LITHOSTRATIGRAPHIC EQUIVALENCE OF THE YORKVILLE AND SNIDER TILL MEMBERS, WEDRON FORMATION, ILLINOIS

by

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ABSTRACT

The fine-grained surface till north of the Illiana Morainic System in the Decatur Sublobe is lithologically similar to the surface tills in the adjacent Peoria ~~and Princeton~~ Sublobes. These tills are part of one lithostratigraphic unit but have been assigned to the Snider, Malden and Yorkville Till Members of the Wedron Formation in different areas by different workers. Snider and Yorkville Till are the most appropriate names based on stratigraphic relationships of the till with the till? at their respective type sections. Based on the principle of priority, it is recommended that Snider Till be dropped as a stratigraphic unit and that Yorkville Till be extended to include the adjacent fine-grained till beyond the Marsilles Morainic System in the Decatur and Peoria Sublobes.

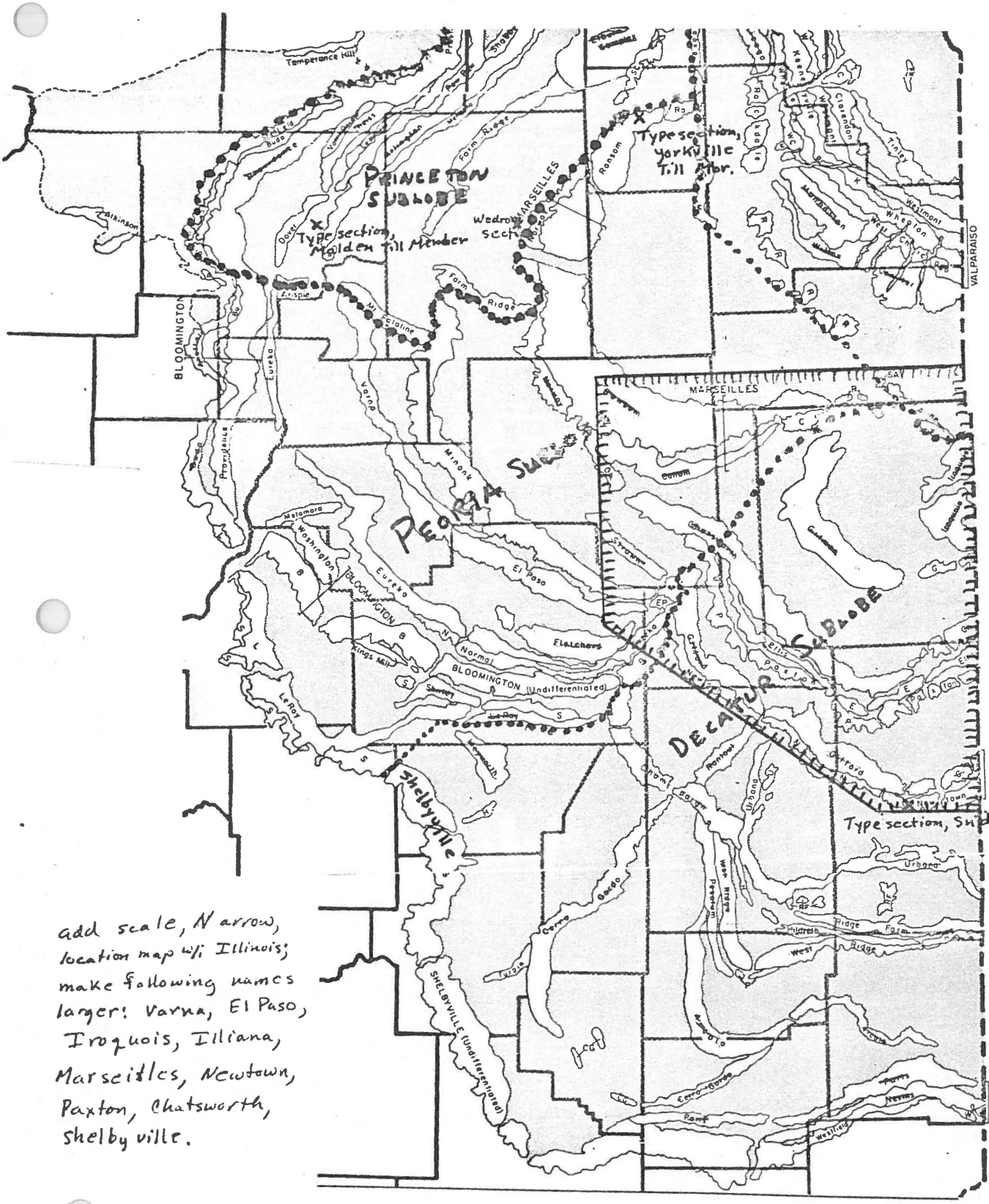
INTRODUCTION

In formulating a formal lithostratigraphic classification for Quaternary glacial deposits in Illinois, Willman and Frye (1970) established separate nomenclature for tills in different glacial lobes and sublobes if they were separated geographically. They defined six till members of the Wedron Formation in deposits of the Lake Michigan Lobe, but did not differentiate members in deposits of the Decatur Sublobe (fig. 1) which they indicated was part of the Erie Lobe. Johnson, Gross and Moran (1971) defined three members in the Wedron Formation near Danville, which is in the eastern portion of the Decatur Sublobe. Thus, separate nomenclature developed for deposits of the Decatur Sublobe and the adjacent Peoria Sublobe of the Lake Michigan Lobe.

