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PETROGENESIS OF GRANULITE-FACIES

METAMORPHIC ROCKS IN

SRI LANKA

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THESIS PRESENTED BY

L. R. K. Perera B. Sc. (Hons.)

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Sri Lanka.

Department of Geology, University of Peradeniya,  
Peradeniya, Sri Lanka.

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## A B S T R A C T

Precambrian charnockites, gneisses and metasediments of Sri Lanka have been subdivided into the Highland Group, the Southwest Group and the Vijayan Complex. The Highland Group-Southwest Group granulite-facies belt is flanked on either side by the amphibolite-facies Vijayan Complex.

Interpretations of the petrogenesis of these Precambrian metamorphic rocks have long been controversial. Several metamorphic and tectonic models have been proposed on the geologic evolution and many workers advocate a multiple of metamorphic events affecting the island as a whole or part by part (Chapters I and II). The controversies are a consequence of some salient petrogenetic problems which are the keys to the metamorphic history of Sri Lanka.

This thesis is an attempt to unravel these problems, which include; (1) the occurrence of a local zone of amphibolite-facies rocks within the granulite-facies belt around Kandy (Chapter III), (2) the irregular distribution of cordierite-bearing gneisses within the granulite facies belt and the restriction of wollastonite-bearing calc-silicate gneisses to the extreme southwest of the belt (Chapter IV), and (3) the charnockite problem (Chapter V); for a better understanding of the metamorphic history of Sri Lanka.

An evaluation of the results of this petrological study (Chapter VI) shows; (a) the bulk chemical control on the mineral assemblages in rocks where largely a fluid phase controlled mineral equilibrium is not taking place, (b) the fluid phase control on the mineral assemblages in rocks where largely a bulk chemically controlled mineral equilibrium

is not taking place, (c) the changing activity of solid and fluid components in rocks with time in the two types of equilibrium mentioned under (a) and (b) respectively, resulted in metamorphic reactions indicating changes of metamorphic conditions affecting the two categories in identical manner, thus in agreement with a common explanation.

The early workers attributed the different mineral assemblages and the mineral reactions observed in the Precambrian metamorphic rocks of Sri Lanka to polymetamorphism, in the light of a poorly understood geochronological framework. The present observations indicate that the mineral reactions are the consequence of a continuous process of **POST METAMORPHIC PEAK P-T-t EVOLUTION**, which progressed in a sequence of discrete steps. During the process, metamorphic reactions have repeatedly and reversibly occurred in rocks, in space and time, suggesting closed fluid and whole rock chemical systems. The peak metamorphic mineral assemblages, governed by the controls (a) and (b) above, have been re-introduced and replaced, partially or completely, during the course of metamorphic evolution, again in rocks of critical bulk chemical and fluid phase composition.

In the resulting **NEW PETROGENETIC MODEL FOR THE PRECAMBRIAN METAMORPHIC EVOLUTION OF SRI LANKA**, four discrete steps are evident in the charnockites, gneisses and metasediments. The peak granulite facies metamorphism ( $M_1$ ) has been an event of major recrystallization, charnockitization and penetrative fabric formation. During the two periods of near-isobaric cooling ( $M_2$  and  $M_4$ ) and the period of near-isothermal decompression ( $M_3$ ) that followed, only localized

recrystallization and fabric formation took place under changing conditions. A second period of arrested charnockitization is evident during  $M_3$  which postdated  $M_2$  but  $M_4$ . The Sri Lankan P-T-t path is analogous to those observed in the Archaean granulite-facies terrains of South India and parts of Antarctica. Despite the recently assigned Late Proterozoic age, comparable metamorphic, tectonic and geochronological evolution with these terrains suggest an Archaean history for Sri Lanka. The presently available data are inadequate for a detailed chronological synthesis of the metamorphic evolution.

The new model proposed here disagrees with the recently envisaged thrust tectonic model as a solution for the "Highland-Vijayan problem" in Sri Lanka. Though small scale post metamorphic peak ( $M_3$  ?) thrusts are observed within the Highland Group area, possible application of thrust tectonics to this problem has to be explored very carefully.