CHAPTER- 2

THE ARCHAEOAN BUNDELKHAND CRATON
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2.1 INTRODUCTION

The ABC is one of the four Archaean cratons (Aravalli, Bundelkhand, Dharwar and Singhbhum) in the Indian peninsular shield and occupies nearly 29,000 sq km as a cup-shaped outcrop in parts of the Central Indian Shield. The craton is bounded by the Gangetic alluvium (Quaternary age) to its north and the Vindhyan Supergroup of sediments (up to ~1700 M. y.) on all other sides. It comprises metasupracrutals (gneisses of tonalite-trondhjemite-granodiorite (TTG) affinity, amphibolites, iron ±manganese- rich high grade metasediments (Pati, 2000), rare marble, calc-silicate rocks and quartzite, at least five phases of compositionally different felsic intrusives, felsic volcanics, giant quartz veins of hydrothermal origin and basic intrusives of mainly tholeiitic affinity. Some of the TTG rocks of 3.5 Ga (Sarkar et al., 1995) to 3.3 Ga (Mondal et al., 2003) age have been reported based on Rb-Sr and single crystal zircon dating by $^{207}\text{Pb}/^{206}\text{Pb}$ systematics, respectively. After the emplacement of granitoids in the Bundelkhand, the Bundelkhand granite-gneiss complex (BGGC) experienced another important tectonomagnetic event in the form of mafic dyke swarms (Mondal and Zainuddin, 1996, 1997). Ion microprobe $^{207}\text{Pb}/^{206}\text{Pb}$ data of zircons of a metabasic enclave of Bundelkhand have yielded an age of 3249±5 Ma (Mondal et al., 2002). The geochronological data on various felsic intrusives tightly constrain their emplacement ages between 2.2 and 2.5 Ga (Crawford, 1970; Sarkar et al., 1990; Mondal et al., 1998; Mondal et al., 2003). Mineral ages of muscovite obtained from pyrophyllite and giant quartz veins suggest that the duration of hydrothermal activity was between 1480 ± 35 Ma and 2010 ± 80 Ma (Pati et al., 1997). The mafic dyke rocks (2000 ï 2150 Ma; Rao et al., 2005) represent the youngest magmatic activity in the Bundelkhand craton (Fig. 2.1.). The cover of sediments belonging to the Vindhyan Supergroup of rocks (1721 ± 90 ï 650 Ma; Ray, 2006) overlie these granitoids. The supracrustals are
Figure 2.1: Spatial deposition of giant quartz veins and cross-cutting mafic dykes within the Archaean Bundelkhand craton.
Modified after Basu (1986)
metamorphosed between greenschist and upper amphibolite/ (granulites?) facies (Pati, 2000).

Studies pertaining to structure and tectonics are rare; only from few selected areas which are physically and spatially unrelated domains (Sharma, 1982; Roday et al. 1995; Prasad et al., 1999). In all five phases of deformation have been reported (Sharma, 1982; Prasad et al., 1999). For the first time, Senthiaappan (1976 and 1981) showed the presence of a ~E-W trending crustal scale shear zone and named it as Raksa Shear Zone. The presence of a nearly E-W trending crustal scale shear zone extending all along the Bundelkhand craton along 25°15′ latitude has been revealed by recent studies (Pati, 1999; Malviya et al., 2006; Pati et al., 2000) based on field and remote sensing data. The map of the Indian shield showing epicenters of historical as well as instrumentally recorded earthquakes (Sukhija, et al. 2000) reveals that a number of earthquakes of magnitude between 4.5 and 6 have been observed along 29° latitude. Mineralization is only confined by pyrophyllite-diaspore deposits associated with giant quartz veins (Sharma, 1986) and incidences of shear zone hosted gold (Pati et al., 1997), molybdenite mineralization with gold (Pati et al., 1997) and some other base metals in traces are also reported. The southern part of the Lalitpur district, U. P. has a strategic resource of commercial grade dimension stones.

Diapiric rise of granitic masses might be pre-tectonic, syntectonic and post-tectonic with reference to the deformation observed in the supracrustal rocks. This phenomenon is also applicable in case of later intrusive ultramafic and ultrabasic bodies around Girar and Madawra area. These in Precambrian terrains generally have an affinity to the lithostratigraphy of greenstone belt sequences. They have been categorized as ketatectonic, mesotectonic and epitectonic by Buddington (1959) more or less synonymous with the term syn-orogenic, ser-synorogenic and post orogenic respectively, used by Stephanssen (1974) and Stephanssen and Johason (1976).

The Bundelkhand craton is considered to have stabilized at about 2.5 Ga and due to ongoing crustal movements, giant quartz veins possibly of
hydrothermal origin (Pati et al., 2007) and mafic magmatism in the form of
dolerite dykes of tholeiitic affinity have occupied north-easterly and north-westerly
fractures, respectively. These linear structures are observed to extend over tens
of kilometres at places. Invariably, the mafic dykes are found to cut across the
giant quartz veins and granitoid variants. Hence, the giant quartz veins and basic
dykes can not be treated as conjugate fractures. The supracrustals, felsic
intrusives and giant quartz veins are deformed as compared to the undeformed
mafic dyke rocks.

The ABC is predominantly composed of granitoids and related felsic
rocks. The mafic-ultramafic rocks are rare and are exposed as linear slivers in
the central part of the craton (between Dhala in the West to Kabrai in the East)
associated with the Bundelkhand Tectonic Zone (BTZ; Pati 1999) and the
remaining outcrops are found at the southern margin of the ABC (Fig. 1.2.b.).