

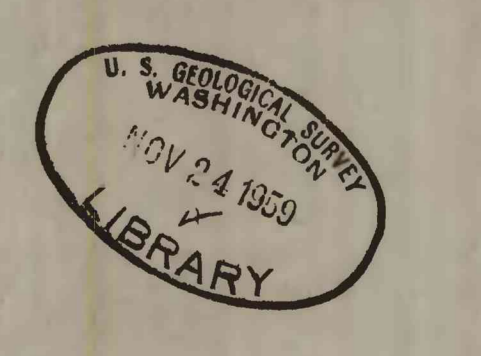
EXPLANATION

- Diabase dike
- Andover granite and associated pegmatites  
Gray, fine to medium-grained muscovite-biotite granite; variable texture; abundant pegmatites.
- Acton granite  
Light-gray, fine-grained granite; slightly gneissic in part; widely distributed as small intrusive masses.
- Ayer granite  
Complex igneous rock with average composition of granodiorite but granite or quartz-monzonite in part; light to medium gray, medium to coarse-grained, commonly porphyritic; gneissic; migmatitic in part; hornblende facies, (ayh); fine-grained tonalite facies, (ayt).
- Dracut orthite-gabbro; diorite facies, dnd
- Light gray; biotite granite
- Fine-grained biotite diorite
- Nashoba formation  
Largely biotite paragneiss, with beds and lenses of amphibolite (am), marble (m), and pegmatite. Contains some thin beds of biotite schist and quartzite.
- Worcester formation  
Chiefly phyllite and sericite or muscovite schist, in part andalusite-muscovite schist. (Formerly considered by Emerson to be part of the Bradford schist). At base a lentil of conglomerate known as Harvard conglomerate (Cwh).
- Merrimack quartzite  
Chiefly light-gray to greenish-gray quartzite (mq), but contains interbedded silty quartzite, arenaceous phyllite, and slate; locally thin feldspathic and quartzitic biotite schist, with lime-silicate lenses and igneous material, or gneissic.  
A light-gray, fine- to medium-grained, gneissic, muscovite granite (mch) lies mostly within, in places adjacent to, the Merrimack quartzite; known commercially as "Chelmsford granite."  
A "migmatitic" border zone (mqm) lies between Merrimack quartzite and "Chelmsford granite." (See note).
- Granite quarry
- Contact  
dashed where approximate or indefinite
- Fault

**Notes:** The "Chelmsford granite" is included by Jahns in his "Igneous and hybrid rocks" (Geol. Soc. America, Guidebook for field trips in New England, November 10-12, 1952); he considers the border zone, mqm, as mapped by him, to be migmatitic, at least in part, and the granite to be largely a hybrid rock. Currier (ibid.; also, 1947, Jour. Wash. Acad. Sci., v. 37, p. 75-86, 1937; Am. Geophys. Union Trans., 18th Ann. meeting, pt. 1, p. 168-201) considers it to be largely or entirely a metamorphic replacement of the Merrimack quartzite, and for the most part not a true migmatite. On this basis it is here included in the Merrimack quartzite, as a metamorphic facies, but the controversial nature of this assignment is recognized.

The "Chelmsford granite" as mapped by Jahns (this map) occupies a position within the Merrimack quartzite horizon and everywhere in the mapped area it is bordered by the quartzite at one or both contacts. The border zone, mqm, as indicated by Jahns, is shown diagrammatically and without definite boundaries.

This report and/or map is preliminary and has not been edited or approved for publication by the Geological Survey standards or nomenclature.



Massachusetts (Lowell-Westford area).  
Geol. 1:31680. 1959.  
cop. 1.

PRELIMINARY BEDROCK GEOLOGIC MAP OF THE  
**LOWELL-WESTFORD AREA, MASSACHUSETTS**  
COMPRISING PARTS OF THE TYNGSBORO, WESTFORD, BILLERICA AND LOWELL QUADRANGLES  
BY R. H. JAHNS, M. E. WILLARD, W. S. WHITE, and OTHERS