GEOLOGIC AND RADIOMETRIC SURVEY OF THE SWEENEY FARM, MILTON, VERMONT

by

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1. Introduction

The purpose of this study was to conduct a ground survey of the radiometric anomalies located on the farm of Mr. Floyd Sweeney, in Milton, Vermont, and to determine the rock types associated with these anomalies. The study area is one half mile S75W of Cobble Hill (see Fig. 1).

Abnormal concentrations of radioactive material were known to exist in this area in 1951 (McKeown, 1951), when a very general roadside survey was done in the Milton area (see Fig. 3) by the U. S. Geological Survey, using car-mounted Geiger-Mueller counters. Much of the area between roads was covered on foot. This report covers the area McKeown (1951) labeled as E (see Fig. 4). Appendix B consists of brief notes covering areas McKeown (1951) labeled as A, B, C and D.

2. Methods and Radiometric Data

This study covers approximately 25 acres of the Sweeney Farm. Methods of study include the following: 1) A grid system was set up and radiometric readings were taken at predetermined intervals using a gamma ray spectrometer. When an anomalous area was found, it was thoroughly covered using the spectrometer and detailed measurements and records were taken. All underlined numbers on the Geologic and Radioelement Survey Map of the Sweeney Farm, Milton, Vermont (Appendix A) represent the arithmetic mean of five one-second total count readings with the spectrometer held at waist level. At points of anomalous radioactivity, ten-second readings were taken for total count (TC), as well as for Potassium (K), Uranium (U), and Thorium (Th). The longer counts (also at waist level) were taken so that a radioelement assay could be performed (see Table 2). 2) A detailed geologic map was compiled on the same grid system as the radiometric survey (see Appendix A).

Table 1 contains analytical data obtained by the U. S. Geological Survey for the study area. Table 2 is a list of anomalous radiometric and radioelement readings, along with the measured analytical data which were obtained from various areas located on the Geologic and Radioelement Map (these areas are noted as "10 second count waist level" on Appendix A), where detailed readings were taken for Potassium, Uranium, and Thorium.

3. Stratigraphy: Clarendon Springs Formation

The study area is entirely underlain by the Clarendon Springs Formation (see Fig. 2), which has been designated by Stone and Dennis (1964) as being Upper Cambrian or Lower Ordovician in age.

Two lithologies within the Clarendon Springs Formation were mapped in the study area, based on the absence or presence of chert and quartz veins.

3.1 Homogeneous Dolomite

This unit is a massively bedded, light gray, coarse-grained dolomite sometimes containing worm burrows and well-rounded quartz grains. This lithology is devoid of any noticeable chert or quartz veins.

The rock weathers a tannish gray color, and in both lithologies, bedding is difficult to determine.

3.2 Dolomite with Chert and Quartz Veins

The majority of the study area is underlain by a massively bedded, light gray dolomite with varying amounts of dark gray chert inclusions and small white quartz veins (1/8" to 1/2" wide).

A chaotic algal laminated dolomite is also present (see location on Appendix A, 150 feet east on line 5). The matrix is a light gray, coarse-grained dolospar. An interesting concentric, chert laminated algal structure (1/2" to 3" in diameter) is also present. The light and dark gray chert and chert-rich laminations (thread-like individually and 1/4" to 1/2" wide in groups) concentrically surround a circular or oval shaped medium-grained darker gray dolospar center. Numerous white quartz pockets are also present, filling in the voids between algal structures and worm burrows.

The weathered surface of the chert and quartz rich dolomite is a tannish gray color with the chert, and sometimes minute quartz crystals, standing out in relief. The dark gray chert weathers to a light gray color with a "sponge-like" texture.

Another interesting feature is the presence of some white mushroom-shaped weathering structures of possibly phosphate. McKeown (1951) calls this a phosphate "bloom". The bloom weathers a white color and stands 1/2" above the usual weathered surface and looks like a mushroom. It is not known what the phosphate looks like within the rock, but it is very apparent on the weathered surface (if it really is the phosphate "bloom").

4. Radioactivity

It does not appear that there is a simple correlation between rock type and radioactive anomalies.

In one area (knoll at southwest corner of the study area) it appeared that the high radioactivity (TC=129 cps) might be associated with small quartz veins and minor amounts of chert in the dolostone. This did not apply to other rocks of similar lithology. One hundred and fifty feet east along line 3A, the rock was very chert rich, but the readings were relatively very low (TC=34 cps with background being 25 cps). In some cherty areas, the rocks had total counts of 100 cps, but some of the highest counts per second were associated with small amounts of chert. Abnormally high counts were also found over soil, with no outcrops present (TC=200 cps).

