RECONNAISSANCE OF THE CONTACT METAMORPHISM OF THE KATAHDIN AND SQUAW MOUNTAIN INTRUSIVES, MAINE.

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ABSTRACT. Geologic reconnaissance of the Katahdin granite and the Squaw Mountain intrusive in central Maine indicates that these plutonic bodies have metamorphosed their adjacent country rocks in a manner similar to that of the Onawa pluton, described in detail by the writer previously. Contact metamorphics including injection hornfels, hornfels and schist have been produced. Keith's mapping indicates that all three of these bodies are in contact with Cambro-Ordovician argillaceous and sandy sediments. Since the writer's geologic study of the Onawa pluton indicated that the contact metamorphics surrounding it were of the same age as the common country rock slate of the region, Silurian, rather than Cambro-Ordovician as mapped by Keith, the Cambro-Ordovician age of the rocks bordering the Squaw and Katahdin intrusives is questioned.

INTRODUCTION.

THIS paper is written to invite attention to the fact that the Katahdin granite has undoubtedly metamorphosed its contiguous country rock along its southern and southwestern borders, and that similar metamorphic rocks bound the adjacent Squaw Mountain intrusive. This is based on:

1. Various reconnaissance trips on foot through the area at intervals from 1931 to 1939;

2. Study of a limited number of thin sections of both igneous and metamorphic rocks from the Squaw Mountain intrusive; and

3. Comparison of conditions in this area with those in the metamorphic aureole of the Onawa pluton[1], some ten miles to the south.

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INTRUSIVES.

The Katahdin granite and its associated metamorphic rocks occupy a belt of varying width that apparently extends completely across Piscataquis County, Maine, in a northeasterly

[1] Philbrick, Shailer S.: "Contact Metamorphism of the Onawa Pluton, Piscataquis County, Maine." This Journal, Vol. 31, pp. 1-40, 1936.

direction from the eastern side of Moosehead Lake past Mt. Katahdin to the western side of Penobscot County. Its greatest length is 47 miles and its greatest width is about 20 miles. The Squaw Mountain intrusive, 11 miles long by 5 miles wide,

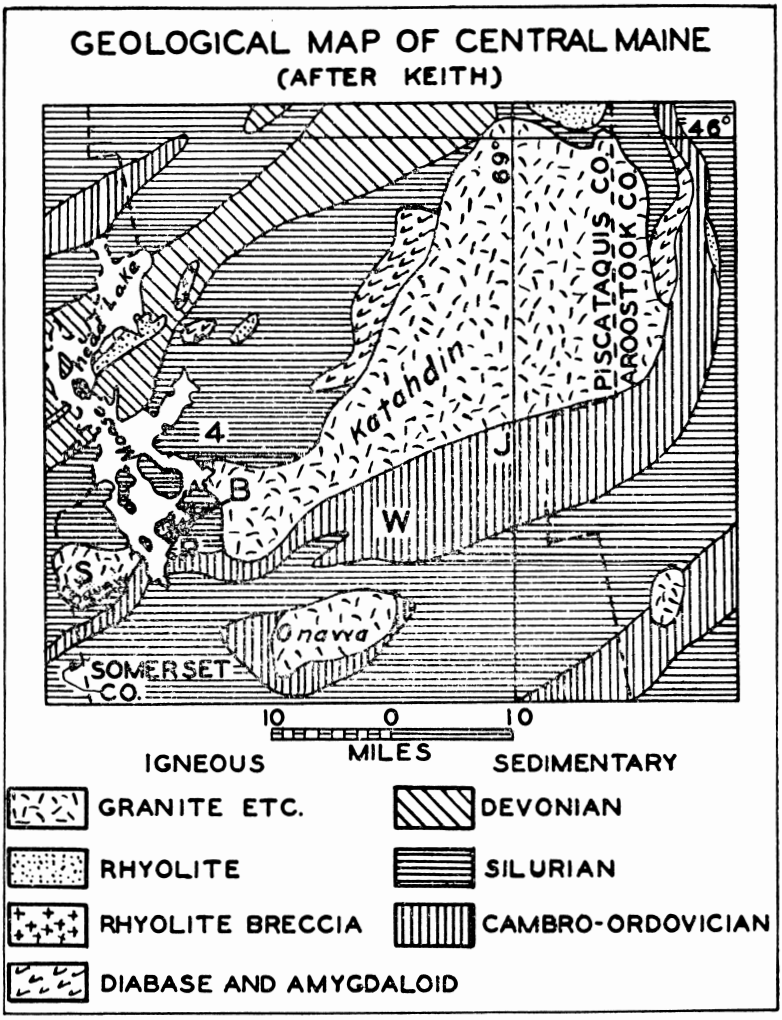

FIG. 1.

extends from near the southwestern border of the Katahdin granite across Moosehead Lake to the western limits of Piscataquis County. Mountains ranging from the massive Katahdin at the northeast to the lesser but almost as conspicuous

Squaw at the southwest mark much of this area. A series of prominent ranges and hills supported by the metamorphic rocks trace the southern limit of the granite and merge westward with the mountains of the Moosehead Lake region. The central area underlain by the granitic intrusive is more or less flat, covered with many lakes and ponds, interspersed between low hills.