Subsequent work has revealed that the deposits of these two sublobes are lithologically similar (Kempton, Du Montelle and Glass, 1971; McKay, 1975; Johnson, 1976; Moore, 1981), and that the Decatur Sublobe is also part of the Lake Michigan Lobe (Johnson, Moore and McKay, in preparation). The stratigraphic nomenclature has become confused and our purpose is to document the lithostratigraphic equivalence of the Yorkville and Snider Till Members of the Wedron Formation, and to recommend that the name Snider be replaced by Yorkville for equivalent lithologic deposits in the Decatur Sublobe.

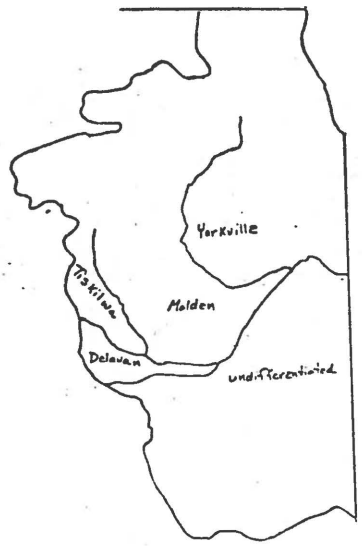
DEVELOPMENT OF CURRENT NOMENCLATURE

In the Peoria Sublobe, Willman and Frye (1970) recognized four till members, Delavan, Tiskilwa, Malden and Yorkville (fig. 2a). Yorkville was described as a very clayey till and a road cut near Yorkville in the

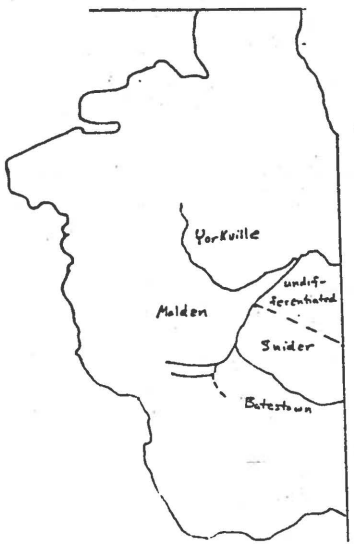


add scale, N arrow, location map w/ Illinois; make following names larger: Varna, El Paso, Iroquois, Illiana, Marseilles, Newtown, Paxton, Chatsworth, Shelbyville.

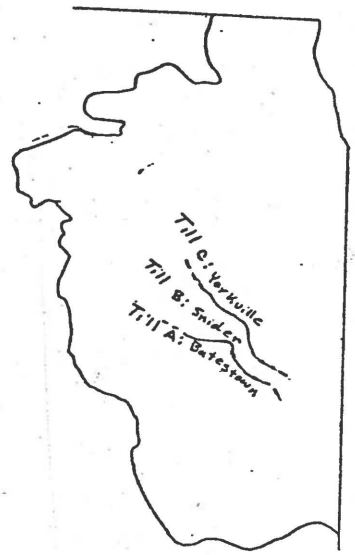
Figure 1 Location of Princeton, Peoria and Decatur Sublobes, type sections of the Malden, Yorkville, and Snider Till Members, the Wedron Section, Woodfordian end moraines and the area of study.



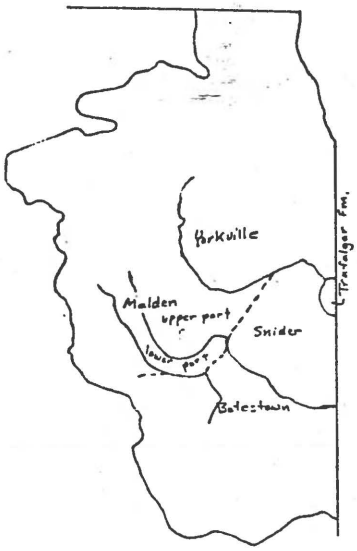
a. Willman and Frye, 1970



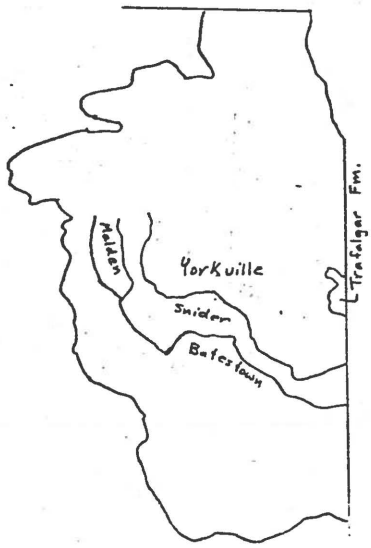
b. Johnson, Follmer, Gross and Jacobs, 1972



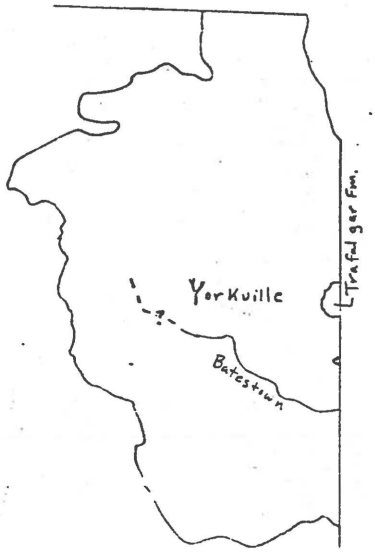
C. McKay, 1975



d. Johnson, 1976



e. Lineback, 1979



f. This paper, 1982

fig. 2 Maps showing outline of Wedron Formation and nomenclature of tills in previous mapping and classification of deposits in the Peoria and Decatur Sublobes.

