Chapter 1. Introduction

1.1 General

The Champaner Group, previously referred to as "Champaner Series" (Blanford, 1869) of western India, is believed to be a part of the upper Aravalli supracrustal rocks and is exposed at the eastern most fringe of Gujarat, India (Fig. 1.1.a). The Champaner Group is geographically located at the southern-most part of the Aravalli Mountain Belt (AMB) and is considered as a major Proterozoic stratigraphic unit of the Southern Aravalli Mountain Belt (SAMB) in Gujarat (Fig. 1.1.b). Being isolated, small yet time-worn, the Champaner Group did not receive substantial attention and remained un-investigated for nearly five decades. As in the case of the lower Aravallis, majority of the Groups were studied in great detail by several workers due to their structure and associated mineralization, the Champaner Group came into the limelight on account of its manganese deposits, based on which it was correlated with the Dharwar rocks of the South India (Fermor, 1909). Thereafter, most of the work was carried out to revise the stratigraphic status of the Champaner Group with respect to the Aravalli rocks of Rajasthan and Delhi rocks of the north-eastern Gujarat (Heron, 1917; Rama Rao, 1931; Gupta and Mukherjee, 1938; Gopinath et al., 1977).Jambusaria (1970) gave a detailed outline of rocks exposed at Shivrajpur and surrounding regions in terms of stratigraphy, structure and metamorphism. However, other parts of the Champaner Group were beyond the scope of Jambusaria's study. The geological and structural maps prepared by the earlier workers extensively highlight that the deformation pattern of the Champaner Group is quite simple and faintly modified by the post acidic intrusive surrounding it. The same reason proved as a stronger quote to substantiate the idea of placing the Champaners over Delhi supracrustals, due to its unmatched structural disposition with the Aravallis (Roy, 1988). Although the work carried out by Karanth and Das (2000) and Das (2003) on the Pre-Champaner Gneissic Complex (PCGC) and neighbouring Lunavada Group (Mamtani, 1998) in extremity to the main Champaner domain have profoundly explained the structural complexity within these rocks. It is therefore surprising that the Champaner Group, though a part of the Aravalli Mountain Belt (AMB), escaped delineation of

complex deformation pattern, unlike the case of neighbouring Proterozoic supracrustals. Therefore, it will not be an exaggeration to state that there lies a lacuna in understanding the structural setup pertaining to the Champaner Group as a whole. Moreover, the true surface and subsurface extension of these rocks till date remains unravelled.

