A Geochemical Study of Dorset Mountain

Vermont Geological Survey Contract No. 0960271

Submitted by: Dr. Helen Mango, Contracting Geologist
Department of Natural Sciences
Castleton State College
Castleton, VT 03735

Introduction

The aim of this study was to sample the rocks of Dorset Mountain, located on the border of Rutland and Bennington Counties in southwestern Vermont, for potentially geochemically and economically interesting rocks. This project was initially conceived on the basis of a conversation with a geologist intimately familiar with the geology of Vermont (J.B. Thompson, pers. communication), who suggested that the Dorset Mountain "slice" of the Taconic Mountains might be a favorable locale for economic mineralization, primarily gold. Previously collected samples from the northern part of the Taconic allochthon, primarily in slates, are of no metallic economic interest (unpublished data); it was suggested that the more highly metamorphosed rocks of the Dorset Mountain region might yield superior results. Placer occurrences of gold have been documented on the Batten Kill near Mount Equinox and on the Poultney River near Poultney (Slack and Schruben, 1990); presumably the gold was eroded from the surrounding Taconic rocks.

In addition, as a by-product of the search for gold mineralization, this study attempted to show that variations in the distribution of a wide variety of elements could potentially be used to map differences in the protoliths of the metamorphosed rocks, differences that may be observationally indistinct due to the metamorphism. If such a geochemical distinction exists, it would provide a way of defining geologic terranes that have been complicated by deformation and metamorphism.

Description of the Study Site

Dorset Mountain is the easternmost occurrence of rocks of the Taconic Allochthon (cf. Thompson, 1990). It is located at approximately 43°18' latitude and 73° longitude, on the border of Rutland and Bennington counties in the towns of Danby and Dorset. It consists of metasedimentary rocks (primarily phyllites, with some areas approaching schists) sitting above, and in thrust contact with, parautochthonous white and gray marbles of the Middlebury Synclinorium. This eastern side of the Taconic Allochthon is more metamorphosed than the western side, where Taconic rocks are mostly slates, and the underlying carbonates are dolomites and limestones rather than marbles. The phyllites are textbook examples: mica flakes are just becoming visible, the luster is silky to soapy, and cleavage planes are visible. The slightly more metamorphosed schists have distinct muscovite flakes and there is in some samples a pronounced layering.

The phyllite and schist are cut by numerous veins of white ("bull") quartz, some of which have spots (up to several millimeters in diameter) of iron oxide. Because of the common association of gold with iron oxide in other geologic settings, these veins were especially targeted for sampling.

Twenty seven samples were taken on three different ascents up Dorset Mountain. One ascent started at the south, on Dorset Hollow Road, the second started from the north, just south of Danby Four Corners, and the third started from the east, at Emerald Lake. Early and ultimately continuously snowy winter weather precluded additional trips. The sample locations are shown on the accompanying topographic map (Figure 1). Samples 1 through14 and 22 through 26 are phyllites/schists; samples 15 through 21 and sample 27 are marbles.

Results

The twenty seven samples, plus one duplicate (sample 28), were sent to Activation Laboratories, Ltd., of Ancaster, Ontario, for their "Au + 34" INAA analytical package. The results of the analyses are given in Table 1. Much to the disappointment of this geologist, the results are rather inconclusive. Gold is reported in parts per *billion*, with the highest value being only 11 ppb. Economically interesting gold values would be in the parts per *million* range. There is no measurable silver. Other typical "pathfinder" elements for gold exploration (arsenic, cobalt, mercury, uranium and zinc) are present only in very small quantities. Maximum values for these elements are:

As	23 ppm
Co	60 ppm
Hg	< 1 ppm
U	8.7 ppm
Zn	203 ppm

None of these values is noteworthy. All other elements, with the exception of the common rock-forming elements calcium and sodium, are present in concentration in the low ppm range.

The elements' concentrations show only small variation from sample site to sample site. Grouping the samples by rock type (that is, grouping the phyllites and schists together, with the marbles forming a second group) indicates very little variation in element concentration, and certainly no variation that can be meaningfully contoured. Figures 2 through 5 show the concentrations of gold, arsenic, uranium and zinc, respectively, mapped out according to sample location. Even a cursory look at these figures indicates that contouring the values would be an exercise of questionable value.

Conclusions

The results of this study suggest that Dorset Mountain is not a suitable location for further geochemical analysis for the purposes of this type of study. The chemical analysis of a reasonable distribution of samples from across the mountain shows little of interest economically. There is no indication that there is any great variation in rock type, at least based on the chemical analyses. This shows, at least, that the Dorset Mountian slice is indeed one lithologic unit, and is appropriately mapped as such. Continued samples would serve to delineate the extent of the Dorset Mountain slice more exactly.

