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Structural Geology of the Skitchewaug Mountain Area

Thompson, J.B.

TRIP E

STRUCTURAL GEOLOGY OF THE SKITCHEWAUG MOUNTAIN AREA, CLAREMONT QUADRANGLE, N. H. - VT.

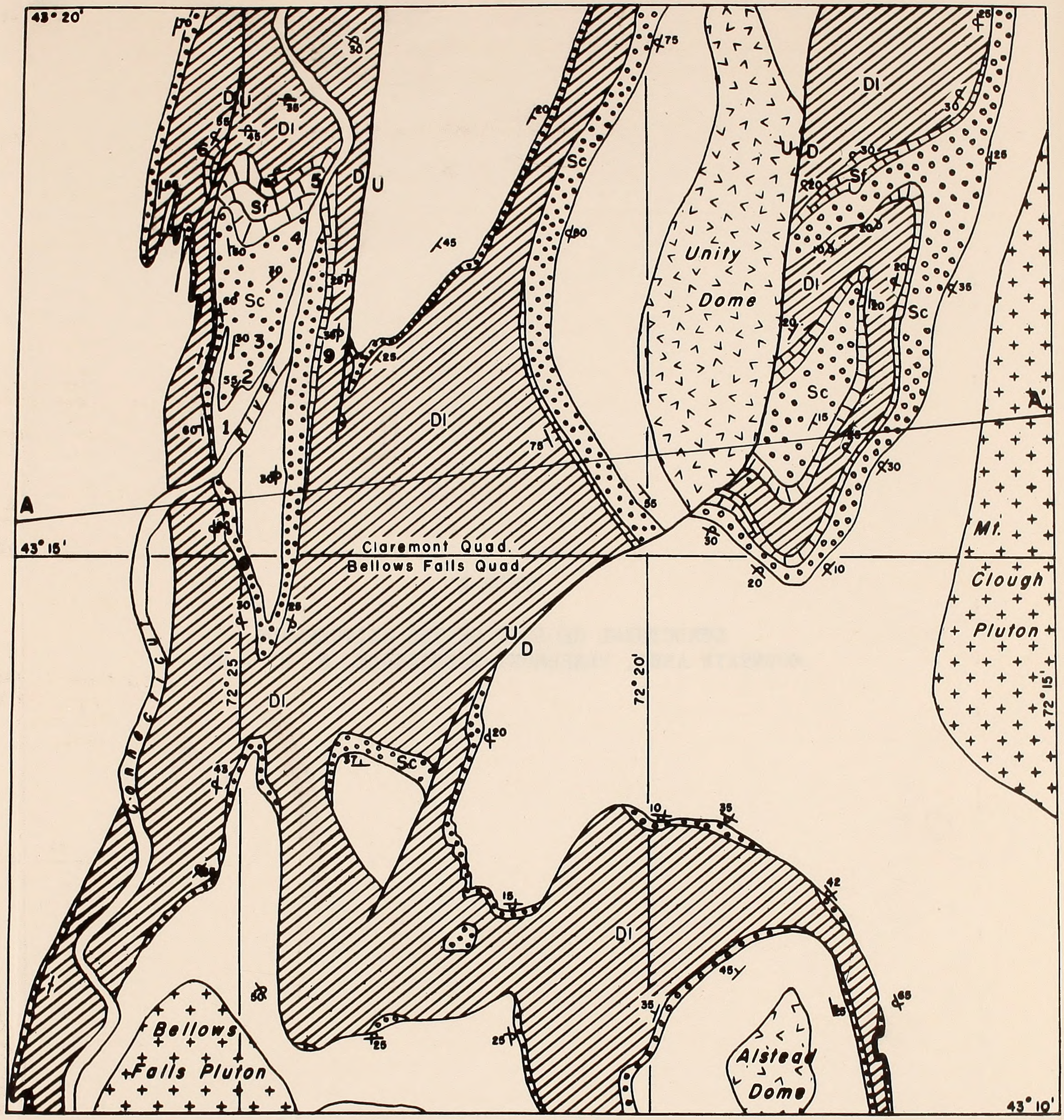
GEOLOGIC SKETCH MAP OF SKITCHEWAUG NAPPE AREA