The high radioactivity, when found, was limited in size to approximately 1 foot in diameter. No linear pattern or correlation with a specific lithologic characteristic appeared to be present.

McKeown (1951) suggested that there were two types of inclusions found in the study area, one radioactive and one not radioactive. He states that the radioactive inclusions are black calcareous clay galls and that when treated with hydrochloric acid, these inclusions crumble to a black spongy mass and a thin film of oil is formed. The non-radioactive inclusions, McKeown states, are really chert and when treated with hydrochloric acid, the chert fragments become porous, but remain hard, and no oil film is formed. When the inclusions (TC=70 cps) the authors found were tested in the field, they did not appear to become porous, crumbly, or produce an oil film. Even when observed under a microscope, they did not appear to do what McKeown had observed.

McKeown (1951) also notes the association of high radioactivity with what he calls a phosphate "bloom". The authors did not note such a correlation, with TC=34 cps (if in fact what the authors saw was the phosphate "bloom" he described).

The author's 10 second radiometric readings found that in all but one location, the Potassium readings were higher than the Uranium (see Table 2). McKeown (1951) states that the uranium accounts for two thirds of the radioactivity, which is not what the authors found to be true.

By comparing the percent of uranium found in Table 1 with Table 2, it appears that the author's figures are somewhat low when compared to McKeown's (1951).

5. Fossil

Within the dolomite with chert and quartz veins (for location see Appendix A, 150 feet east on line 5), an incomplete fossil was found. The fragment has been identified as either an inarticulate brachiopod, or the pygidium of a trilobite.

Fossils within the Clarendon Springs Formation, near Cobble Hill, are not uncommon. Stone and Dennis (1964) note that trilobites, brachiopods, and gastropods have been recognized.

Table 1

U. S. Geological Survey analytical data for study area (McKeown, 1951, p. 44, 46). Location: 1/2 mile S75W of the top of Cobble Hill.

Description	eU%*	U%**
Dolomite with black chert-like breccia and phosphate bloom...........................	.010	
Dolomite with black chert-like breccia and phosphate bloom...........................	.015	
Dolomite with inclusions of black chert-like fragments.....		.009
Dolomite with inclusions of black chert-like fragments.....	.015	.007

*eU%--Numbers determined by using geiger counters.

**U%--Numbers determined by detailed analytical work.

Table 2

Anomalous radiometric and radioelement readings, and measured analytical data; TC=Total Count, K=Potassium, U=Uranium, Th=Thorium. Readings are in counts per second, except where other units are given. Ten second readings at waist level were used for these calculations. In computing the % and ppm, the following background radiation was subtracted from the actual readings before computation: TC=25.4 cps, K=2.4 cps, U=1.2 cps, Th=0.3 cps. See Appendix A for map locations and rock type.

Location--150 feet northeast of knoll at southwest corner of map

TC=103.6	analytical data using spectrometer readings
K= 5.4	.866%
U= 3.4	43.121 ppm = .004%
Th= 0.1	-5.673*ppm

Location--Line 3A; 150 feet east of stream valley

TC=92.8	analytical data using spectrometer readings
K= 4.7	-.600%*
U= 3.4	26.442 ppm = .003%
Th= 0.5	.118 ppm

Between Line 3A and 4; approximately 300 feet east of stream valley

TC=105.6	analytical data using spectrometer readings
K= 6.4	.985%
U= 3.4	21.047 ppm = .002%
Th= 1.0	14.118 ppm

Line 4A; approximately 130 feet east of stream valley

TC=162.3	analytical data using spectrometer readings
K= 7.8	-.533%*
U= 5.9	38.537 ppm = .004%
Th= 0.6	-2.206*ppm

Line 4A; 350 feet east of stream valley

TC=111.4	analytical data using spectrometer readings
K= 6.7	-.013%*
U= 4.4	31.889 ppm = .003%
Th= 1.2	17.226 ppm

Line 5A; approximately 115 feet east of stream valley

TC=211.8	analytical data using spectrometer readings
K= 8.1	-7.130%*
U= 11.1	122.226 ppm = .012%
Th= 0.9	-7.870*ppm

*It appears that when a negative number (ppm or %) results that the element is present in negligible amounts (Reference: EG&G Geometrics, makers of our spectrometer).