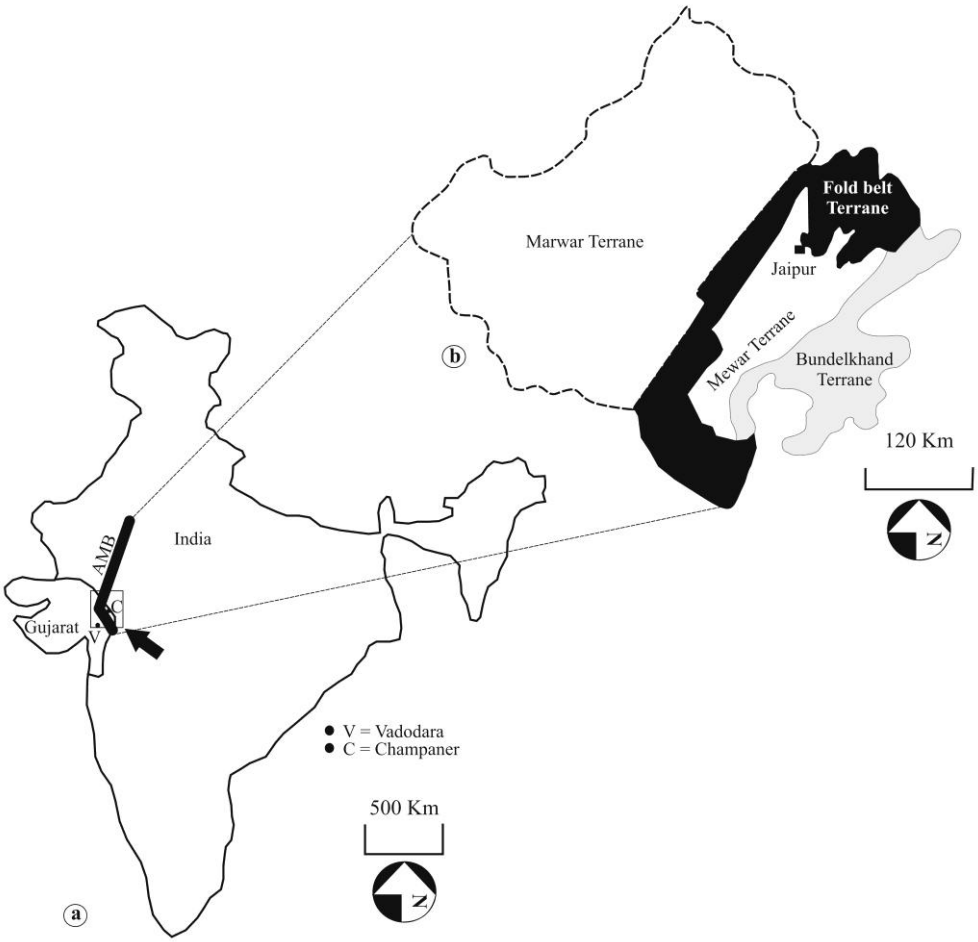

Figure 1.1: (a) Location map of the study area. (b) Major crustal terranes of NW India; (modified after Sinha-Roy, 2000).

1.2 Topography

The topography of the study area is undulating in nature. The area is characterised by linear, 'S' shaped, 'C' shaped and 'V' shaped ridges having more or less flat tops alternating with narrow valleys reflecting lithological variations of the constituent rocks. The eastern part of the study area comprises a flat topography with occasional low to medium elevated circular mounds. The extreme western and southern part of the study area has by and large similar topography, except at the north-western part where high elevated circular mound with flat top resembling a plateau like feature exists

at Pavagadh. The core central portion of the study area holds varieties of ridges shape, starting from west and the elevation gradually increases progressing towards the east. Initially the ridges attend broad ‘S’ shaped pattern and often found to be bounded by linear ridges on either side. Advancing towards east the ridges acquire compressed ‘C’ shaped pattern followed by ‘V’ shaped at the middle portion of the study area. There also exist few domal features at the eastern and north-eastern end of the study area at Narukot and Poyeli region. The domes are elliptical in shape and the size of its long axis increases toward the northern part. The area encompasses eroded peneplain surfaces at the south-eastern part of the Champaner region and can be very well appreciated through Shuttle Radar Topography Mission (SRTM) derived shaded relief map (Fig. 1.2). The alternating valleys between the ridges are mainly occupied by softer rocks like phyllites and slates, prone to be eroded faster and buried under soil cover, whereas the quartzites and granites stand as high ridges and mounds respectively, due to its surpassing hardness. The highest bench mark situated at the southern part of the study area recorded is 354 mt, which comprises of quartzites.

1.3 Communication

The study area is approachable by both road and railways (Fig. 1.3). The nearest airport is The Maharaja Sayajirao Gaekwad (MSG) International Airport, Vadodara. The most convenient way to visit study area is by roadways. The state highway number 87 from Vadodara to Nurpura (~ having trend NE-SW) reaches the study area. Further, the SH 87 meets SH 194 and has direct connection to Halol town. The Champaner region lies east of Halol town and has a superior accessibility through SH 5. The trend of SH 5 is more or less NW-SE and attends almost N-S trend after Jambughoda village. The peculiarity of SH 5 is that the exposures of all representative rocks belonging to each formations of the Champaner Group are seen on either side of the road. Moreover, the study area has excellent connectivity through internal roads. The area has rail connectivity through Vadodara-Godhra-Delhi (broad gauge). The nearest railway station to the study area is Champaner Road Junction near Khakhariya village. State Highway 150 connects the railway station and leads towards Halol town. SH 5 join the Halol which further guides towards the Champaner

