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Reconnaissance Bedrock Geologic Map of the Randolph Center Quadrangle, Vermont

by

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INTRODUCTION

The purpose of this map is to provide data in support of some new ideas on the stratigraphy of the rocks in the Connecticut Valley trough of east-central Vermont (fig. 1) (Hatch, 1988). The recognition of locally widespread graded beds in recent detailed and reconnaissance mapping has compelled a rethinking of the stratigraphic relationships between some of the major units of the trough. The trough is bounded on the west by Precambrian to Ordovician strata on the east flank of the Green Mountain anticlinorium and on the east by Ordovician (?) to Devonian strata of the Bronson Hill-Boundary Mountains anticlinorium (fig. 1).

The earliest mapping in the area was done by Hitchcock (1861). In the early 1900s Richardson (1927; Richardson and Cabeen, 1923) studied the rocks of eastern Vermont. The granitic rocks of this and nearby quadrangles were studied by Dale (1909, 1923) and by Balk (1927). In the late 1950's Ern (1963) mapped the Randolph 15' quadrangle, of which the Randolph Center 7 1/2' quadrangle forms the northeast quarter. Ern's (1963) mapping, with only minor changes, was included in Doll and others (1961) Centennial geologic map of the state. In 1980 Fisher and Karabinos published a report on a study of the previously unreported graded beds in the Townshend-Brownington syncline belt of Gile Mountain Formation well exposed along and near the White River, about 6 km south of this quadrangle.

RESULTS OF NEW WORK

Reconnaissance remapping of the Connecticut Valley trough north of 43°40' since the mid 1980's has indicated that the graded beds reported by Fisher and Karabinos (1980) are present in the Townshend-Brownington syncline belt of Gile Mountain at least as far north as 44°40'. These rhythmically graded beds indicate that the Gile Mountain Formation stratigraphically overlies the Waits River Formation throughout the belt.

In addition, identical graded beds are present, locally, in the Northfield Member of the Gile Mountain (see Hatch, 1991). These graded beds, where they are exposed near the Northfield-Waits River contact north and northwest of the Randolph Center Quadrangle, indicate that the Northfield is stratigraphically above, rather than below (Doll and others, 1961), the Waits River Formation. If this interpretation is correct, the Northfield occupies the same stratigraphic position as the Gile Mountain Formation (Hatch, 1988), and is interpreted as a more distal facies of the western belt of the Gile Mountain Formation. Therefore it has been proposed (Hatch, 1991) that the Northfield be changed from a separate formation at the bottom of the trough sequence to a formal member of the Gile Mountain Formation along the west edge of the trough. This relationship requires that the west margin of the trough, commonly known as the R.M.C., (Richardson Memorial contact) be a fault, in agreement with the conclusions of Westerman (1987) on the basis of field textural data. Westerman (1987) has named this fault the Dog River fault zone.

The belt of Northfield shown here, and which extends into the Randolph 7 1/2' quadrangle to the west, is significantly wider (as wide as 3.7 km) than shown by Ern (about 0.4 km) (1963) and Doll and others (1961). This wider belt is mapped on the basis of several factors. First, highway cuts along Interstate Route 89 made after Ern's (1963) mapping was complete have provided some excellent fresh exposures. Second, the presence of distinctive graded beds in the eastern part of the area previously mapped as Waits River Formation and here mapped as Northfield strongly suggests a close affinity to Northfield/Gile Mountain. And third, because the Northfield has long been recognized as containing some thin beds of calcite-quartz-mica granofels, and the Waits River Formation has not been reported to contain any graded quartzite beds, it seems more appropriate to map phyllites interbedded with lesser amounts of calcite-quartz-mica granofels in beds as much as a few meters thick as Northfield Member of the Gile Mountain Formation rather than Waits River Formation.

STRUCTURE

The rocks of the Randolph Center quadrangle are within what has been called the Connecticut Valley-Gaspi synclinorium (Cady, 1960) and more recently (Hatch, 1988) the Connecticut Valley trough. They have been folded at least twice, and metamorphosed to as high as kyanite grade (Ern, 1963). The first stage of folding produced tight to isoclinal, possibly horizontal folds with a well-developed axial surface schistosity. Although these isoclinal folds are relatively common in outcrop scale, particularly in the rhythmically graded member of the Gile Mountain Formation, only locally are reversals in topping direction noted which are interpreted as due to isoclinal folding. The schistosity that commonly parallels bedding is attributed to this first stage of isoclinal folding.