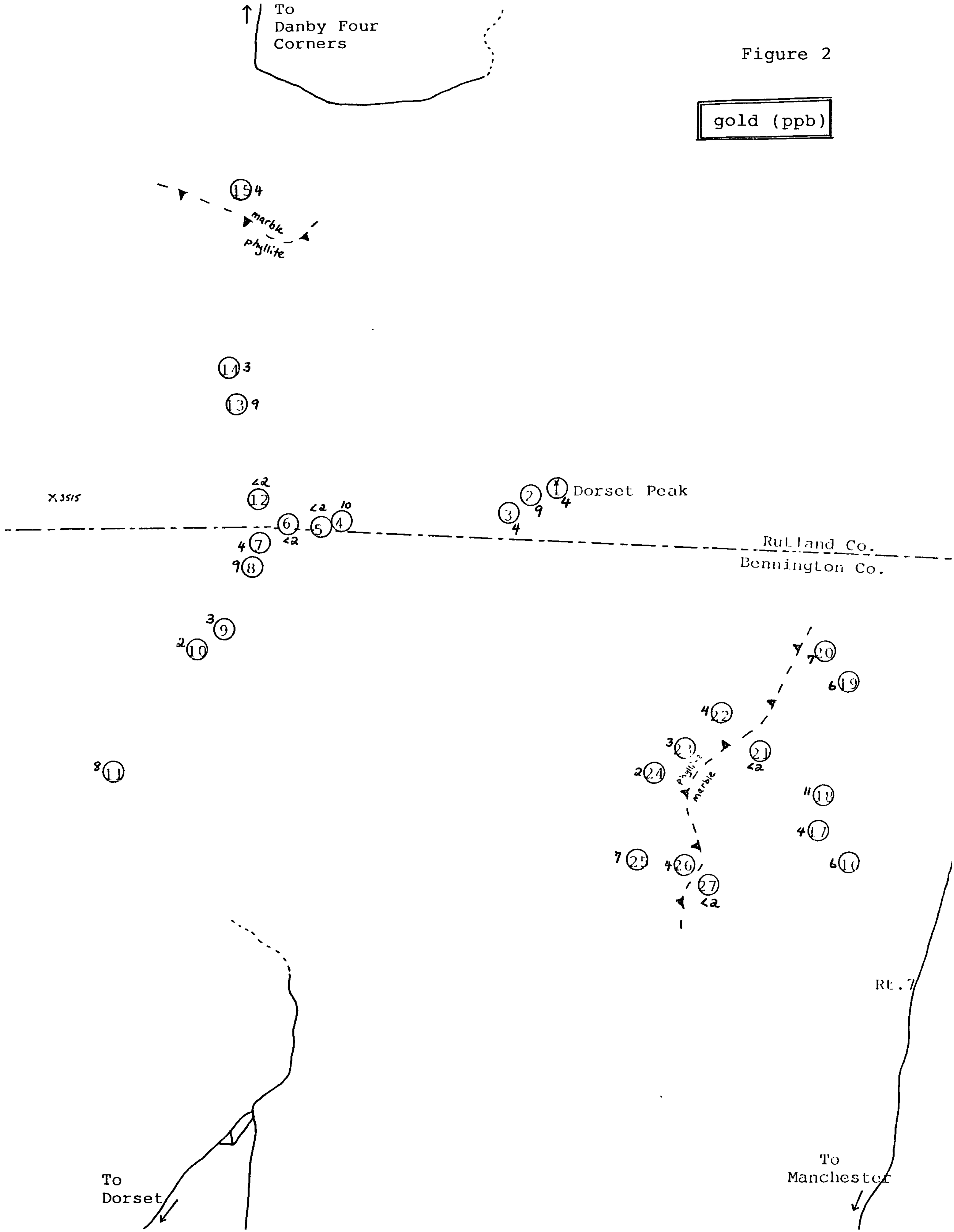
Because of the documented occurrences of placer gold within the Taconic allochthon, continued work on this project in a larger area will continue. Perhaps a Castleton undergraduate can be persuaded to pan the various rivers and creeks of the Taconic region in Vermont. A documented occurrence of vein quartz hosting some gold is located in Taconic rocks just north of Cambridge, New York; this merits some inspection.

