CHAPTER - I

INTRODUCTION

INTRODUCTION

The Bundelkhand massif of late Archean to Paleoproterozoic age lies in between the Aravallis and the Satpura orogenic belts and forms a semicircular to triangular outcrop. It occupies an area of about 26,000 sq km covering the southwestern part of Uttar Pradesh and northeastern part of Madhya Pradesh in central India. The massif is mainly composed of granitoid rocks. It is overlain by the Bijawar Group of rocks comprising metamorphosed sediments of Paleoproterozoic age towards the southeast and south of the massif and by the Vindhyan Group of sediments of Neoproterozoic age towards south, west and southeast; the northern portion is covered by Indo-Gangetic alluvium (Fig. 1).

Previous investigations on Bundelkhand massif have been mainly restricted to the determination of the petrological diversity of the massif; the informations so far available are generally sketchy or incomplete. Detailed investigations have not been carried out to discriminate and delineate the different magmatic episodes and to elucidate the tectonic setting of emplacement of the granitoids. The basement into which the granitoids were emplaced has remained poorly defined. The nature and origin of the enclaves are yet another unresolved problem. The study so far carried out has mainly been localised and cursory and as a result, the problems have remained enigmatic and controversial.

Purpose of Study

Recent work (Rahman and Zainuddin, 1993; Zainuddin et al., 1992) reveals that the granitoids of the Bundelkhand massif represent

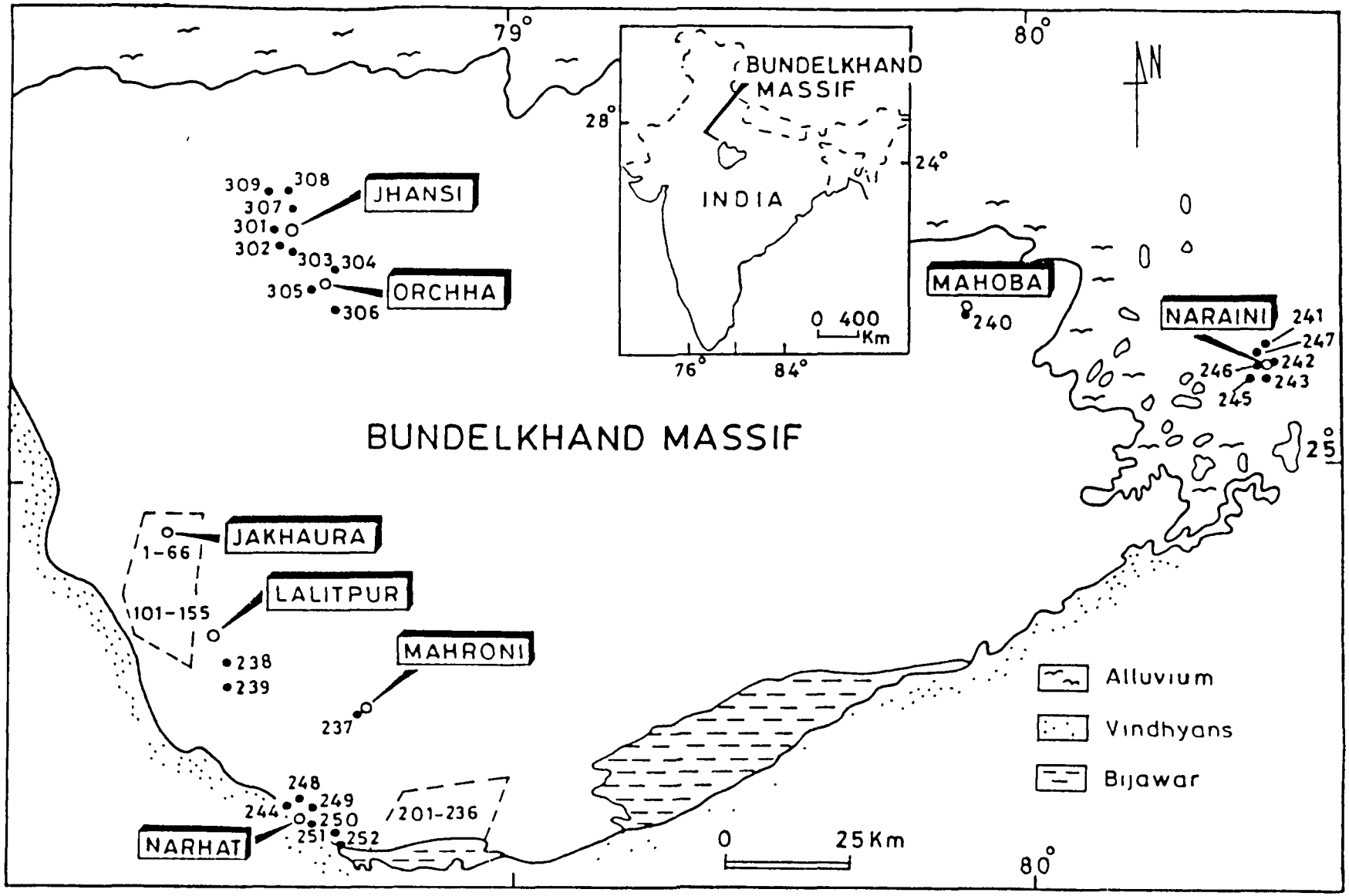

Fig. 1 Geological map of Bundelkhand region (G S I , 1977) Numbers indicate location of samples

collision-related magmatism. The inference is based on the geochemical characteristics of the granitoids in parts of Hamirpur district in the northeastern portion of the massif.