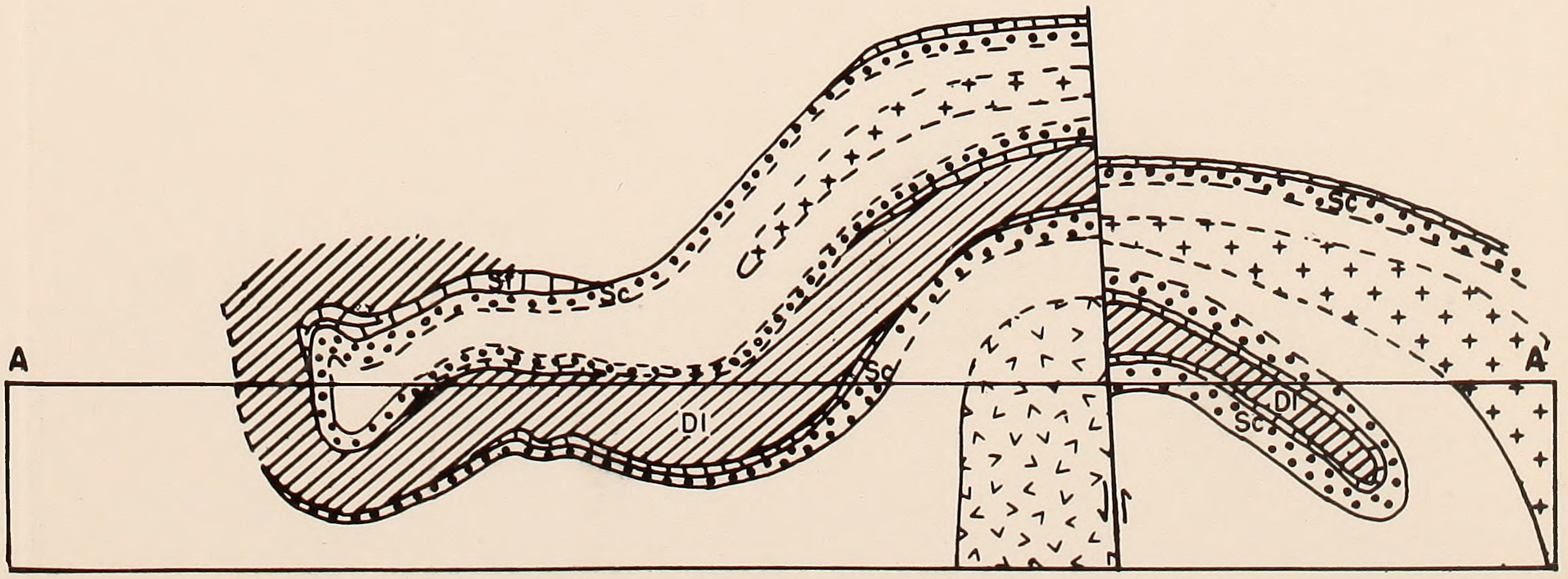
LEGEND

- Bethlehem gneiss
- Oliverian gneiss
- Dl — Littleton formation
- Sf — Fitch formation
- Sc — Clough formation
- Formations older than the Clough, chiefly Partridge formation and Ammonoosuc volcanics
- Strike and dip
- Strike and dip of overturned beds
- U/D — High angle fault

Geology by J.B. Thompson, 1954, based in part upon maps by C.A. Chapman, 1942 and F.C. Kruger, 1946.

0 1 2 3 miles





TRIP E

STRUCTURAL GEOLOGY OF THE SKITCHEWAUG MOUNTAIN AREA, CLAREMONT QUADRANGLE, VERMONT - NEW HAMPSHIRE

SUNDAY, OCTOBER 10, 1954, 8:30 A. M.