References

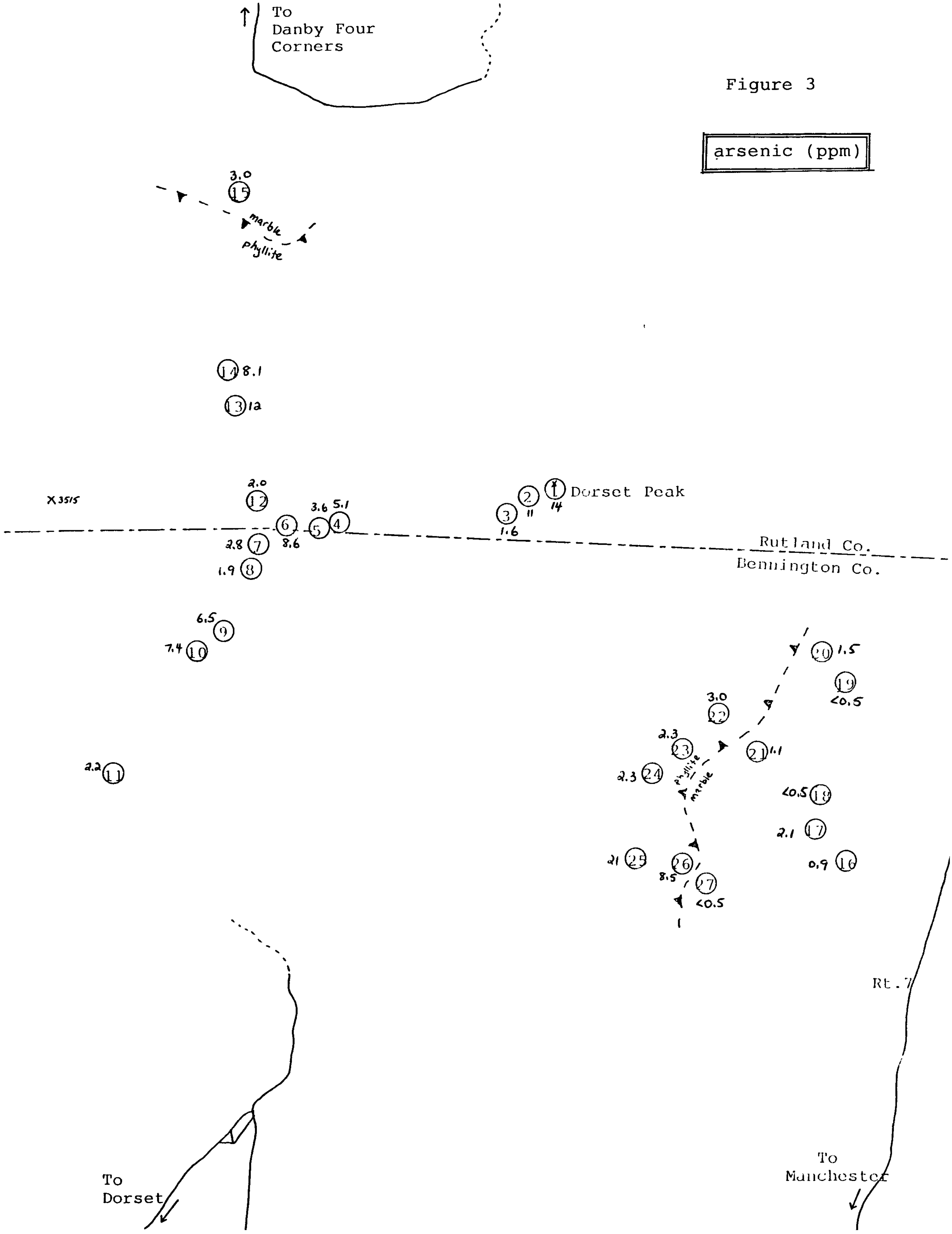
Slack, John F. and Schruben, Paul G., 1990, Metallic mineral deposits in the Glens Falls 1° x 2° quadrangle, New York, Vermont, and New Hampshire, *in* John F. Slack, ed., Summary Results of the Glens Falls CUSMAP Project, New York, Vermont, and New Hampshire, U.S. Geological Survey Bulletin 1887.

Thompson, J. B., Jr., 1990, An introduction to the geology and Paleozoic history of the Glens Falls 1° x 2° quadrangle, New York, Vermont, and New Hampshire, *in* John F. Slack, ed., Summary Results of the Glens Falls CUSMAP Project, New York, Vermont, and New Hampshire, U.S. Geological Survey Bulletin 1887.

Figure 2



gold (ppb)
To Danby Four Corners
marble
phyllite
X3515
Dorset Peak
Rutland Co.
Bennington Co.
Rt. 7
To Dorset
To Manchester



To
Danby Four
Corners
arsenic (ppm)
3.0
15
marble
phyllite
14 8.1
13 12
X 3515
2.0
12
3.6
5.1
6
5
4
2.8
7
8.6
1.9
8
2
11
1
14
Dorset Peak
3
1.6
Rutland Co.
Bennington Co.
6.5
9
7.4
10
20 1.5
19
<0.5
3.0
22
2.3
23
21 1.1
2.2
11
2.3
24
phyllite
marble
<0.5
18
2.1
17
21
25
26
8.5
27
<0.5
0.9
16
Rt. 7
To
Dorset
To
Manchester