Peoria Sublobe was designated the type section. The outer boundary of the Yorkville was shown at the front of the Marseilles Morainic System (fig. 1). The subjacent Malden Till Member was described as a silty to locally sandy till, and its type section is located in the Princeton Sublobe.

Johnson, Gross and Moran (1971) defined three till members, Glenburn, Batestown and Snider, in the Wedron Formation in the Danville region of the Decatur Sublobe. Batestown was described as silty and clayey till (mean 29% sand, 37% silt, and 33% clay) and Snider as a clayey till (mean 19% sand, 45% silt and 36% clay). All were typed at the Emerald Pond Section and the outer limit of the Snider was suggested to be at the front of the Newtown Moraine. Johnson et al. (1972) confirmed that Snider did not extend beyond the Newtown Moraine, and they showed the unit continuing at the surface northward into Iroquois County (fig. 2b.).

Tills have been correlated between the Decatur and Peoria Sublobes by recent workers. Kempton, Du Montelle and Glass (1971), utilizing subsurface data, delineated five informal till units (Units 1 to 5) in McLean County in the Peoria Sublobe, and first suggested that several of these units extended to the southeast across a morainic reentrant, called the Gibson City Reentrant, into the Decatur Sublobe. This Reentrant was long believed to be a significant border between major glacial lobes; thus, workers believed that tills on either side of it were different. Johnson, Gross and Moran (1971) concurred with Kempton et al. (1971) and correlated Unit 2 with the Batestown Till and Unit 4 with the Glenburn Till at Danville.

McKay (1975) tested the concept of stratigraphic continuity between the two sublobes by mapping and studying the composition of the tills across the Gibson City Reentrant. He delineated three informal till units: Till A south of the Newtown and El Paso Moraines was a sandy till (mean 25% sand); Till B between these moraines and the Paxton and Chatsworth Moraines was clayey (mean 44% clay) and contained less sand (mean 15% sand); and Till C northeast of the Chatsworth and Paxton Moraine fronts contained even less sand (mean 9% sand) and more clay (mean 55% clay). All tills extended across the Reentrant and Till A extended beneath Till B in the subsurface. McKay correlated Till A with the Batestown Till, Till B with the Snider Till, and Till C with the Yorkville Till (Fig. 2c). These correlations extended nomenclature from one sublobe to the other for the first time.

Johnson (1976) utilized McKay's interpretations but maintained separate nomenclature for equivalent tills in the two sublobes. He noted that Malden Till as mapped by Willman and Frye (1970), contains two textural types, a lower till with appreciable sand (McKay's Till A) and an upper fine-grained till (McKay's Tills B and C), which were referred to as the lower and upper parts of the Malden and were correlated with Batestown and Snider Tills, respectively (fig. 2d). A dashed line was arbitrarily used to separate equivalent rock units in the two sublobes. Yorkville was restricted to the Marseilles Moraine as mapped by Willman and Frye (1970). Johnson did note, however, that the upper Malden and Snider were part of a grouping of fine-textured tills in the upper part of the Wedron Formation and were thus lithologically more similar to Yorkville than lower Malden or Batestown.

The most recent published mapping is on the new state map of Quaternary deposits (Lineback, 1979) which follows the concepts sugguested by McKay (1975). Both Yorkville and Snider Tills are mapped in both sublobes and follow McKay's mapping, except locally in the Peoria Sublobe, both the Snider and Yorkville are extended farther to the southwest following concepts suggested by Kempton, Du Montelle and Glass (1971) and based on mapping by J.P. Kempton and M.M. Killey for the state map (fig. 2e). Moore (1981) studied the northern part of the Decatur Sublobe and the western part of the Peoria Sublobe. Data used in this report are from his work as well as that of Johnson et al., 1972; McKay, 1975; and W.H. Johnson (unpublished).

LOCATION AND LABORATORY PROCEDURES

The area of study includes the northern part of the Decatur Sublobe and the northeastern part of the Peoria Sublobe. Samples were collected from exposed sections and subsurface borings; sample locations and the area are shown on Figure 3.

Grain-size analyses were completed under the supervision of W. A. White in the Clay Laboratory of the Illinois State Geological Survey, utilizing standard hydrometer and sieve techniques. Textural data are reported as percentages of sand (.062-2 mm), silt (.004-.062 mm) and clay (<.004 mm) of the less-than 2 mm fraction. Clay mineral analyses of the less-than 2 μm fraction of unoxidized till samples were made by H. D. Glass and D. W. Moore utilizing procedures development by Glass at the Survey (See Hallberg, 1978). Carbonate analyses of the less-than 74 μm fraction were made on the Chittick appartus by all three authors utilizing procedures

