

T1245

A PETROGENETIC AND GEOCHRONOLOGIC STUDY

OF MIGMATITES AND PEGMATITES

IN THE CENTRAL FRONT RANGE

By

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A Thesis submitted to the Faculty and the Board of Trustees of the Colorado School of Mines in partial fulfillment of the requirements for the degree of Doctor of Science.

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ABSTRACT

The earliest recorded history, in central Colorado, is in the accumulation of a very thick sequence of sedimentary and volcanic rocks, probably in an ensimatic eugeosynclinal environment. The bulk of the accumulation apparently occurred in a period of no more than a few hundred million years prior to 1,750 m.y. ago. From about 1,750 to 1,700 m.y. ago, these rocks were subjected to intense orogenic and metamorphic forces. Complex structures and great diversity of metamorphic and igneous rock types were formed within a short time span. Migmatites and pegmatites developed in many places. Probably, local anatectic granitic melts were formed, but major igneous rocks of this period (Boulder Creek Granodiorite) were derived from greater depth.

The orogenic and metamorphic forces waned soon after 1,700 m.y. ago, and by 1,650 m.y. ago the rocks had ceased to deform plastically. During these waning stages leucogranite, lamprophyre, and more pegmatites were emplaced.

Essentially no record of igneous or metamorphic activity is then found until the emplacement of the Silver Plume Granites 1,440 m.y. ago. Some local plastic deformation occurred during the intrusion of these granite masses, but the dominant tectonic feature was cataclasis. A group of tabular, sharply discordant pegmatites also formed at this time.

The Pikes Peak batholith was emplaced 1,040 m.y. ago. This complex batholith was intruded into fairly rigid, cool country rocks in a short span of time. Satellitic masses were emplaced to the north-northwest of the main batholith, and a series of north-northwest trending granitic dikes were intruded. No further record of the remaining Precambrian is found in the central Front Range.

Migmatites formed during the peak of the 1,700 to 1,750 m.y. metamorphic and deformational activity. They are metamorphic rocks apparently formed by metamorphic processes. The leucocratic phases of the migmatites are in mineralogical, chemical, and isotopic equilibrium with their enclosing schists and gneisses. The forces driving their formation are poorly understood, but the process seems clear. Approximately 35 percent quartz and 65 percent feldspar (either plagioclase, microcline, or some combination) is the preferred combination which begins to concentrate along foliation planes. Biotite (and if necessary quartz) is excluded and recrystallizes to form a mafic rim around the leucocratic segregation.

Pegmatites are related to almost every period and type of igneous and metamorphic activity. Those pegmatites which are in the rocks from which they formed (either igneous or metamorphic) show distinct mineralogical and chemical similarities to their host rocks. These pegmatites formed by the concentration of quartz and feldspar in a structurally favorable site. Pegmatites which were emplaced out away from their parent rock lose the mineralogical and chemical characteristics of their origin and begin to acquire those of the rocks which they transgress.

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