Figure 3

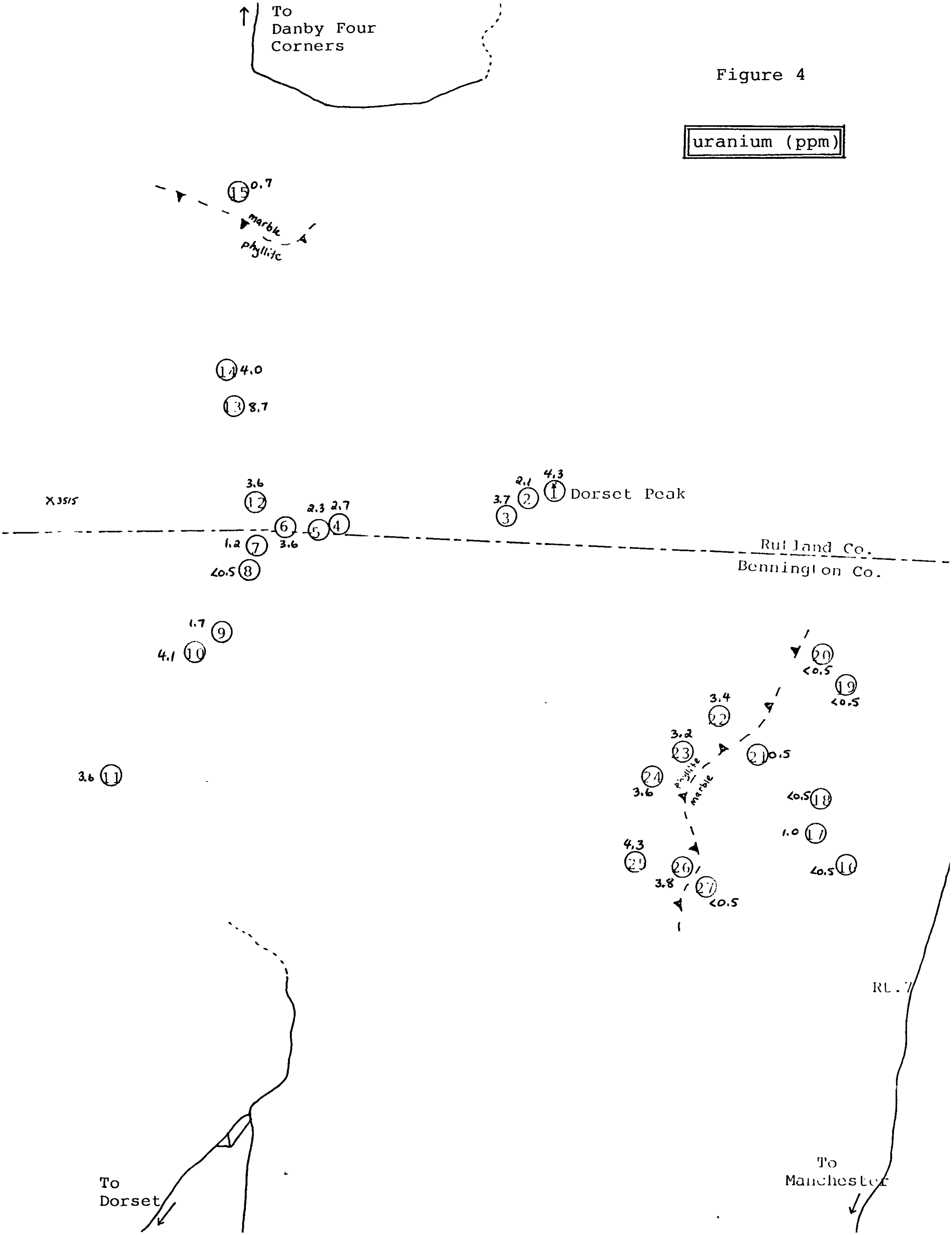
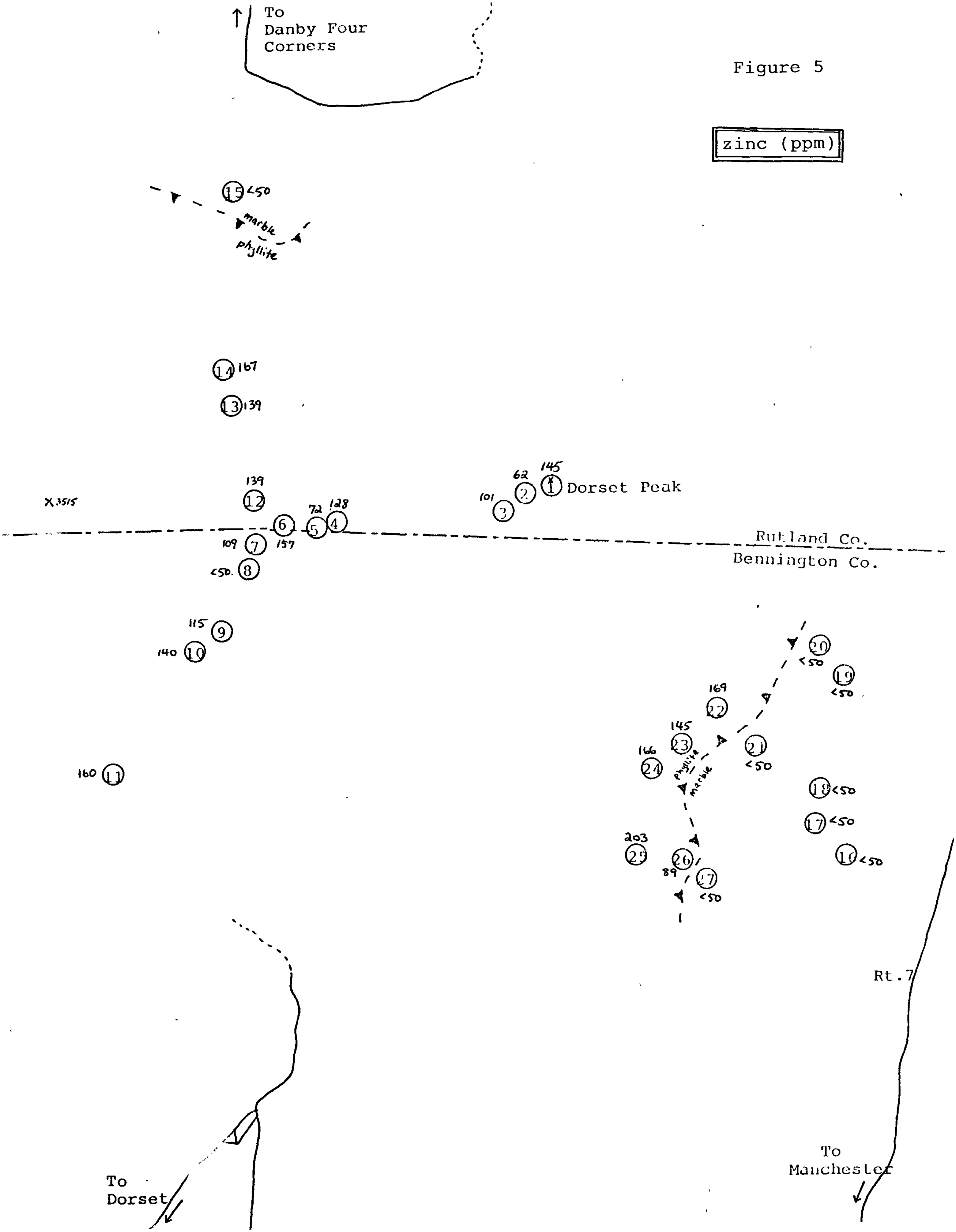