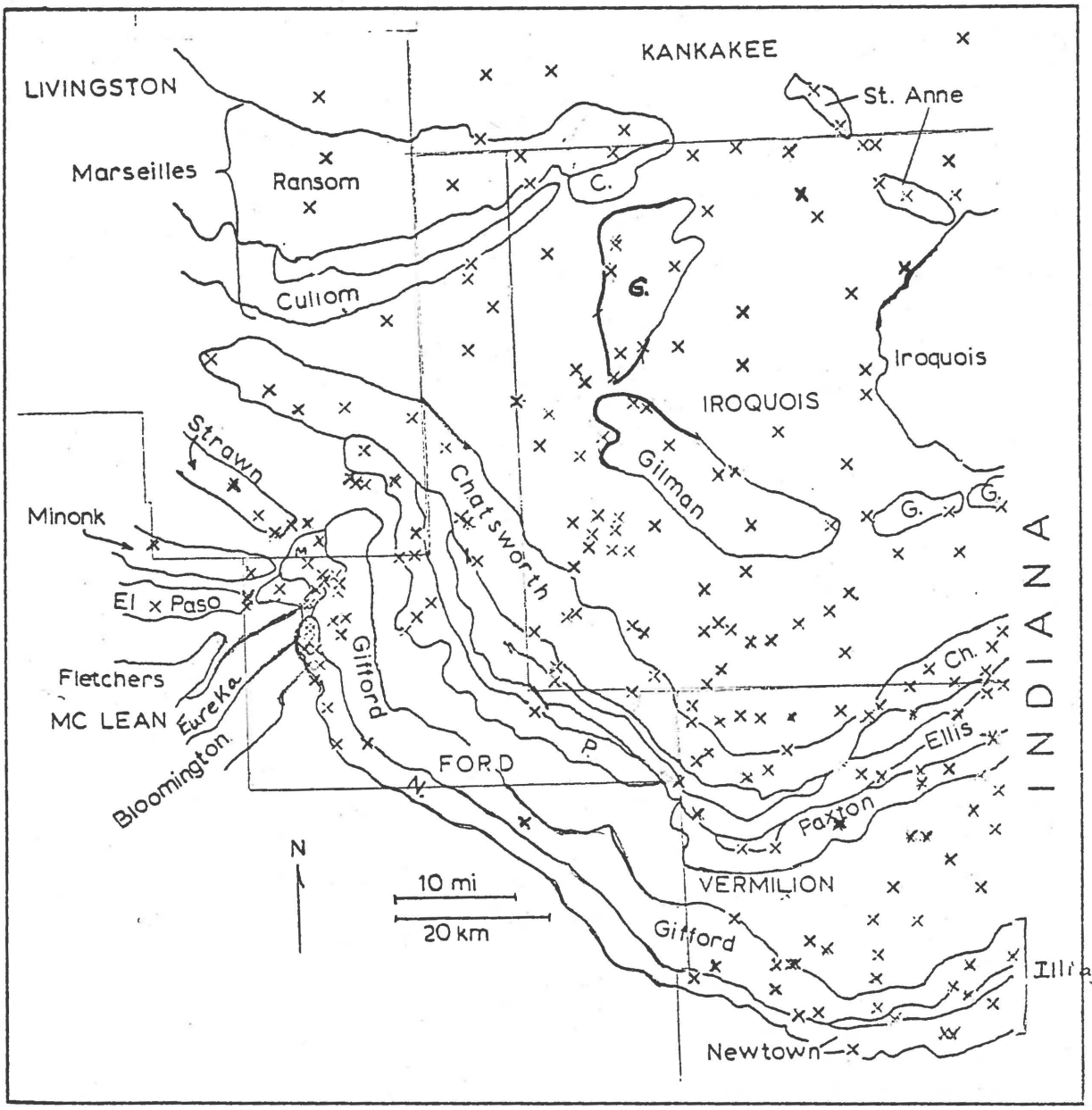


Figure 3 Map of area showing end moraines and sample locations.

described by Dreimanis (1962). Contour maps of textural and compositional data are modifications of computer-drawn maps.

LITHOLOGY OF THE SURFACE TILL

With the exception of till in the Iroquois Moraine of eastern Iroquois County, the surface till throughout the area is generally fine-grained and compositionally similar. Loam till in the Iroquois Moraine is texturally and compositionally distinct (Moore, 1981), and Johnson (1976) utilized Indiana nomenclature, Trafalfar Formation, for the till (fig. 2d). It will not be considered further in this note, except to note that the extent of the Trafalgar has been modified (fig. 2f) based on work by Moore (1981).

The remaining surface till has a dark gray (5Y 4/1; Munsell color notation) color when moist and unoxidized. The upper 3 to 4 meters are commonly oxidized, and typical moist colors are olive (5Y 5/4 to 4/3), olive brown (2.5Y 4/4), grayish brown (2.5Y 5/2, dark grayish brown (2.5Y 4/2 and very dark grayish brown (2.5Y 3/2). Most clasts are pebble-size and are mainly shale with moderate amounts of dolostone and limestone.

Texturally, the till ranges from a silty clay loam to a clay using the USDA system of textural classification. Sand content of the matrix (less-than 2mm size material) is rarely greater than 20% and usually ranges from 5 to 15% (fig. 4). Clay and silt contents are variable and each range from about 30% to 70% (fig. 5). Textural variations are irregular geographically. As noted long ago by Wascher and Winters (1938), they do not generally reflect morainic patterns or sublobe boundaries and contours of sand and clay contents commonly cut across morphologic features (figs. 4 and 5). When textural data are averaged by moraine area (Table 1), all are