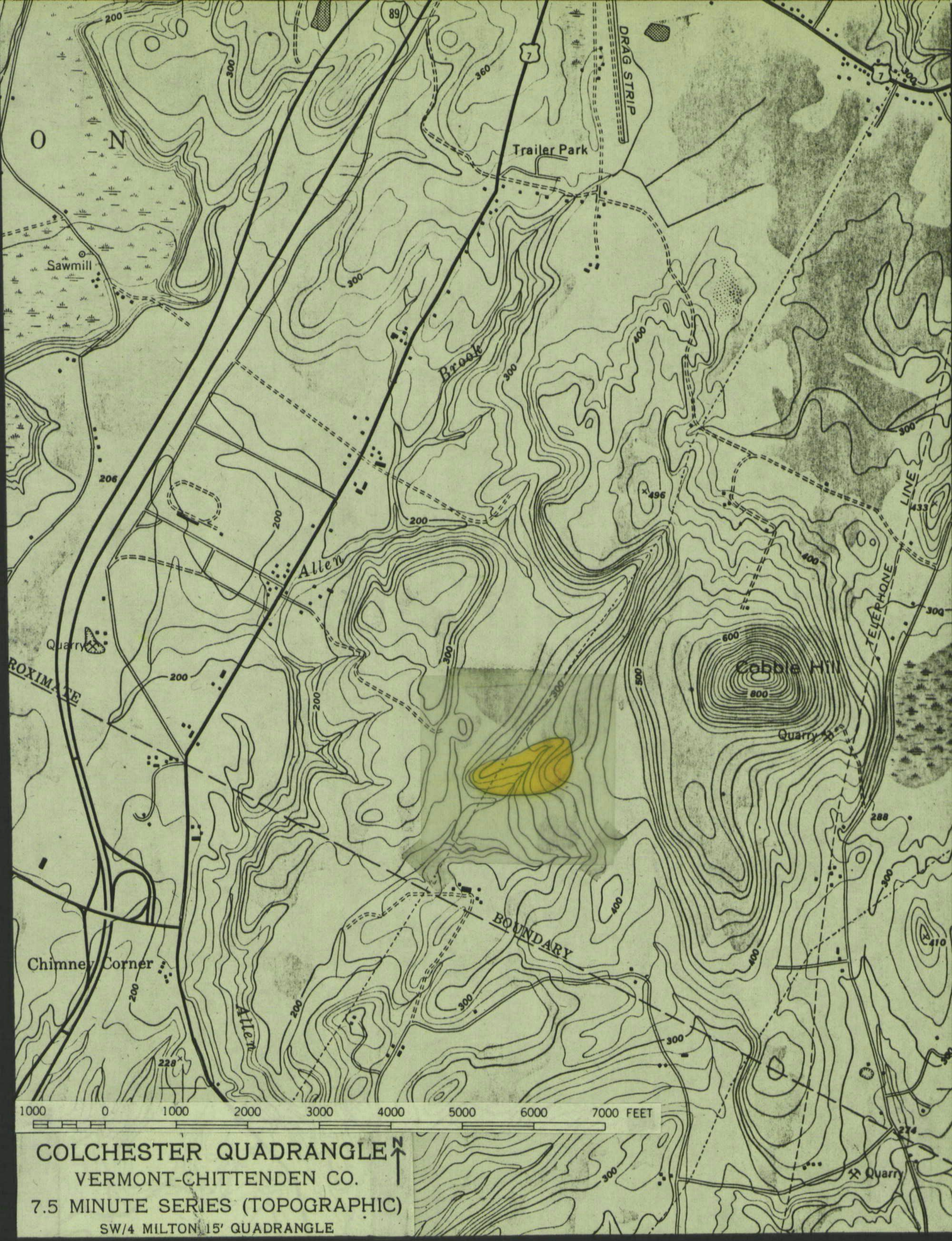

Figure 1. Topographic map with approximate outline of study area in yellow.

Figure 2. Bedrock geology of study and surrounding area.
€Ocs = Clarendon Springs Formation.
Scale 1:62,500.; Study area outlined in red.
Map from: Stone, S. W. and Dennis, J. G., 1964.