To
Danby Four
Corners
uranium (ppm)
15 0.7
marble
phyllite
14 4.0
13 8.7
X 3515
12 3.6
6
5 2.3
4 2.7
7 1.2
3.6
8 <0.5
3 3.7
2 2.1
1 4.3
Dorset Peak
Rutland Co.
Bennington Co.
9 1.7
10 4.1
11 3.6
20 <0.5
19 <0.5
22 3.4
23 3.2
21 0.5
24 3.6
phyllite
marble
18 <0.5
17 1.0
25 4.3
26 3.8
27 <0.5
16 <0.5
Rt. 7
To
Dorset
To
Manchester

Figure 4

Figure 5



To
Danby Four
Corners
zinc (ppm)
15 <50
marble
phyllite
11 167
13 139
145
62
1 Dorset Peak
101
2
3
139
12
X 3515
72
128
6
5
4
Rutland Co.
Bennington Co.
109
7
157
<50
8
115
9
140
10
20
<50
19
<50
169
22
145
23
21
166
24
phyllite
marble
<50
160
11
18 <50
17 <50
203
25
26
89
27
<50
16 <50
Rt. 7
To
Dorset
To
Manchester

Table 1

Activation Laboratories Ltd. Work Order: 6353 Report: 6249

Sample description	AU PPB	AG PPM	AS PPM	BA PPM	BR PPM	CA %	CO PPM	CR PPM	CS PPM	FE %	HF PPM	HG PPM	IR PPB	MO PPM	NA %	NI PPM	RB PPM	SB PPM	SC PPM	SE PPM	SN PPM	SR PPM	TA PPM	TH PPM
DOR-93-1	4	<5	14	1100	<0.5	<1	15	140	6	5.85	10	<1	<5	<1	1.48	<28	190	0.4	26	<3	<100	<500	<0.5	24
DOR-93-2	9	<5	11	250	<0.5	<1	8	34	2	2.39	2	<1	<5	<1	0.29	<20	59	0.2	6.2	<3	<100	<500	<0.5	4.7
DOR-93-3	4	<5	1.6	670	<0.5	<1	12	82	4	4.40	3	<1	<5	<1	0.82	<20	100	0.6	15	<3	<100	<500	<0.5	14
DOR-93-4	10	<5	5.1	620	<0.5	<1	60	59	3	5.72	4	<1	<5	<1	0.48	70	84	0.3	12	<3	<100	<500	0.7	12
DOR-93-5	<2	<5	3.6	420	<0.5	<1	10	47	3	3.16	2	<1	<5	<1	0.36	30	60	0.3	9.1	<3	<100	<500	0.8	8.5
DOR-93-6	<2	<5	8.6	680	<0.5	<1	21	96	5	6.00	4	<1	<5	<1	0.84	<23	100	0.5	19	<3	<100	<500	1.6	17
DOR-93-7	4	<5	2.8	420	<0.5	<1	11	42	2	3.76	4	<1	<5	<1	0.41	<20	56	0.2	10	<3	<100	<500	0.8	6.9
DOR-93-8	9	<5	1.9	<50	<0.5	<1	<1	10	<1	0.09	<1	<1	<5	<1	<0.01	<20	<15	<0.1	<0.1	<3	<100	<500	<0.5	<0.2
DOR-93-9	3	<5	6.5	240	<0.5	<1	11	54	2	3.62	2	<1	<5	<1	0.31	<20	50	0.3	10	<3	<100	<500	<0.5	7.3
DOR-93-10	2	<5	7.4	700	<0.5	<1	13	70	3	4.29	9	<1	<5	<1	1.57	<23	100	0.2	14	<3	<100	<500	1.8	15
DOR-93-11	8	<5	2.2	450	<0.5	<1	9	95	3	5.50	5	<1	<5	<1	0.16	<20	96	0.2	13	<3	<100	<500	1.2	15
DOR-93-12	<2	<5	2.0	830	<0.5	<1	10	110	5	7.20	5	<1	<5	<1	1.21	<20	130	2.3	24	<3	<100	<500	1.8	18
DOR-93-13	9	<5	12	920	<0.5	<1	21	94	5	5.86	5	<1	<5	<1	0.78	<25	140	0.6	20	<3	<100	<500	1.1	16
DOR-93-14	3	<5	8.1	750	<0.5	<1	7	100	5	5.76	5	<1	<5	<1	1.41	<28	110	0.9	21	<3	<100	<500	1.8	17
DOR-93-15	4	<5	3.0	190	<0.5	31	2	17	<1	0.54	1	<1	<5	<1	0.12	<20	24	<0.1	2.3	<3	<100	<500	<0.5	2.3
DOR-93-16	6	<5	0.9	56	0.9	22	<1	<5	<1	0.31	<1	<1	<5	<1	0.02	<20	<15	<0.1	0.4	<3	<100	<500	<0.5	0.2
DOR-93-17	4	<5	2.1	<50	<0.5	26	<1	<5	<1	0.12	<1	<1	<5	1	0.01	<20	<15	<0.1	0.4	<3	<100	<500	<0.5	0.3
DOR-93-18	11	<5	<0.5	<50	<0.5	25	<1	<5	<1	0.07	<1	<1	<5	<1	0.01	<20	<15	<0.1	0.2	<3	<100	<500	<0.5	<0.2
DOR-93-19	6	<5	<0.5	<50	<0.5	41	<1	<5	<1	0.05	<1	<1	<5	<1	<0.01	<20	<15	<0.1	0.2	<3	<100	<500	<0.5	<0.2
DOR-93-20	7	<5	1.5	56	<0.5	40	<1	<5	<1	0.14	<1	<1	<5	<1	<0.01	<20	<15	<0.1	0.5	<3	<100	<500	<0.5	0.5
DOR-93-21	<2	<5	1.1	54	<0.5	39	<1	<5	<1	0.14	<1	<1	<5	<1	0.01	<20	<15	0.1	0.5	<3	<100	<500	<0.5	0.5
DOR-93-22	4	<5	3.0	840	<0.5	<1	22	100	5	7.08	5	<1	<5	<1	0.80	<26	150	0.6	23	<3	<100	<500	0.9	17
DOR-93-23	3	<5	23	810	0.9	<1	17	94	5	6.59	4	<1	<5	<1	0.60	30	160	0.2	21	<3	<100	<500	<0.5	16
DOR-93-24	2	<5	2.3	950	<0.5	<1	19	97	6	5.97	6	<1	<5	<1	0.76	<20	190	0.3	21	<3	<100	<500	<0.5	18
DOR-93-25	7	<5	21	950	<0.5	<1	21	120	4	7.76	6	<1	<5	<1	0.92	110	150	1.1	24	<3	<100	<500	2.1	20
DOR-93-26	4	<5	8.5	790	<0.5	<1	11	68	4	4.06	6	<1	<5	<1	1.05	74	110	0.3	13	<3	<100	<500	1.0	13
DOR-93-27	<2	<5	<0.5	<50	<0.5	43	<1	<5	<1	0.11	<1	<1	<5	<1	<0.01	<20	<15	<0.1	0.3	<3	<100	<500	<0.5	0.3
DOR-93-28	9	<5	6.0	650	<0.5	<1	71	67	4	6.49	4	<1	<5	<1	0.54	<20	100	0.3	14	<3	<100	<500	1.4	14