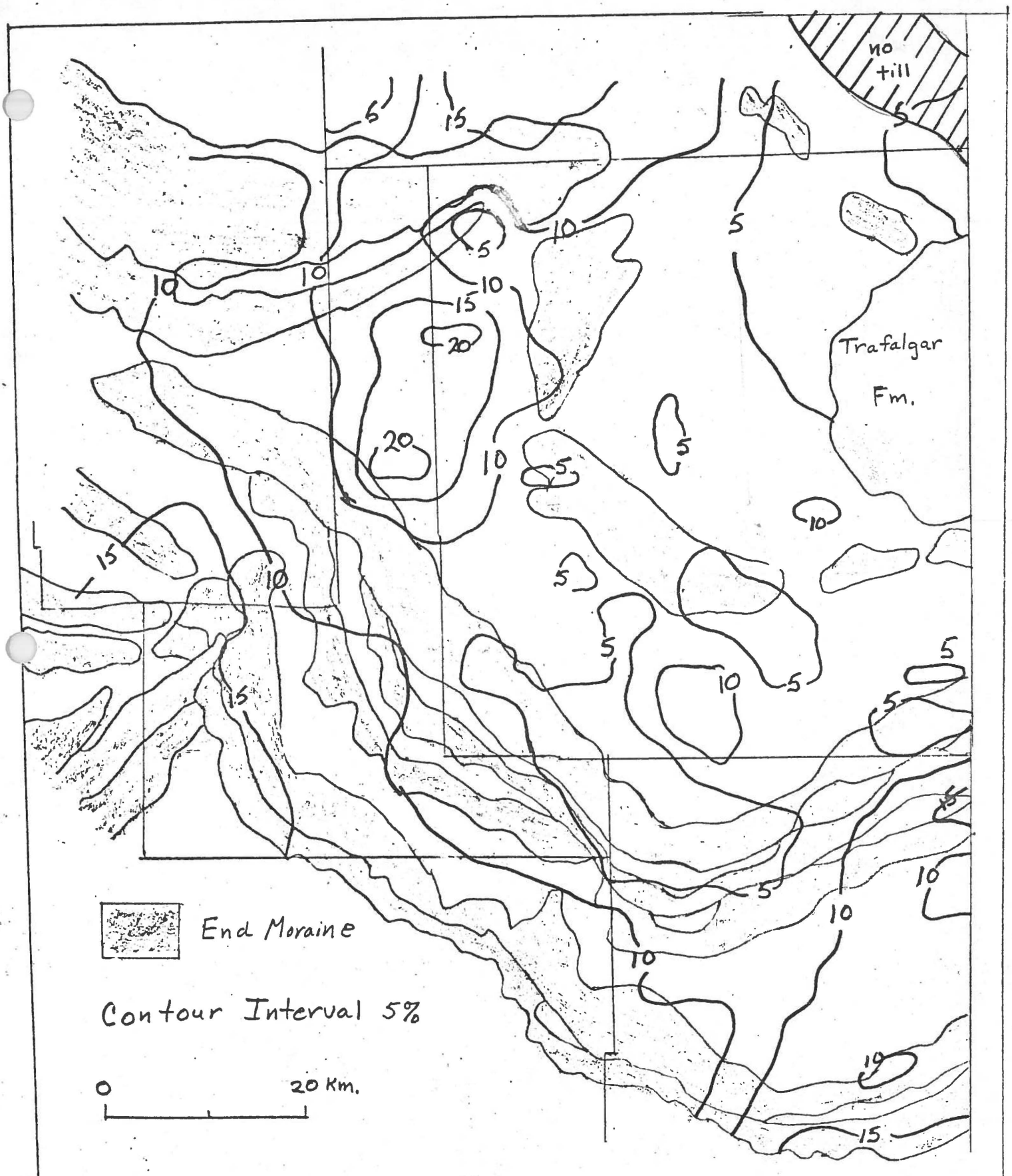


Figure 4 Isopleth map of percent sand in the < 2 mm fraction of the till. Based on ___ analyses at ___ sampling sites. After Moore, 1981.

