BRIEF OUTLINE OF THE THESIS

This thesis describes isotopic age data for the Precambrian rocks of Rajasthan, Western India by the Rb-Sr isochron method based on more than 100 analyses on whole rocks and 50 analyses on their constituent minerals. Emphasis was on the personal collection of the samples in the field in collaboration with the scientists from the Geological Survey of India, Rajasthan Division. Isotopic analyses of the samples were made in the geochronology laboratory, Physical Research Laboratory, Ahmedabad. The geochronological findings permit not only a refinement of the earlier work but also a new interpretation of the primary and post crystallisation histories of the rock succession in Rajasthan. The thesis comprises seven Chapters, a brief summary of each is given below.

The first Chapter describes the geology of Rajasthan with main emphasis on the classification of the rock sequences according to Heron. The crystalline, deformed, Precambrian rocks of Rajasthan consist of two orogenic type sequences that consist of folded metasediments, basic metavolcanics and intrusives of granite, mafic and ultramafic compositions. These are the Aravalli and the Delhi Supergroups separated by an erosional unconformity. These folded sequences rest on an older basement
of granite and migmatite called the Banded Gneissic Complex (BGC). The BGC of Heron comprises two isolated gneissic terranes and the Berach Granite on the eastern margin, which are all believed to be time equivalent. The type Aravalli rocks occur in the vicinity of Udaipur and have been correlated with metasediments surrounding the Berach Granite to the east. The Delhi Supergroup constitute the Aravalli Mountain Range in the Central Rajasthan. West of the Aravalli Mountain Range, there are vast exposures of the post Delhi Erinpura Granites and their possible extrusive equivalents, the Malani Igneous Complex.

Chapter-2 describes the prominent outcrops of granites or granitic rocks associated with each of the three major stratigraphic sequences and sampled for the present study.

Chapter-3 presents a critical review of the previous isotopic age data obtained by different techniques and provides the background for the present investigation.

Chapter-4 describes the experimental techniques adopted for the isotopic age measurements. These include rock procession and dissolution, isotopic dilution, ion exchange separation of Rb and Sr and mass-spectrometry. Constituent mineral phases have been separated using magnetic separator and heavy liquids and processed the same way as the whole rocks. Mass spectrometric analyses based
on manual peak-jumping and recording with chart recorders have a precision of about 2% for $^{87}\text{Rb}/^{86}\text{Sr}$ and 0.1% for $^{87}\text{Sr}/^{86}\text{Sr}$. Blank analyses run in parallel with samples show negligible contamination at the levels of the sample Rb and Sr normally handled.

Chapter-5 presents the Rb-Sr analytical data for about 100 whole rocks representative of the three rock sequences and 50 mineral fractions. The data have been plotted on Sr evolution diagrams to calculate the age of isotopic equilibration of a given set of related samples and the Sr isotopic composition at equilibration using a two-error least-square regression method. Criteria have been developed to distinguish departure from perfect isochronism other than due to experimental errors. The whole rock ages fall into distinct age groups: 3000 to 2500, 2400-1900, 1700-1500 and 850-750 Ma, respectively. Mineral ages based on nearly complete isotopic equilibration between the mineral phases also fall into distinct groups around 1500, 850 and 500 Ma, respectively.

Chapter-6 discusses the application of the geochronological data to the geological sequences emphasising the agreement or otherwise between the traditional belief and the new findings regarding the geological succession in Rajasthan. The data discussed provides a framework
for the establishment of a reliable geochronology of the area. The major new findings are: (a) Crustal remnants older than 3000 Ma exist in at least one of the BGC terranes, (b) The time equivalence of the various BGC terranes assumed by Heron is not tenable (c) There is as yet no good radiometric age control on the time of the Aravalli Supergroups. There is a distinct possibility that it is late Archean instead of early Proterozoic, as is currently believed, (d) The Delhi Supergroup rocks comprise two non-overlapping age provinces corresponding to 1600 and 850 Ma respectively, thereby suggesting that they may be made of two distinct metasedimentary sequences with independent depositional and magmatic histories, (e) There is a general younging in age from east to west suggesting that the continental crust may have grown in this direction from about 3000 to 700 Ma.

Chapter-7 summarises the major findings and suggests lines for future work in the region to build upon the present work.