Table 1 (cont.)

Activation Laboratories Ltd. Work Order: 6353 Report: 6249

Sample description	U PPM	W PPM	ZN PPM	LA PPM	CE PPM	ND PPM	SM PPM	EU PPM	TB PPM	YB PPM	LU PPM	Mass g
DOR-93-1	4.3	<1	145	96	180	84	14	3.1	1.9	6.2	0.95	32.29
DOR-93-2	2.1	<1	62	19	36	16	2.7	0.6	<0.5	1.4	0.23	34.10
DOR-93-3	3.7	<1	101	59	110	49	8.6	1.9	1.5	3.7	0.62	27.98
DOR-93-4	2.7	<1	128	50	93	35	6.8	1.3	1.1	3.3	0.50	34.24
DOR-93-5	2.3	<1	72	33	62	28	4.6	1.0	0.7	2.2	0.32	36.52
DOR-93-6	3.6	3	157	68	120	53	9.3	1.9	1.1	4.0	0.65	33.95
DOR-93-7	1.2	<1	109	30	56	22	4.9	1.2	0.8	2.5	0.39	38.31
DOR-93-8	<0.5	<1	<50	<0.5	<3	<5	<0.1	<0.2	<0.5	<0.2	<0.05	41.85
DOR-93-9	1.7	<1	115	31	58	25	4.5	1.0	0.7	2.2	0.35	34.46
DOR-93-10	4.1	<1	140	51	100	45	8.0	1.8	1.4	4.3	0.59	32.44
DOR-93-11	3.6	3	160	9.2	23	8	1.8	0.5	0.6	2.0	0.29	35.30
DOR-93-12	3.6	<1	139	30	63	25	5.3	1.4	1.6	5.9	0.88	33.01
DOR-93-13	8.7	<1	139	74	130	59	11	2.3	1.8	4.9	0.70	32.50
DOR-93-14	4.0	<1	167	76	140	66	11	2.3	1.8	4.8	0.81	29.46
DOR-93-15	0.7	<1	<50	6.8	14	5	1.0	0.2	<0.5	0.5	0.08	40.03
DOR-93-16	<0.5	<1	<50	4.3	9	<5	0.7	0.3	<0.5	0.5	0.07	37.54
DOR-93-17	1.0	<1	<50	2.3	5	<5	0.3	<0.2	<0.5	<0.2	<0.05	39.26
DOR-93-18	<0.5	<1	<50	0.9	<3	<5	0.1	<0.2	<0.5	<0.2	<0.05	39.66
DOR-93-19	<0.5	<1	<50	1.4	3	<5	0.2	<0.2	<0.5	<0.2	<0.05	36.76
DOR-93-20	<0.5	<1	<50	2.0	4	<5	0.3	<0.2	<0.5	<0.2	<0.05	36.66
DOR-93-21	0.5	<1	<50	3.3	7	<5	0.4	0.2	<0.5	0.2	<0.05	41.62
DOR-93-22	3.4	3	169	86	170	66	13	3.0	2.1	5.9	0.92	33.24
DOR-93-23	3.2	<1	145	55	120	46	9.0	2.0	1.5	4.9	0.70	33.15
DOR-93-24	3.6	<1	166	76	150	67	12	2.5	1.3	5.0	0.76	25.94
DOR-93-25	4.3	<1	203	37	100	27	5.8	1.4	1.7	6.0	0.95	31.29
DOR-93-26	3.8	<1	89	12	58	13	2.9	0.7	0.9	4.0	0.60	32.41
DOR-93-27	<0.5	<1	<50	1.3	<3	<5	0.2	<0.2	<0.5	<0.2	<0.05	35.44
DOR-93-28	2.8	<1	126	56	100	39	7.7	1.5	1.3	3.7	0.54	33.55

Table 1 (cont.)