The Katahdin granite, well exposed in the vicinity of Mt. Katahdin where no pronounced structure aside from jointing is to be noted, is an acid intrusive in which the rock is a typical, medium- to coarse-grained granite. On the other hand the Squaw Mountain intrusive may be as basic as gabbro, as shown by a thin section of olivine-bearing gabbro from the eastern foot of Squaw Mountain. A dike of granodiorite porphyry cuts the gabbro there, but at the other side of the Squaw Mountain intrusive a thin garnetiferous pegmatite occurs.

COUNTRY ROCKS.

Keith's mapping[2] represents the intrusive as being in contact with an interbedded series of slates, argillites, thin sandstones, and quartzites with some limestone in the upper part, ranging in age from Cambrian through Upper Silurian. The altered diabase and amygdaloid and the Devonian sediments are not included in the study.

METAMORPHIC ROCKS.

Both intrusives have metamorphosed their country rock, with the production of three, more or less, distinct rock types, almost identical with those found during a detailed study of the contact-metamorphic aureole of the Onawa pluton. From the intrusives outward they are: Injection hornfels, hornfels, and schist. Near the igneous contact considerable aplitic material has been injected in veinlets, and ptygmatic folding and brecciation have been produced in the hornfels. This type is called injection hornfels. Somewhat farther out from the intrusive similar rock without the veinlets occurs and is called hornfels. The outermost zone is composed of schist, commonly carrying andalusite, which probably merges into the country rock slate series.

[2] Keith, A.: "Preliminary Geologic Map of Maine," 1933. Scale 1:1,000,000.

Text Fig. 1 shows the outlines of the Katahdin granite and Squaw Mountain intrusive, taken from the Preliminary Geologic Map of Maine, 1933, by Arthur Keith. Along the outlines are letters representing the locations of reconnaissance traverses made up certain mountains.

TABLE I.

Distribution of Metamorphic Types.

	Topographic Location				
Mountain	*Foot*	*Slope*	*Peak*	*Slope*	*Foot*
Joe Mary	Injection hornfels	Hornfels	Slate	.....	.....
White Cap	Covered	Hornfels	Slate	Covered	Slate
Prong Pond	Diorite (?)	Covered	Andalusite schist	Slate	Slate
Squaw	Gabbro*	Hornfels	Injection hornfels*	.....	.....
Burnt Jacket	Diorite (?)	Diorite (?)	Injection hornfels*	.....	.....
No. 4	.....	.....	Injection	Covered hornfels	Covered

* Examined in thin section.

In Table I, the left-hand column lists the names of these mountains, beginning with the easternmost, Joe Mary, and proceeding clockwise along the boundaries. In the table the granite is placed at the left side and the country rock at the right side. The five columns from left to right are respectively, then, the five topographic zones of the mountain: 1. foot near the granite, 2. slope toward the granite, 3. peak of the mountain, 4. slope toward the country rock, and 5. foot near the country rock. Where blanks appear the areas in question have not been investigated.

At the foot of Joe Mary Mountain injection hornfels was found in outcrop and was succeeded up the mountain by hornfels. However, no exposure of the schist was found and the summit is composed of apparently unmetamorphosed slaty sediments. Southwestward of Joe Mary Mountain is a large peaked range called Whitecap Mountain. Midway up the north slope hornfels is encountered in outcrop. No contact

metamorphics were found on the summit, or south slopes of Whitecap.

In the vicinity of Moosehead Lake and lying between it and Whitecap are several ranges of mountains of varying size. Along the south side of the intrusive a long ridge-like hill called Prong Pond Mountain carries on its western end some moderately well-defined andalusite schist comparable to that found near the outer border of the schist zone surrounding the Onawa pluton. The north slope of the ridge is heavily wooded, but sporadic outcrops fail to show any of the typical metamorphic zones.

At the southwest foot of Moosehead Lake, Squaw Mountain is capped with injection hornfels carrying the aplitic veinlets which are typical of those surrounding the Onawa pluton. The similarity in character between Squaw Mountain and Boarstone Mountain of the Onawa pluton area was recognized by the late Prof. E. H. Perkins of Colby College who mentioned the similarity to the writer in 1931. Typical injection hornfels is also present on Burnt Jacket Mountain on the east side of Moosehead Lake. Farther northeast near the contact of the Katahdin granite, much aplite is present in the hornfels at the top of No. 4 Mountain.