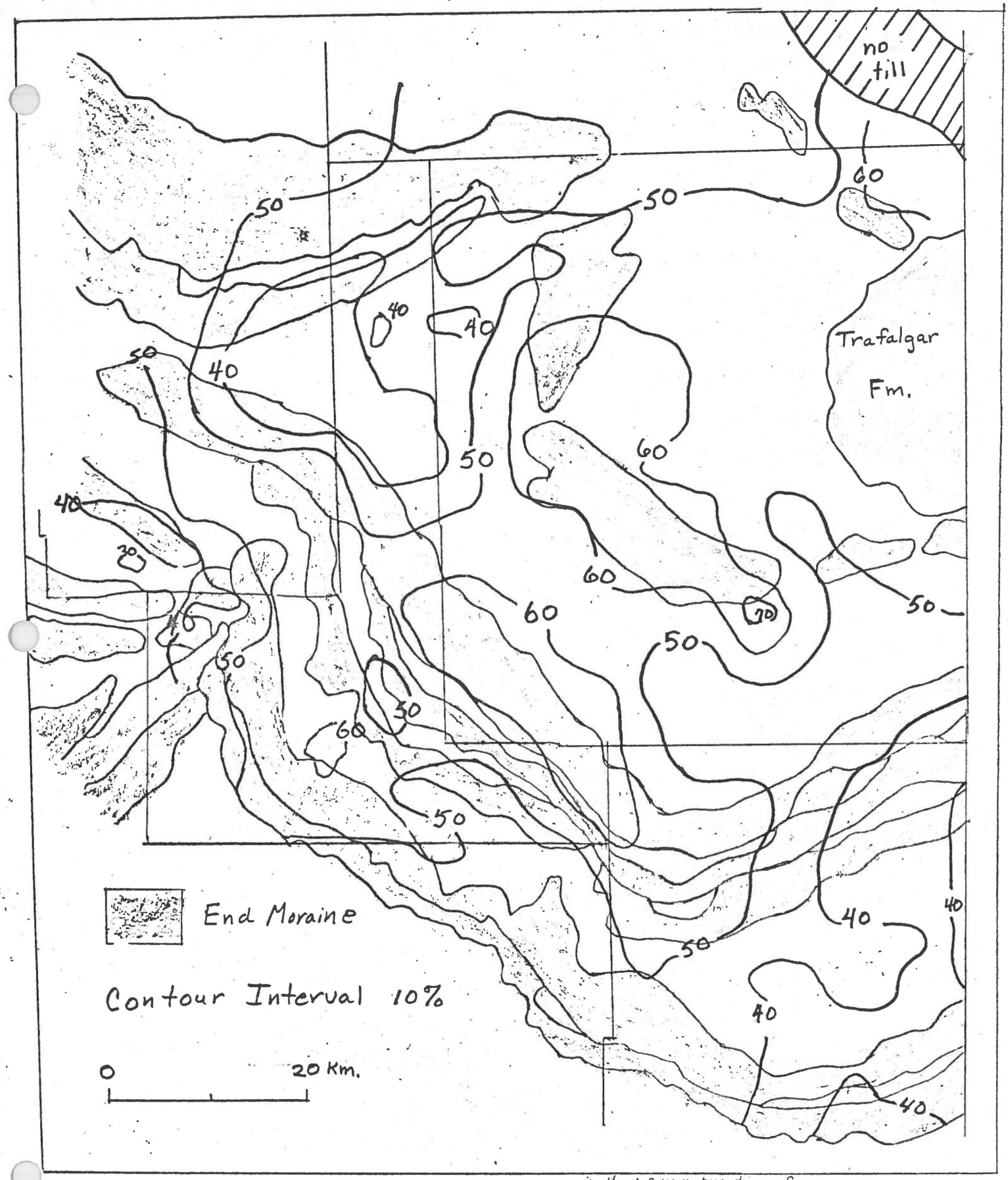


Figure 5. Isopleth map of percent clay in the < 2 mm fraction of the till. Based on ___ analyses at ___ sampling sites. After Moore, 1981.

Table 1. Mean grain size and carbonate mineral content from samples of the till grouped by moraine area, north to south. After Moore, 1981.

Moraine	Grain Size			Carbonate Minerals		
	%Sand	%Clay	(N)*	%Calcite	%Dolomite	(N)
Marseilles	11	40 49	(41)	4	18	(34)
Gilman	8	34 58	(87)	5	15	(53)
Chatsworth	9	40 51	(181)	4	16	(126)
Ellis	13	45 42	(16)	4	18	(13)
Paxton	9	49 42	(24)	5	18	(20)
Gifford	10	48 42	(59)	5	17	(50)
Newton	16	47 37	(18)	6	18	(18)

* number of samples

texturally similar with till of the Newtown Moraine (farthest south) being coarsest and that in the Gilman finest. Textural variability is thought primarily to reflect spatial variations in the amount and type of surficial sediment (glaciofluvial sand and glaciolacustrine sand, silt and clay) which was incorporated during the glacier advance (Krumbein, 1933; McKay, 1975; Johnson, 1976).

Clay and carbonate mineralogy of the till is relatively uniform. Illite is the dominant clay mineral present and usually makes up more than 80% of the clay fraction (fig. 6). The remainder is primarily chlorite (including some kaolinite) with no more than a few percent expandable clay minerals. Variation appears to be random except for the northeastern portion of the area where illite content drops to 75% in the upper part of the till. Carbonate in the less-than 74 μm fraction is mostly dolomite, and it rarely exceeds 20% (fig.7). Calcite content is usually less than 5% except in the northeastern part again where till is slightly more calcitic. Variations in carbonate content are controlled primarily by texture; as clay content increases, the amount of carbonate (mainly dolomite) decreases (figs. 5 and 7). A relationship between texture and carbonate content has been recognized by most recent workers studying this till (McKay, 1975, Kemmis, 1978; Killey, 1980; Moore, 1981). Compositional variations are small, and, as with texture, they generally do not correspond to either moraine or sublobe boundaries.

STRATIGRAPHIC NOMENCLATURE

The surface till in the area forms one lithostratigraphic unit. It is similar in color, texture and composition and cannot be differentiated