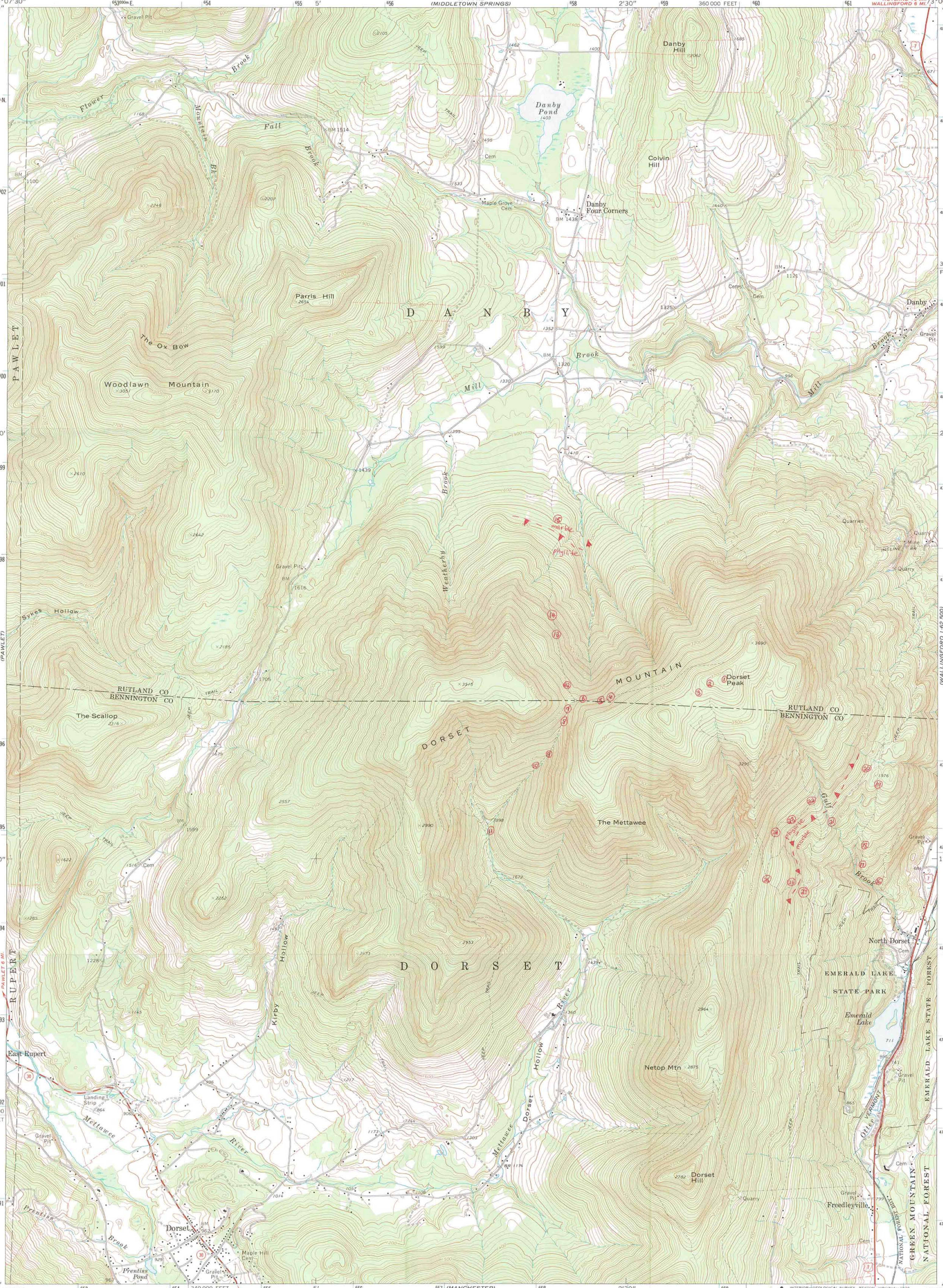
Activation Laboratories Ltd. Work Order: 6353 Report: 6249B