Leader: J. B. Thompson

Assembly Point

Ascutney, Vermont, at the junction of Route 5 with Routes 131, 12, and 103.

Ascutney is 21 miles south of White River Junction and 26 miles south of Hanover, on the Vermont side of the Connecticut River.

General

The discovery, in the spring of 1950, of a fossiliferous quartzite on Skitchewaug Mountain in Springfield, Vermont, has cast new light on certain of the stratigraphic and structural problems of southwestern New Hampshire and southeastern Vermont.

Subsequent detailed mapping in that area has shown that the fossiliferous quartzite of Skitchewaug Mountain is equivalent to the upper part of the Clough formation as mapped by Chapman (1939, 1942, 1952), Kruger (1946), and Moore (1949) along the flanks of the Bronson Hill anticline to the east. The fossils are deformed and metamorphosed (garnet and staurolite zones) but sufficiently well preserved to indicate a Silurian or early Devonian age, corroborating the correlations made by the above authors with the fossiliferous rocks at Littleton, N. H., to the north, and at Bernardston, Mass., to the south.

The unique feature of the Skitchewaug Mountain rocks is their structural relation to surrounding areas. The quartzites and associated rocks crop out over an area about five and one half miles wide and five and one half miles long on both sides of the Connecticut River in Springfield, Vt., and Charlestown, N. H. The pattern on the map is that of an arrowhead pointing south. The barbs of the arrowhead mark the "leading edge" or nose of a major recumbent anticline in the quartzites. The trend of this "leading edge" is here nearly east-west. The quartzites between the barbs, where the shaft of the arrow would fit, are on the upper limb of the recumbent anticline or nappe and in normal stratigraphic order or "right side up". It is noteworthy that the only recognizable fossils are confined to this area. The quartzites outlining the point of the arrow are on the under limb of the nappe and are consequently in inverted stratigraphic order. The various stratigraphic units appear to be thinner here than on the upper limb. That this thinning may be largely tectonic is suggested by the marked flattening and elongation of the cobbles in the basal conglomerate of the quartzite here as compared to that on the upper limb. The present map-pattern has been brought about by the superposing of an open synclinal fold with a north-south axis upon the structure just described.

Revision, during the past field season, of portions of the Bellows Falls area adjacent to the south has shown that the Bellows Falls pluton of the Bethlehem gneiss is surrounded by a band of the same quartzite, dipping beneath the gneiss in inverted position. These quartzites come within less than a mile of those of the Skitchewaug area in the hills just east of Charlestown village and were clearly continuous with

them at one time. A third area of inverted quartzites appears to the east in the area between the Alstead (Kruger, 1946) and Unity (Chapman, 1942) domes of the Bronson Hill anticline. Although cut out by a later normal fault in the north part of the Bellows Falls quadrangle for about two miles, these quartzites may be traced north into the Claremont and Sunapee quadrangles where they dip east (still inverted) beneath the Mt. Clough pluton of the Bethlehem gneiss, and south along the east side of the Alstead dome. The logical interpretation seems to be that the Skitchewaug area and the Bellows Falls pluton area outline a large nappe rooting east of the Bronson Hill anticline in the area of the Mt. Clough pluton, with the Bethlehem gneiss forming the core of the nappe. This interpretation lends support to the proposal of Kruger and Linehan (1941) that the Bellows Falls and Mt. Clough plutons were once connected over the crest of the Bronson Hill anticline.

The conspicuous ledges of quartzite and conglomerate in the Skitchewaug area have attracted the interest of geologists for some time. Galen D. Hull (1890) mapped the New Hampshire part of the area while a student at Dartmouth College and interpreted many of the structural relations correctly, although not recognizing the inversion of the stratigraphic sequence. C. H. Hitchcock (1912), noting similarities to the fossiliferous rocks at Littleton and Bernardston, suggested a Devonian age for the quartzites, though no fossils had been found at that time, and C. H. Richardson (1930), apparently noting the dissimilarity with other rocks in southeastern Vermont, raised the question: "Does Skitchewaug Mountain represent a fault block that has been thrown to the west of the Connecticut River from New Hampshire?" The writer is grateful to C. A. Chapman and J. C. Ratte, who have worked in the area more recently, for access to their findings. The writer has been mapping in the area intermittently since 1950 and work is still in progress.