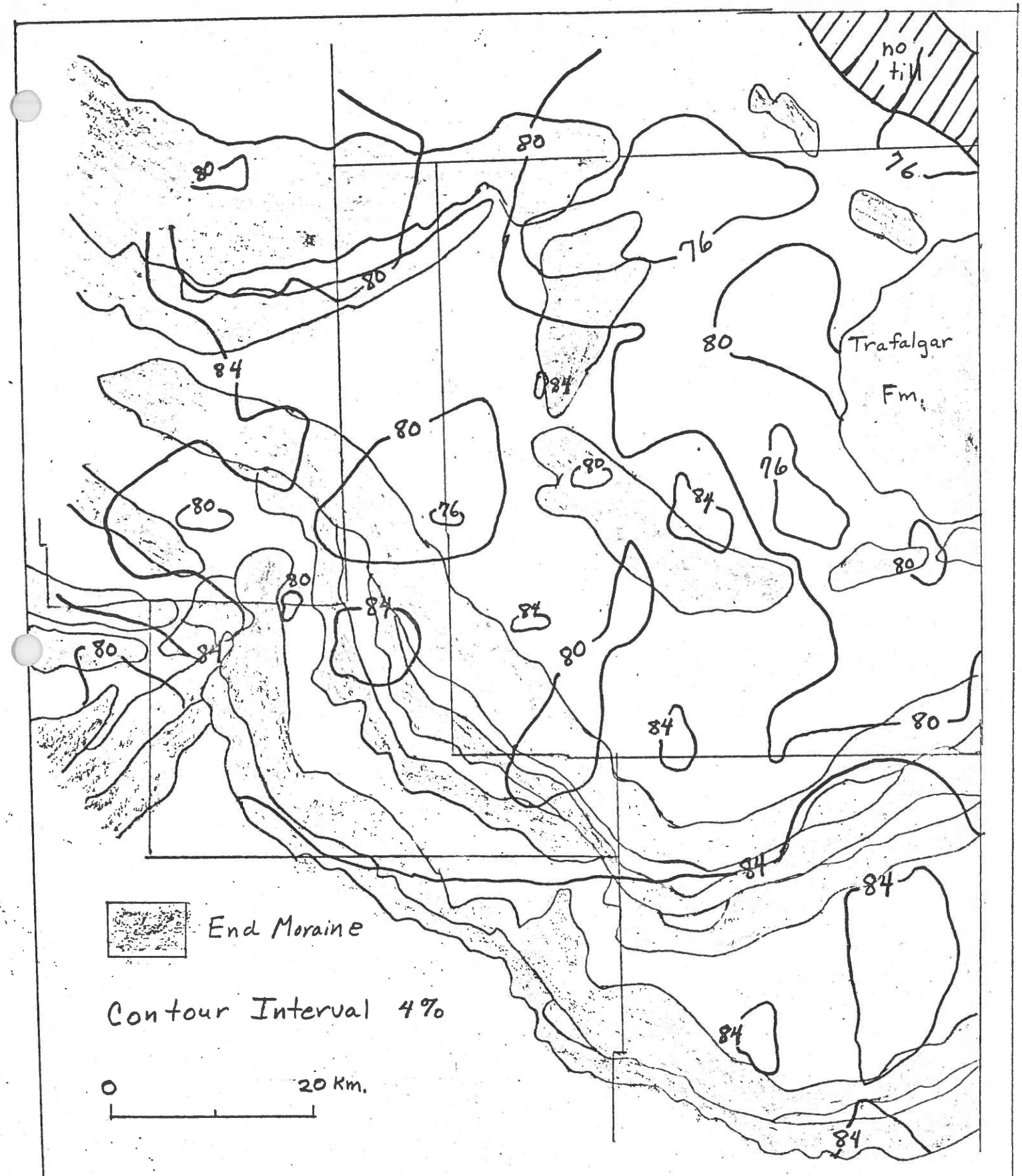


Figure 6 Isopleth map of percent illite in the < 2μm fraction of unoxidized till. Based on ___ analyses at ___ sampling sites. After Moore, 1981.