Sample description	CU PPM	PB PPM	ZN PPM	AG PPM	NI PPM	MN PPM	SR PPM	CD PPM	BI PPM	V PPM	CA %	P %	MG %	TI %	AL %	K %	Y PPM	BE PPM
DOR-93-1	10.	21.	119.	0.6	30.	277.	134.	<0.5	<5.	100.	0.02	0.012	0.90	0.12	14.81	3.26	2.	3.
DOR-93-2	16.	33.	53.	<0.4	13.	137.	34.	<0.5	<5.	25.	0.03	0.021	0.36	0.03	3.97	0.99	2.	<2.
DOR-93-3	34.	33.	90.	<0.4	26.	948.	101.	<0.5	<5.	73.	0.07	0.037	0.55	0.07	10.90	2.11	2.	<2.
DOR-93-4	46.	23.	126.	0.4	40.	738.	70.	<0.5	<5.	57.	0.16	0.076	1.07	0.05	7.99	1.75	4.	<2.
DOR-93-5	29.	10.	61.	<0.4	20.	899.	49.	<0.5	<5.	36.	0.06	0.017	0.48	0.05	5.45	1.04	2.	<2.
DOR-93-6	54.	34.	141.	<0.4	43.	1411.	92.	<0.5	<5.	84.	0.05	0.030	1.04	0.07	12.80	2.24	4.	2.
DOR-93-7	22.	39.	109.	<0.4	25.	1432.	59.	<0.5	<5.	37.	0.07	0.040	0.65	0.04	5.94	1.10	2.	<2.
DOR-93-8	2.	<5.	6.	<0.4	2.	23.	2.	<0.5	<5.	2.	0.05	0.002	0.01	0.01	0.02	0.01	2.	<2.
DOR-93-9	9.	18.	85.	<0.4	18.	1232.	36.	<0.5	<5.	42.	0.10	0.050	0.38	0.04	5.70	0.87	2.	<2.
DOR-93-10	13.	24.	96.	<0.4	23.	734.	80.	<0.5	<5.	62.	0.07	0.040	0.65	0.17	8.98	2.22	2.	<2.
DOR-93-11	7.	7.	134.	0.4	23.	313.	30.	<0.5	<5.	77.	0.12	0.045	2.31	0.08	6.50	1.55	4.	<2.
DOR-93-12	19.	31.	134.	<0.4	43.	1142.	88.	<0.5	<5.	89.	0.15	0.088	0.87	0.08	12.26	2.19	4.	2.
DOR-93-13	121.	35.	131.	<0.4	42.	3220.	101.	<0.5	<5.	74.	0.06	0.042	0.74	0.07	11.41	2.18	4.	2.
DOR-93-14	10.	24.	122.	<0.4	39.	832.	94.	<0.5	<5.	78.	0.07	0.043	0.85	0.07	10.90	1.99	2.	2.
DOR-93-15	2.	<5.	6.	<0.4	2.	59.	250.	<0.5	<5.	7.	32.90	0.004	1.20	0.01	1.53	1.32	6.	<2.
DOR-93-16	2.	11.	22.	<0.4	2.	207.	87.	<0.5	<5.	2.	20.87	0.008	11.29	0.01	0.28	0.31	6.	<2.
DOR-93-17	2.	<5.	16.	<0.4	2.	134.	182.	<0.5	<5.	6.	22.09	0.006	10.36	0.01	0.17	0.10	2.	<2.
DOR-93-18	2.	<5.	7.	<0.4	2.	93.	164.	<0.5	<5.	2.	23.26	0.005	10.11	0.01	0.06	0.02	2.	<2.
DOR-93-19	2.	<5.	4.	<0.4	2.	38.	225.	<0.5	<5.	2.	45.06	0.002	0.11	0.01	0.07	0.03	4.	<2.
DOR-93-20	2.	<5.	8.	<0.4	2.	17.	190.	<0.5	<5.	2.	36.70	0.005	2.05	0.01	0.26	0.20	2.	<2.
DOR-93-21	2.	<5.	10.	<0.4	2.	34.	220.	<0.5	<5.	2.	42.21	0.005	1.13	0.01	0.31	0.18	4.	<2.
DOR-93-22	14.	29.	141.	<0.4	34.	1576.	84.	<0.5	<5.	84.	0.16	0.056	0.64	0.06	12.98	2.26	2.	<2.
DOR-93-23	22.	44.	138.	<0.4	46.	1471.	102.	0.6	<5.	82.	0.13	0.058	0.94	0.07	12.10	2.75	5.	2.
DOR-93-24	24.	30.	129.	<0.4	33.	435.	94.	<0.5	<5.	78.	0.10	0.046	0.98	0.08	11.74	2.78	4.	2.
DOR-93-25	20.	24.	168.	<0.4	48.	1709.	134.	0.5	<5.	89.	0.22	0.079	1.18	0.09	15.44	2.54	7.	2.
DOR-93-26	27.	21.	89.	<0.4	22.	480.	52.	<0.5	<5.	53.	0.10	0.042	0.91	0.40	7.62	2.35	6.	<2.
DOR-93-27	2.	<5.	6.	<0.4	2.	34.	194.	<0.5	<5.	2.	44.90	0.003	0.19	0.01	0.15	0.05	2.	<2.
DOR-93-28	41.	25.	121.	0.4	40.	749.	69.	<0.5	<5.	56.	0.22	0.076	1.01	0.05	7.60	1.57	4.	<2.

FIGURE 1

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DORSET QUADRANGLE
VERMONT
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1965. Field checked 1967

Polyconic projection. 1927 North American datum
10,000-foot grid based on Vermont coordinate system
1000-meter Universal Transverse Mercator grid ticks, zone 18, shown in blue

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

National forest boundaries represent proclamation lines and do not necessarily imply Federal jurisdiction

UTM GRID AND 1967 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY
DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route
U. S. Route
State Route

DORSET, VT.
N4315—W7300/7.5
1967
AMS 6370 I SE—SERIES V813