ZONE OF INJECTION HORNFELS.

Any discussion of the inner zone of the metamorphics must consider the dual character of the injection hornfels. It is at once a hornfels and an injection gneiss. The outstanding characteristic of the rocks of this zone are the aplitic veinlets of varying thickness, which course through the hornfels with and without regard to pre-metamorphic structures, particularly bedding. Plate I, Fig. 1, shows the typical injection hornfels at the summit of Burnt Jacket Mountain, where the white dikes may be seen cutting the thin-bedded darker banded hornfels which has been displaced somewhat along the dikes. Near the left side of the photograph the regular lit-par-lit injection merges with a brecciated phase. Plate I, Fig. 2, is a photograph of a rather large boulder on the tote road down the West Branch of Pleasant River in the southwestern part of the Katahdin granite. Here the injection hornfels is almost an "eruptive breccia" composed mainly of aplitic material carrying many unoriented fragments of hornfels. The rock

composing this zone has been invaded by the magma in degrees varying from the well localized thin channels shown in Plate I, Fig. 1, to the almost complete permeation indicated in Plate I, Fig. 2.

The petrographic description of the injection hornfels is based on a pair of thin sections from each of Squaw and Burnt Jacket Mountains, in the Squaw Mountain area. One thin section from each locality was made of the hornfels so as to include a thin veinlet. The other thin section was cut through one of the larger aplite dikes. The hornfels on Squaw Mountain is a fine-grained andalusite hornfels composed of quartz, microcline, biotite, andalusite, and accessories. That on Burnt Jacket is a fine-grained cordierite hornfels composed of cordierite, quartz, biotite, orthoclase, and accessories. The veinlets in each of these thin sections reflect the character of the enclosing rock, carrying up to 5 per cent andalusite in the andalusite hornfels and up to 25 per cent cordierite in the cordierite hornfels. Both veinlets are composed primarily of quartz with some potash feldspar, plagioclase, and biotite. Alteration of the cordierite to chlorophyllite (?) is also to be noted. If the sillimanite and andalusite are neglected in classifying the thicker dikes, then the dike sampled on Squaw Mountain is a true aplite while that on Burnt Jacket can be called a quartz dike. But since the former carries 2 per cent of andalusite and the latter carries an alteration series running from biotite through a fibrous aggregate to well-defined fibrolite, it seems advisable to call them respectively an andalusite-bearing aplite and a sillimanite-quartz dike.

COMPARISON WITH THE ONAWA AUREOLE.

It can be said that the Squaw Mountain intrusive of 32 square miles[3] in area has metamorphosed its country rocks in a manner almost identical with that of the 27 square mile[4] Onawa pluton some 10 miles to the southeast. Slightly higher temperature conditions may have obtained in the Squaw area, where a garnetiferous pegmatite was found just within the intrusive. Also the sillimanite is somewhat more plentiful in thin section, but aside from these, conditions are nearly similar to those at Onawa.

[3] By planimetry from Keith's map.
[4] Philbrick: op. cit., p. 6.

The Katahdin granite with an approximate area of 550 square miles[3] has metamorphosed its country rocks in a manner similar to that of the Onawa pluton with an area of 27 square miles, but the Katahdin granite seems to be characterized by a wider aureole and more intense brecciation of the injection hornfels.

This paper is presented to show that a belt of contact-metamorphic rocks is present along the southern and southwestern sides of the Katahdin granite, similar to a belt of rocks examined during a detailed study of the Onawa pluton. The rocks surrounding the Onawa pluton were mapped by Keith as Ordovician and Cambrian, in distinction from the adjacent Silurian. Structural mapping indicated that the Silurian sediments continue into the aureole around the Onawa pluton, where they become the metamorphic rocks. A similar relationship appears to be the case with the Katahdin metamorphics, although only a reconnaissance investigation has been made as yet. It is natural to raise a question as to the Ordovician and Cambrian age for the rocks under discussion and to suggest that they may be metamorphosed Silurian. Final determination of this will come when recognizable fossils are found or detailed stratigraphic and structural relationships can be shown.

CONCLUSIONS.

1. Three subalkaline intrusives in central Maine—Katahdin, Squaw Mountain, and Onawa—, despite their great variation in areal extent appear to have metamorphosed their similar contiguous country rocks in essentially the same manner and to approximately the same degree, both by addition of feldspathic liquids and by recrystallization of the original minerals.

2. Detailed investigations of the subalkaline intrusives of central Maine should yield considerable data on the metamorphism of argillaceous rocks but will be seriously hampered until adequate base maps of the area are completed.

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FIG. 1

FIG. 2

FIG. 1. Typical injection hornfels, summit of Burnt Jacket Mountain.
FIG. 2. Boulder of brecciated hornfels, West Branch of Pleasant River.