STOP 1 0.8 miles north of the west end of the Cheshire Toll Bridge on Route 5.

Exposure

Outcrop on west side of road is dark muscovite-biotite schist of Partridge (?) formation. At the south end of the exposure is an amphibolite dike cutting across the schistosity.

Note: The schists of the Partridge formation generally contain pyrite or pyrrhotite and are characteristically rusty-weathering in contrast to those of the Littleton formation. The Partridge formation is the oldest rock exposed in this portion of the nappe.

STOP 2 0.5 miles north of Stop 1.

Exposure

Ledges west of road are basal conglomerate of Clough formation.

STOP 3 0.7 miles north of Stop 2.

Exposure

Interbedded pebbly quartzites and garnet-bearing mica schists in the central part of the Clough formation.

Note: Notice fold with axial plane trending nearly east-west and dipping south.

STOP 4 1.2 miles north of Stop 3.

Exposure

West of road are quartzites in the upper part of the Clough formation.

Note: Rusty-weathering calcareous bands in quartzite contain numerous highly deformed fossils and fossil fragments. Recognizable remains are chiefly crinoid stems and corals, but brachipods, a cephalopod and a possible trilobite have also been found. The fossils have been studied by Dr. A. J. Boucot of the U.S.G.S. who will be present on the excursion. Just south of the principal road cut, a large mafic dike, now metamorphosed to epidote-amphibolite, cuts across the quartzites.

STOP 5 0.5 miles north of Stop 4.

Exposure

Road cuts in calcareous rocks of the Fitch formation. Characteristic types include quartz-calcite-biotite schist and calcite-actinolite granulites.

STOP 6 About 2.0 miles north of Stop 5 turn sharply left on Vermont Route 10 (Skitchewaug Trail), and proceed southwest about 1.5 miles to picnic table on right hand side of road.

Exposure

An inverted contact between the Fitch and Littleton formations is exposed in a cut on the southeast side of the road.

Note: On the hill above, exposures of the Fitch formation show characteristic pitted weathering. In the pasture grey sandy phyllites of the Littleton formation show easterly plunging folds. The exposures at Stop 6 are on the under limb of the Skitchewaug nappe, but close to the axial plane, and are just west of the axis of the open syncline superposed on the nappe.

STOP 7 About 1.0 miles south of Stop 6, at Spencer School.

Exposure

Conglomerate east of the road is believed to belong to the Clough formation on the under limb of the recumbent syncline beneath the Skitchewaug nappe (a recumbent anticline).

Note: Notice steeply plunging folds with sinistral pattern.

STOP 8 Proceed south on gravel road from Stop 7 for about 2.5 miles to junction with Vermont Route 11. Turn left (east) on Route 11 and proceed to Charlestown, N. H., crossing Cheshire Toll Bridge (15 cents) at about 1.5 miles. Bear right after crossing bridge and proceed south about 1.6 miles to Charlestown village, turning sharply left here on Routes 11 and 12, and proceed 0.8 miles northeast to Snumshire.

Exposure

Quartzite and quartz-conglomerate dipping northeasterly. The quartzites belong to the Clough formation on the lower limb of the Skitchewaug nappe.

STOP 9 On Routes 11 and 12 about 3.0 miles north of Stop 8.

Exposure

East and west of road are grey staurolite schists and thin-bedded micaceous quartzites of Littleton formation.

Note: Walk west 0.3 miles to conspicuous ledges (Rattlesnake Hill) overlooking Connecticut River and Skitchewaug Mountain, passing over inverted section through lower Littleton, Fitch and Clough formations en route. Ledges overlooking river are basal conglomerate of Clough formation. The rocks dip consistently west and are on the lower limb of the Skitchewaug nappe and upon the east limb of the open syncline which bends the axial plane of the nappe.

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