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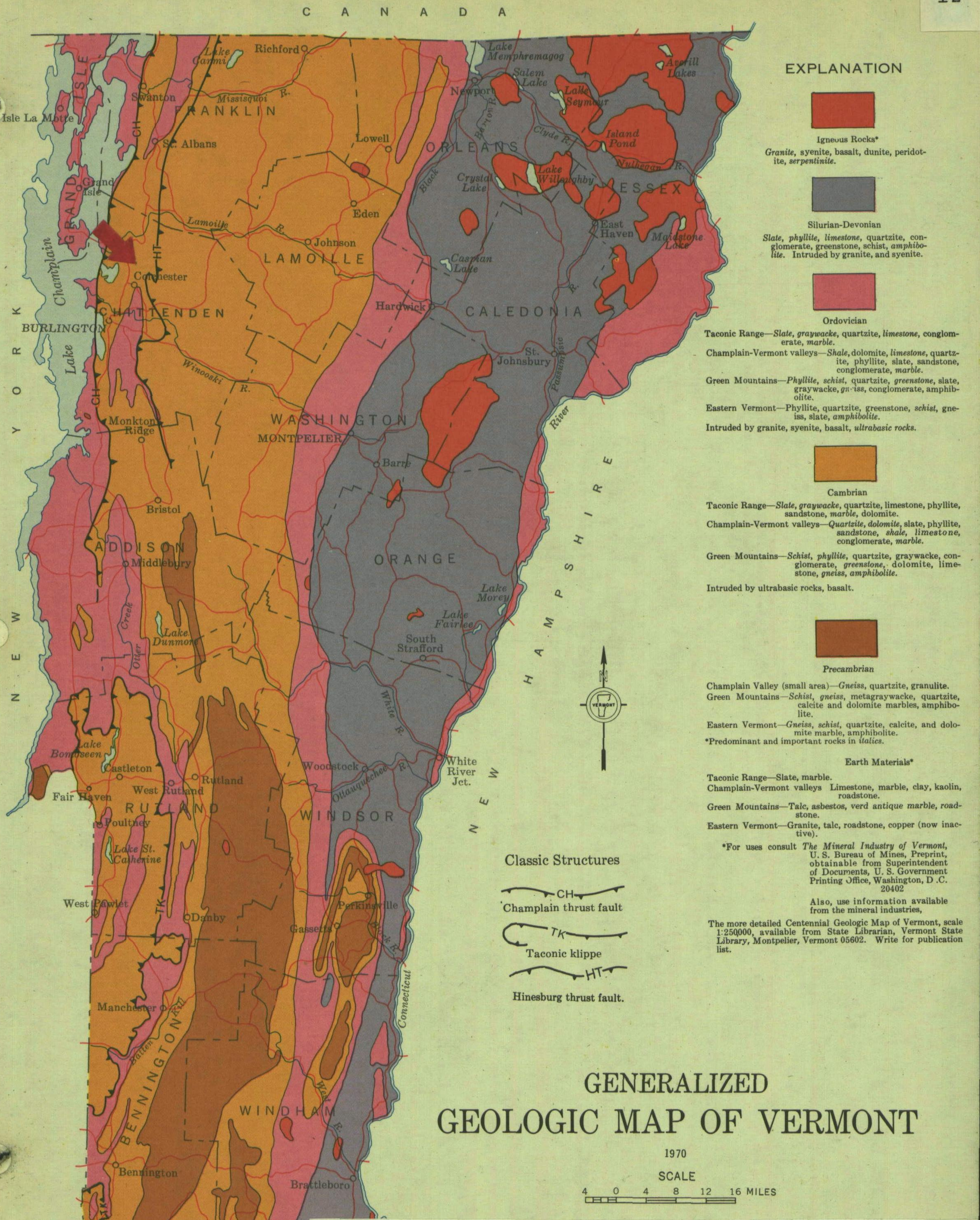

Figure 3. Generalized geologic map of Vermont. Red arrow points to approximate location of study area.