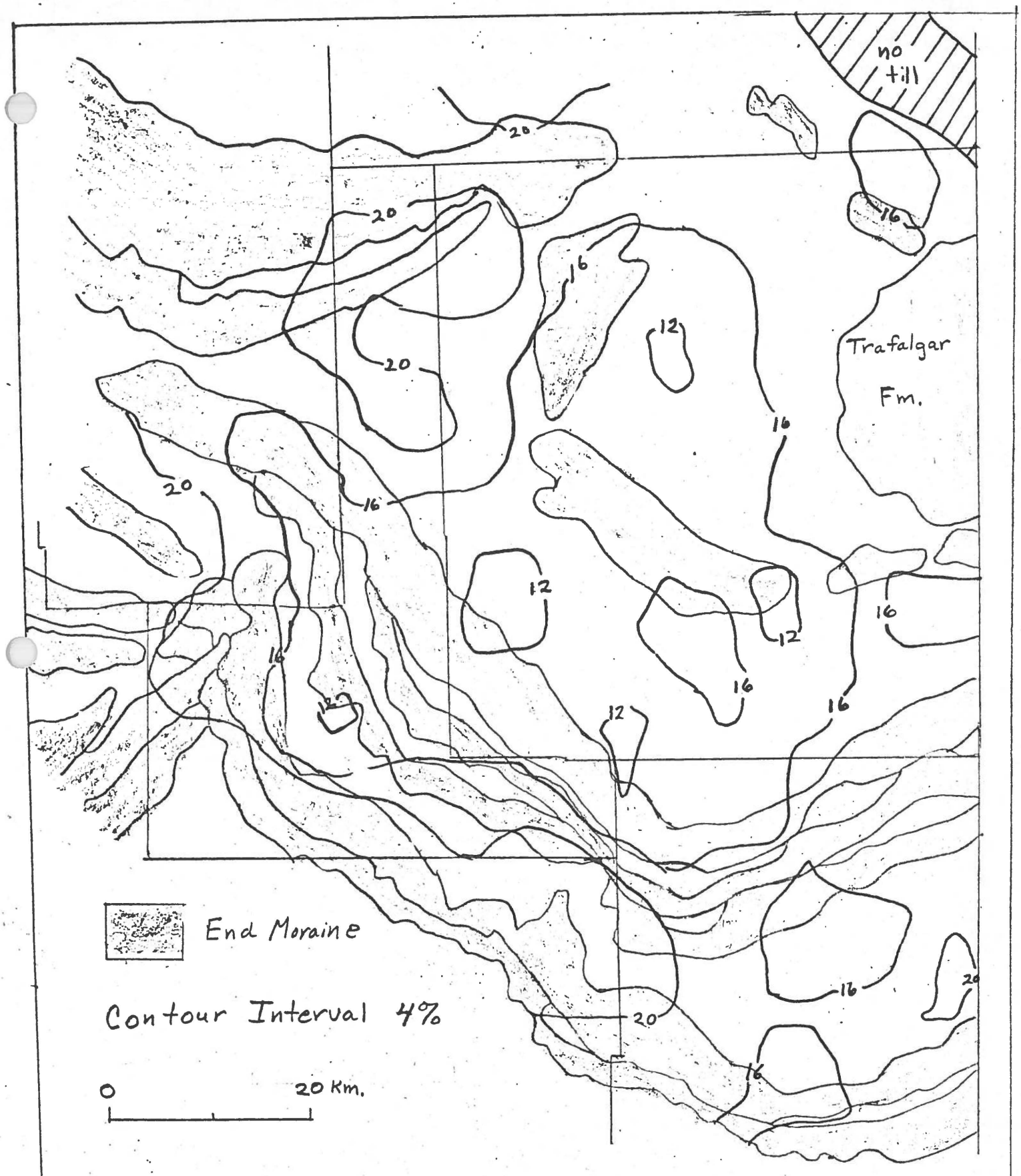


Figure 7 Isopleth map of percent dolomite in the < 74 μm fraction of the till. Based on — analyses at — sampling sites. After Moore, 1981.

lithologically in the field. Except for the northeastern portion (area of the St. Anne Moraine and part of the Marseilles Moraine) samples belong to a single population of till based on results of analysis of variance and least significant difference tests (Moore, 1981). This till, however, has been called Malden, Yorkville, and Snider (fig. 2) in different areas and locally by different names in the same area.

The type section for Malden Till is located in the Princeton Sublobe, immediately northwest of the Peoria Sublobe (fig. 1). Till at the type section is a silty clay loam and is texturally similar to the till in question. Much of the Malden near the type section is coarser, however, and at the Wedron Section, the Malden consists of three till units; a basal loam till, a middle silty clay till, and an upper loam till. The latter till is the surface till immediately west of the Marseilles Moraine, north of the Illinois River. The till described in this report is finer than much of the Malden, that portion of it in the Marseilles Moraine is younger than the Malden, and the other portions are texturally finer than the upper part of the Malden in the Princeton Sublobe. These relationships indicate that Malden is an inappropriate name for this till. Further study of the Malden is needed to determine stratigraphic relationships between till sheets in the Malden and till sheets within this unit. It appears that portions of the Malden in the Princeton Sublobe are chronologically equivalent to the lower portions of this fine-grained till unit.

The type section of the Yorkville Till Member is located in the Peoria Sublobe, but outside the area of this study (fig. 1). Killey (1980; 1982), however, has studied Yorkville Till in the area immediately to the northwest which includes the type section. She delineated two compositional zones within

the Yorkville. Her lower Yorkville included the type Yorkville and was shown to be continuous from the type section to the south around the Marseilles Moraine where it adjoins the area of this study. The upper part was delineated and named a mineral zone, the Dwight, and was more restricted in extent. It appears to be the same as the till with less illite and more calcite found in the northeastern part of this area in the St Anne Moraine (Moore, 1981). Of more importance to this paper is her direct tracing of Yorkville from the type section to till that is the surface till in the northwestern part of the area of this study, and which cannot be lithologically differentiated from the upper till throughout the area. This indicates that in the Peoria Sublobe the till should be correlated with Yorkville and not Malden, and that Yorkville as a lithostratigraphic unit extends beyond the Marseilles Moraine as suggested by McKay (1975).

The type section of the Snider Till Member is located at the southern margin of the area (fig. 1) in the Decatur Sublobe. At the type section the till is coarser than usual (mean 19% sand, 47% silt, 34% clay), but within 5 km of the type section till with more typical texture (<15% sand) has been sampled and is continuous with till at the type section (fig. 4). This is the till that extends to the north and which has been shown to be continuous with till of the Peoria Sublobe. Consequently, the name Snider is also appropriate for this till based on continuity with till at the type section.

DISCUSSION AND CONCLUSIONS

The till in question is lithologically similar and traceable to the type sections of both Yorkville and Snider Till Members. Although both names

could be retained by arbitrarily restricting Yorkville to appropriate till of the Peoria Sublobe and Snider to appropriate till of the Decatur Sublobe, stratigraphic practice and clarity of nomenclature suggest otherwise; it is more appropriate to utilize one name for this continuous body of rock. We therefore recommend, based on the principle of priority, that the more recent name, Snider Till Member, be dropped as a stratigraphic unit and that material formerly included in the Snider be part of the Yorkville Till Member (fig. 2f). The suface till in the northeastern portion of the area which contains less illite (fig. 6) and more calcite is assigned to the Dwight Mineralogical Zone of the Yorkville Till. It appears to be related to an advance of the ice sheet on to the backslope of the Marseilles Moraine and to the St. Anne Moraine.

The Yorkville Till Member, as modified herein, contains lithologically similar material that resulted from several glacial events in several sublobes. Stratigraphic relationships with lacustrine sediments, the well developed series of end moraines, and compositional variations at the top (Killey, 1980; Moore, 1981) indicate it resulted from several glacial advances and retreats and has a complex history, particularly in association with a sequence of proglacial lakes (Moore, 1974; Moore and Johnson, 1981; Killey, 1982). The extent of the Yorkville in the Peoria Sublobe is under review and it is not clear whether material beyond the Varna-El Paso Moraines mapped as Snider on the new state map (fig. 2e) is Yorkville or a fine-grained facies of the Malden.

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