. Jordan, Regional Extension Specialist, Great Lakes Grape Program, Fredonia, Chautauqua County, N. Y., and Lawrence G. Anderson, Associate Professor, Ohio State University, County Extension Agent, Agriculture and CNRD, for Ashtubula County, Ohio were of great assistance, especially with the definition of the boundaries in their areas. Without the organizing push of Doniella Winchell, Executive Secretary of the Ohio Wine Producers Association, this petition might never have been written. J. William Moffett, Executive Director of the Association of American Vintners, deserves a note of thanks for his excellent editorial critique of the first draft of this petition. In addition, drafts of this petition were circulated widely and reviewed by many members of the industry, both in and outside of the Lake Erie area and too numerous to thank individually, who contributed references, their thoughts, or their encouragement and support. Lastly, Frederick S. Johnson, owner of Johnson Estate Wines of Westfield, N. Y. deserves special recognition both for his many perceptive comments and for underwriting much of the time and expense involved in the preparation of this petition.

BIBLIOGRAPHY

1. Abel, D., 1979. Guide to the Wines of the United States. Cornerstone Library, New York. pp. 115-116, 119-120.

2. Adams. L. D., 1978. The Wines of America, 2nd Edition. McGraw-Hill Book Co., New York. pp. 88-90, 95-105, 146-153.

3. Amerine, M. A. and Singleton, V. L., 1977. Wine - An Introduction. University of California Press, Berkeley. pp. 275-278.

4. The Association of American Vintners, 1981. "Wine Tour Guide". Watkins Glen, New York. pp. 8-11.

5. Anderson, L. G., 1975. "Needs and Scope of the Ohio Grape Industry." Masters degree study. Jefferson, Ohio.

6. Cahoon, G. A. and Hill, R. G., 1981. "Grape Growing". Cooperative Extension Service, The Ohio State University Bulletin 509. pp. 3-4.

7. Church, R. E., 1982. Wines of the Midwest. Swallow Press Books/ Ohio University Press, Athens, Ohio. pp. 121-169, 183, 186-197.

8. Dahlberg, R. E., 1961. The Concord Grape Industry of the Chautauqua - Erie Area". Economic Geography, Vol. 37, no. 2, pp. 150-169.

9. Eastern Grape Grower Magazine, Inc. Eastern Grape Grower and Winery News 1981 Directory. Watkins Glen, New York. pp. 38-39.

10. Fadiman, C., and Aaron, S. 1975. The Joys of Wine. Harry N. Abrams, Inc., New York. pp. 141, 150.

11. Feuer, R., Garman, W. L., and Cline, M. G., 1955. "Chautauqua County Soils". N. Y. S. College of Ag. and Life Science Soil Association Leaflet 3, Ithaca, New York. pp. 1-2.

12. Grossman, H. J., 1977. Grossman's Guide to Wines, Beers, and Spirits, 6th Ed. rev. by Lembeck. Charles Scribner's Sons, New York. pp. 228-230.

13. Haeseler, C. W., 1970. "Climatic Factors and the Potential for Wine-Grape Production in Several Areas of Pennsylvania". Penn. State Univ., College of Ag. Progress Report 303, University Park, Pa. 12 pp..

14. Hanlon, E. E., 1957. Richards Atlas of New York State. Frank E. Richards, Publisher, Phoenix, New York.

15. Haskins, F. G., 1950. "A Study of Fruit Sites in Northeastern Ohio from Standpoint of Frost Damage". Proceeding of the Ohio State Horticultural Society for 1950, pp. 80-91.

16. Hedrick, U. P., 1908. The Grapes of New York. Report of the N. Y. S. Ag. Experiment Station for the Year 1907, Albany, New York. pp. 73-87.

17. Hough, J. L., 1958. Geology of the Great Lakes. University of Illinois Press, Urbana, Illinois. 313 pp.

18. Jordan, T. D., Pool, R. M., Zabadal, T. J., and Tomkins, J. P., 1981. "Cultural Practices for Commercial Vineyards". N. Y. S. Col. of Ag. and Life Sci. Bulletin 111, Ithaca, New York. pp. 2-5.

19. Lichine, A. et al, 1974. New Encyclopedia of Wines and Spirits. Alfred A. Knopf, New York. p. 509.

20. Miller, M. E., and Weaver, C. R., 1970. "Extreme Monthly and Annual Temperatures in Ohio". Ohio Ag. Res. and Dev. Ctr. Research Bulletin 1041, Wooster, Ohio. fig. 2, 3, 4.

21. Morrison, P. C., 1936. "Viticulture in Ohio". Economic Geography, vol. 12, pp. 71-85.

22. National Oceanic and Atmospheric Administration, 1978. Climates of the States, vol. 2: New York, Ohio, Pennsylvania. Gale Research Co., Detroit. pp. 696-703, 766-768, 832-837.

23. National Oceanic and Atmospheric Administration, 1979. "Local Climatological Data" for Buffalo, Erie, Cleveland, Toledo, and Detroit with Narrative Climatological Summary. U.S. Dept. of Commerce, Annual Summary. Ashville, North Carolina.

24. New York Crop Reporting Service, 1976. "New York Orchard and Vineyard Survey". Albany, New York. pp. 8, 37-42.

25. Ohio Crop Reporting Service, 1976. "1976 Ohio Fruit Tree and Vineyard and Survey". Columbus, Ohio. pp. 12-16.

26. Olmstead, C. W., 1956. "American Orchard and Vineyard Regions". Economic Geography, vol. 32, no. 3, pp. 220-221.

27. Pennsylvania Crop Reporting Service, 1978. "1978 Pennsylvania Orchard and Vineyard Inventory Survey". Harrisburg, Pa. pp. 38-42.

28. Pennsylvania Wine Association, 1981. "Wine Trails of Pennsylvania". Pennsylvania Grape Letter and Wine News, February, 1981.

29. Phillips, D. W. and McCulloch, J.A.W., 1972. "The Climate of the Great Lakes Basin". Environment Canada Climatological Study Number 20. Toronto. 40 pp., 57 charts.

30. Pierce, L.T., 1959. "The Occurance of Freezing Temperatures in Late Spring and Early Fall". Ohio Ag. Exp. Station Special Circular 94. Wooster, Ohio. fig.34.

31. Shaulis, N. and Dethier, B., 1970. "New York Site Selection for Wine Grapes". Proc. N. Y. S. Horticultural Soc. Vol. 115. pp. 288-294.

32. Shaulis, N. J., Einset, J., and Pack, A., 1968. "Growing Cold-Tender Grape Varieties in New York". N. Y. S. Ag. Exp. Station Bulletin 821, Geneva, New York. 15 pp.

33. Tarr, R. S., 1902. The Physical Geography of New York State. The MacMillan Company, New York. pp. 37-38.

34. United States Department of Agriculture, 1941. Climate and Man, Yearbook of Agriculture. U. S. Government Printing Office. pp. 411, 1062-1064.

35. United States Department of Agriculture, 1962. The Yearbook of Agriculture. U. S. Government Printing Office, Washington. p. 59.

36. Visher, S. S., 1954. Climatic Atlas of the United States. Harvard University Press, Cambridge. pp. 17-18.

37. Wagner, P. M., 1976. Grapes Into Wine. Alfred A. Knopf, New York. pp. 39, 82, 86.

38. Weaver, R. J., 1976. Grape Growing. John Wiley and Sons, New York. p. 43.

39. Westwood, M. N., 1978. Temperate-Zone Pomology. W. H. Freedman and Co., San Francisco. p. 17.