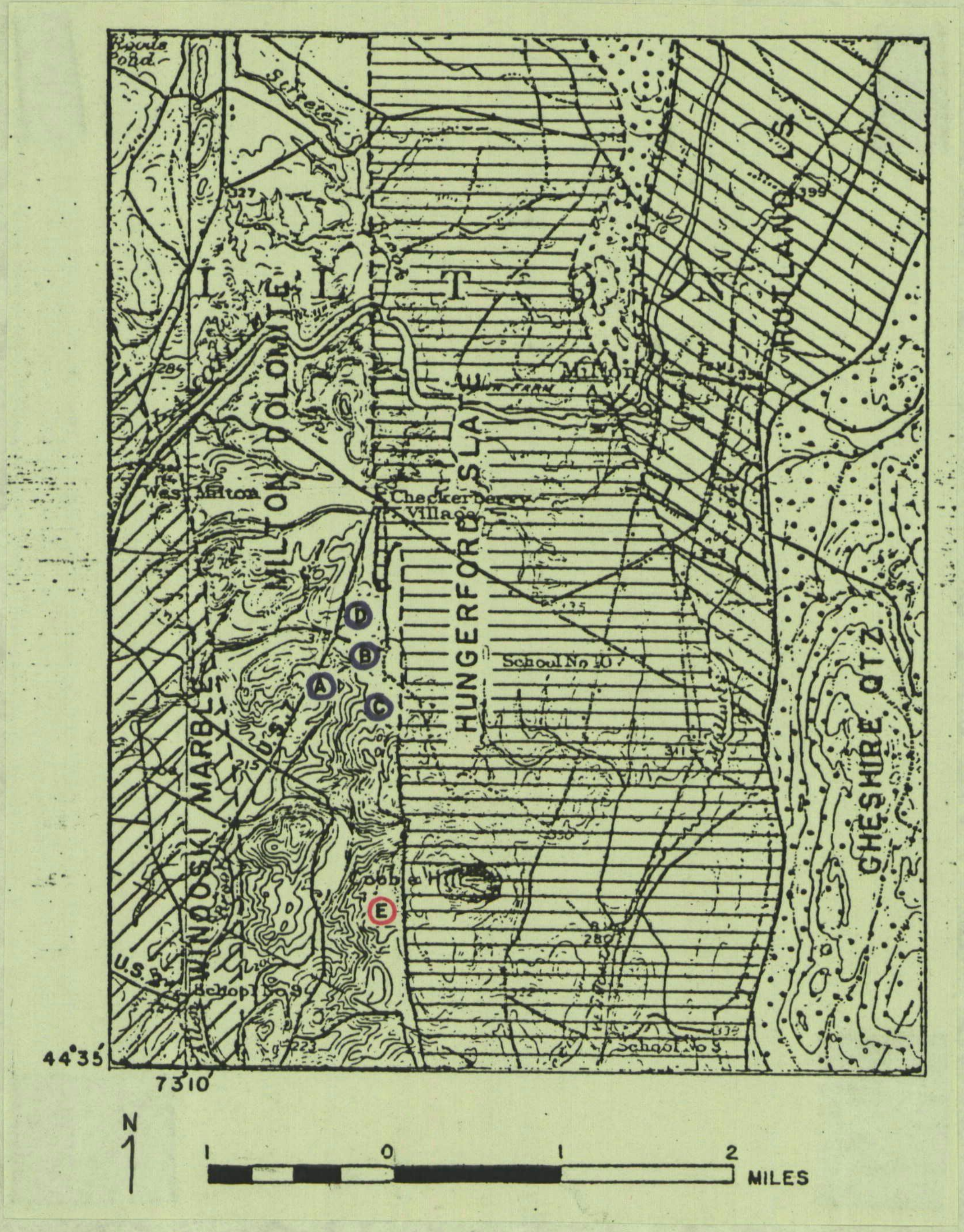

Figure 4. Map showing area covered by McKeown (1951).

The red circle shows the area covered in this report.
The blue circle shows the areas that are briefly described in Appendix B.

APPENDIX B

A bedrock reconnaissance survey was conducted for the Clarendon Springs Formation in the area encompassed by Checkerberry Village, Cobble Hill, and the interesection of U. S. Routes 2 and 7. The only radiometric anomalies detected were several which had previously been mapped by McKeown (1951) (see Fig. 4). High total counts (100-300 cps) were found in soil at locations C and D, while location B revealed a high level bedrock anomaly in a north-south trending stream bed. No unusually high radiometric readings could be found at or near location A. The Danby Formation (interbedded dolomitic quartzite), which was mapped by Stone and Dennis (1964) in this area, was not found to occur anywhere within the reconnaissance. Since outcrop control was very good across several traverses, it is believed that the Winooski Dolomite is directly overlain by the Clarendon Springs Dolomite (Milton Dolomite of Keith, 1932) north of the Route 7/Route 2 intersection.

NOTE: The Milton Dolomite of Keith (1923), is currently known as the Clarendon Springs (Stone and Dennis, 1964); and the Hungerford Slate of Keith (1923), is currently known as the Skeels Corners Slate (Stone and Dennis, 1964).

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Pingree, Rod, 1982, Paleoenvironment of the Hungerford Slate and Gorge Formation in northwestern Vermont: Unpublished Master's thesis, University of Vermont, Burlington, VT, 90 p.