The present work is aimed to understand the nature of the granitoids and the tectonic evolution of the massif. Since the geochemical signatures of the granitoids indicate a subduction-related magmatism, studies have also been undertaken to correlate the geochemistry of spatially distributed granitoids with a view to understand the arc maturity trends. This work also takes into account the mafic magmatic enclaves which are very widespread within the massif. Nature and possible origin of these enclaves have also been studied.

Geography of the Area

The Bundelkhand massif is encompassed approximately between 24°30' N and 26° N latitudes and 77°30' E and 81°E longitudes. It occupies a large area in central India covering parts of Uttar Pradesh and Madhya Pradesh.

Rolling plains with numerous hillocks and elongated quartz ridges dominate the topography of the region. The quartz veins stand out prominently and comprise the most spectacular landmark, running at some places for several kilometres. The outcrop density of the region is low (less than 20%). The isolated hillocks are separated by vast soil cover.

Most of the study areas are accessible by motorable roads. Important towns are connected by metalled roads. Central Railway Main line and National High Way No. 26 pass through the area. The climate is semi-arid; the vegetation is sparse and mostly xerophytic. The region is drained by a number of streams; Betwa, Jamini, Dhasan and Ken rivers constitute the major drainage systems. The rivers flow in the N-S direction.

Scope of the Work

In the course of study, a total area of about 225 sq km was geologically mapped in detail on 1:20, 000 scale. The area mapped is bounded approximately between latitudes 24°45' N to 25° N and 78°15'E to 78°25' E longitudes and lies in between Jhansi and Lalitpur towns. Other parts of the massif were also studied during the field surveys from 1991-1994; the areas include Jhansi, Orchha, Jakhaura, Lalitpur, Mahroni, Narhat, Girar, Madaura, Sonrai, Mahoba and Naraini (Fig. 1). Survey of India quadrangle topographical sheets (First edition surveyed during 1971-1972) were used as base map for field investigations and geological mapping.

The following aspects constitute the scope of this work :

- geological mapping of selected areas
- delineation of genetically different granitoid phases from field observations
- establishing the sequence of major magmatic episodes
- nature and composition of pre-granitoid basement components
- to study the spatial changes across the massif
- collection of samples which include different granitoid phases, basic dykes and mafic magmatic enclaves

- modal and textural studies of the samples on thin sections
- geochemical analyses of major and trace elements including rare earth elements of whole rock samples of different granitoids and mafic magmatic enclaves
- petrogenesis of the host granitoids and the mafic magmatic enclaves
- elucidating a comprehensive tectonic model for the evolution of the massif.

Previous Research

Early workers (Misra, 1948) drew attention to the petrological diversities of Bundelkhand granites. Later, Misra and Sharma (1974), on the bases of modal analyses and major element geochemistry, observed that there were large compositional variations within the granites; the two main types being K-rich and K-poor granite. Mathur (1954) and Saxena (1956) observed the presence of quartzite enclaves in the granites and inferred that the granites have formed by granitization of quartzites. Misra and Sharma (1975) reported the occurrence of quartzites, limestones, syenites, carbonatites and keratophyres in the Bundelkhand region. The petrological evolution of the massif was studied by Saxena (1961); he correlated Bundelkhand granites with Closepet granite and suggested a metasomatic origin of the granites in Bundelkhand region.

Sharma (1983) opined that movements along the tectonic zone of Son-Narmada lineament may have some important bearing on the evolution of the massif. Das et al. (1982), on the basis of the positive correlation of K_2O vs. Al_2O_3 in the Bundelkhand granites, proposed an igneous origin of the granites. Magmatic origin of the granites is also proposed by Alam and Zainuddin (1981).

Jhingran (1958) distinguished ten types of granites on the bases of grain size, colour of feldspars and presence or absence of ferromagnesian minerals. Saha (1979) opined that the massif is a composite body consisting of several granitic and gneissic phases of adamellitic-monzonitic compositon. Three main episodes of granitic activity have been deciphered by Basu (1986); these are porphyritic coarse grained granite, porphyritic medium grained granite and non-porphyritic to sparsely porphyritic medium to fine grained leucogranite.

Sarkar et al. (1969), by dating hornblende and biotite minerals using K-Ar technique, suggested that granitization came to an end during 2500 to 2400 Ma. Crawford (1970) assigned an errorchron age of the massif as 2500 Ma by Rb-Sr total rock dating methods. Sarkar et al (1984) reported the whole rock Rb-Sr isochron age of 2359 $\pm$ 53 to 2246 $\pm$ 78 Ma for different granitic phases of the massif.