The second stage of folding produced somewhat more open mesoscopic folds that fold schistosity; observable small examples are present throughout the quadrangle. They are indicated on the map by the symbol for folds that fold schistosity, and they have axial surfaces that most commonly strike northeast and dip northwest. They generally develop an axial surface cleavage which, particularly in the southern part of the quadrangle, is quite widespread. This cleavage commonly is sufficiently well developed that it becomes a schistosity. On the map, no attempt is made to distinguish first from second stage schistosity; the map symbol is purely descriptive with no interpretation, as is also true for fabrics mapped as cleavage. However, schistosity that strikes generally north and dips steeply and/or is parallel to bedding is almost certainly first generation, and schistosity that strikes northeast and dips northwest, whether or not it can be seen to cut an earlier schistosity, is probably second generation. The large folds that produce the present distribution of map units are interpreted to have formed by a combination of these two fold generations.

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EXPLANATION

"Bethel granite" (Middle(?) Devonian) (g)

Most of the rock is medium to coarse grained, very light colored, and is composed, in approximate decreasing order of abundance, of quartz, oligoclase, potasic feldspar (predominantly orthoclase), muscovite, and minor biotite. Concentrations of biotite in orbicules are particularly common in the west wall of the southern of the two quarries. Exposed in one sill-like body about 180 m north-south and 30 m east-west in the southwest corner of the quadrangle. It is well exposed in two quarries within the main body to the south in the South Royalton quadrangle and locally known as the "Bethel white granite." No isotopic age on the Bethel is known, but the body is thought to be late syn- to post-tectonic, and it intrudes the Waits River Formation thought to be Silurian to Lower Devonian in age.

Gile Mountain Formation (Lower Devonian)

Northfield Member (Dgn)

Consists predominantly of massive, dark-gray, fine-grained muscovite-quartz-chlorite-garnet-biotite graphitic phyllite. Locally includes beds as much as a meter thick of light-gray, medium-grained calcite-quartz-mica granofels. This granofels is characterized by a variably thick (locally as much as 4 or 5 cm) punky-brown weathering rind. These punky-brown weathering granofels beds are characteristic of the underlying Waits River Formation into which the Northfield is gradational. The two units are distinguished by the much higher percentage of punky-brown granofels in the Waits River. Also locally present in the Northfield are beds, generally 10 to 25 cm thick, which grade from light-gray, fine-grained micaceous quartzite into increasingly dark-gray aluminous phyllite identical to the phyllites just described. These graded beds are indistinguishable from the graded beds of the rhythmically graded member of the Gile Mountain Formation a few km to the east. They are mapped as part of the Northfield Member on the basis of a higher percentage of interbedded dark-gray phyllite and the presence of the beds of punky-brown weathering granofels. The Northfield underlies an area approximately 8.5 x 0.5 km in the southwestern part of the quadrangle.

<u>Rhythmically graded member</u> (Dgr)

The member consists of rhythmically graded beds generally 10 to 25 cm thick that grade from light- to medium-gray, fine-grained micaceous quartzite at the base to dark-gray muscovite-quartz-biotite-(garnet)-(chlorite) graphitic phyllite at the top. Beds are almost universally graded particularly in the eastern part of the belt. In the western part of the belt are local exposures of faintly bedded to unbedded dark-gray graphitic phyllite identical to that in the Northfield Member. The rhythmcially graded member underlies a north-south belt, the Townshend-Brownington syncline, 2 to 5 km wide through the central part of the quadrangle.

Waits River Formation (Lower Silurian to Lower Devonian) (DSw) Predominantly dark-gray phyllite, indistinguishable from the phyllite of the Gile Mountain Formation, and punky-brown-weathering, medium- to light-gray, fine- to medium-grained calcite-quartz-mica granofels. Beds generally range from about 25 cm to as much as 10 m in thickness. The Waits River is distinguished from the overlying Gile Mountain Formation by the much greater thickness and abundance of beds of punky-brown-weathering calcite-quartz-mica granofels and the near absence of beds of micaceous quartzite in the Waits River. Forms two north-south belts across the quadrangle, one on each side of the belt of the rhythmically graded member of the Gile Mountain Formation. The phyllites in the eastern belt of Waits River appear to have more quartz veins and to be somewhat less micaceous in composition than the phyllites in the western belt. Furthermore, the percentage of calcite-quartz-mica granofels appears to be higher in the eastern belt than in the western.