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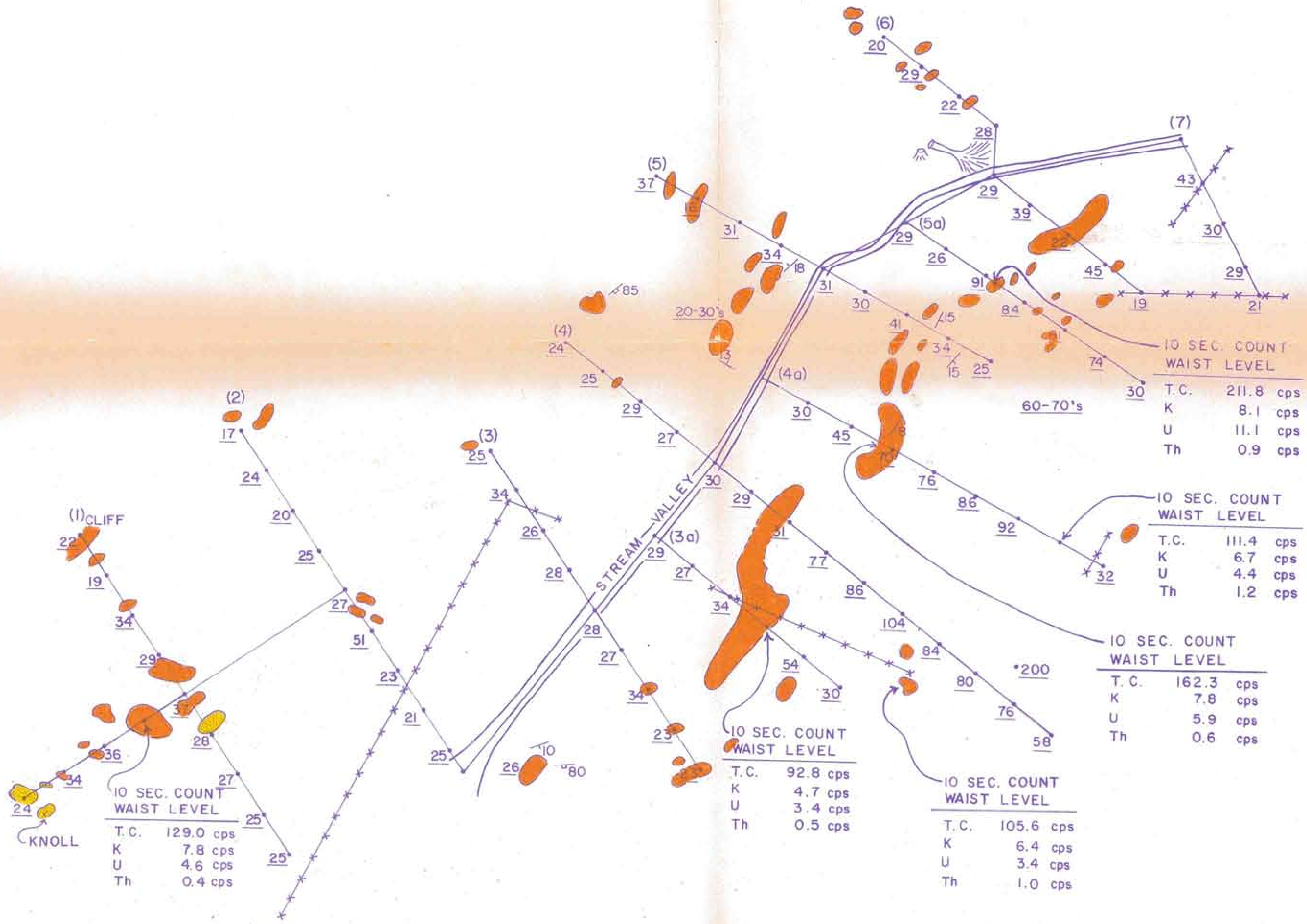
GEOLOGIC AND RADIOMETRIC SURVEY MAP OF PART OF THE SWEENEY FARM, MILTON, VERMONT

(Appendix A)



EXPLANATION

CLARENDON SPRINGS FORMATION (€cs)

- Gray dolostone with chert and quartz veins.
- Gray dolostone without chert, minor quartz veins.
- Bedding
- High angle quartz-filled fractures
- Barbed wire fence
- (2) Traverse line numbers
- 35 Spectrometer readings (average of 5-one second total counts)
- T.C. Total count
- K Potassium
- U Uranium
- Th Thorium

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SCALE 1:1,200

0 50 100 200 FEET

0 25 50 75 METERS