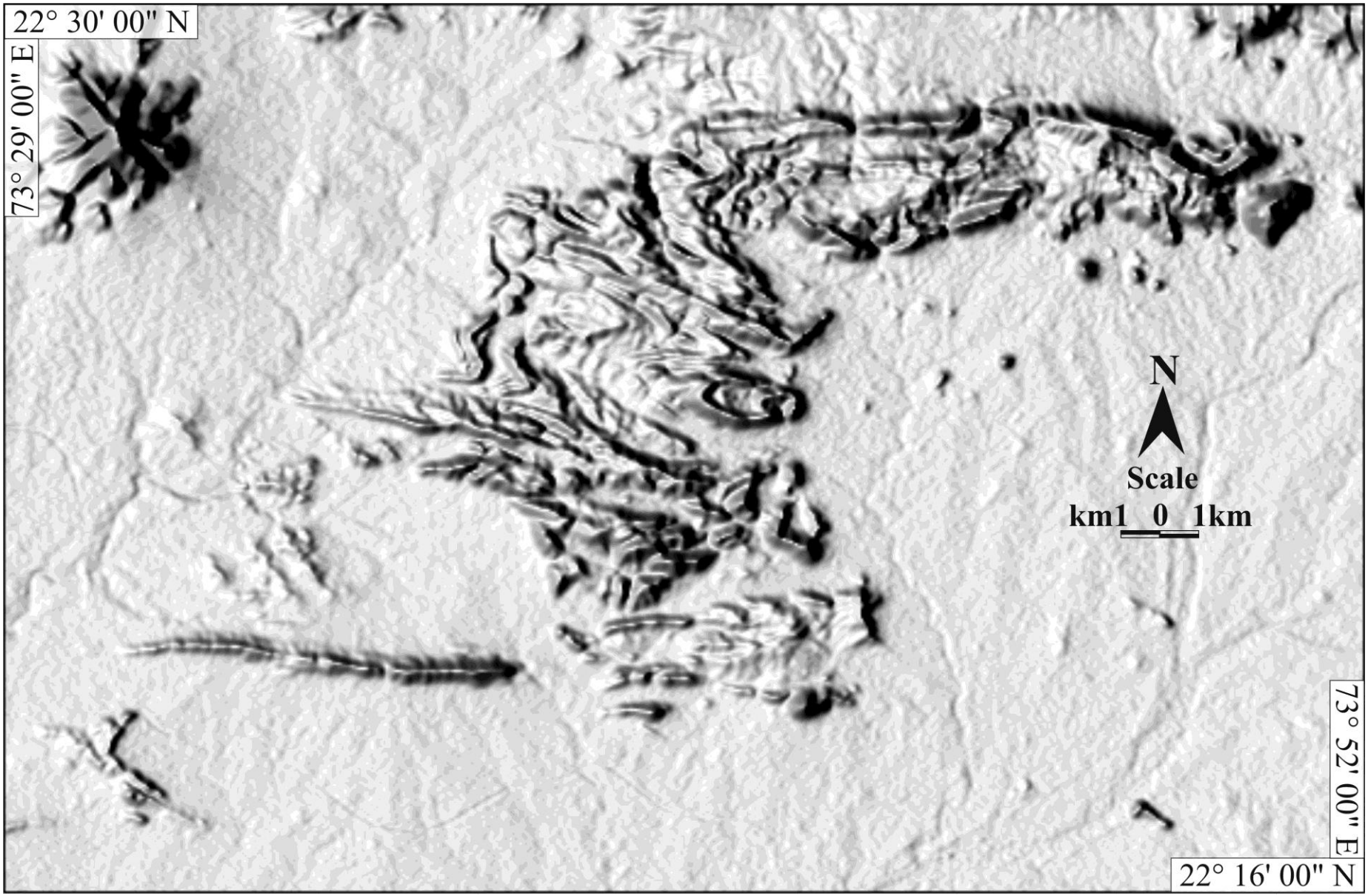

Figure 1.2: Shuttle Radar Topography Mission (SRTM) derived shaded relief map of the Champaner region. Source: USGS Earth-explorer.

region. Cellular network is quite poor within the study area. As SH 5 passes through the intermontane valley region there creates a shadow zone along this specific track. Nevertheless, few networks such as Airtel and Vodafone have connectivity at higher elevations. Emergency medical facility is available only at Alpha Healing Centre near Don Bosco School, Narukot or at Halol.

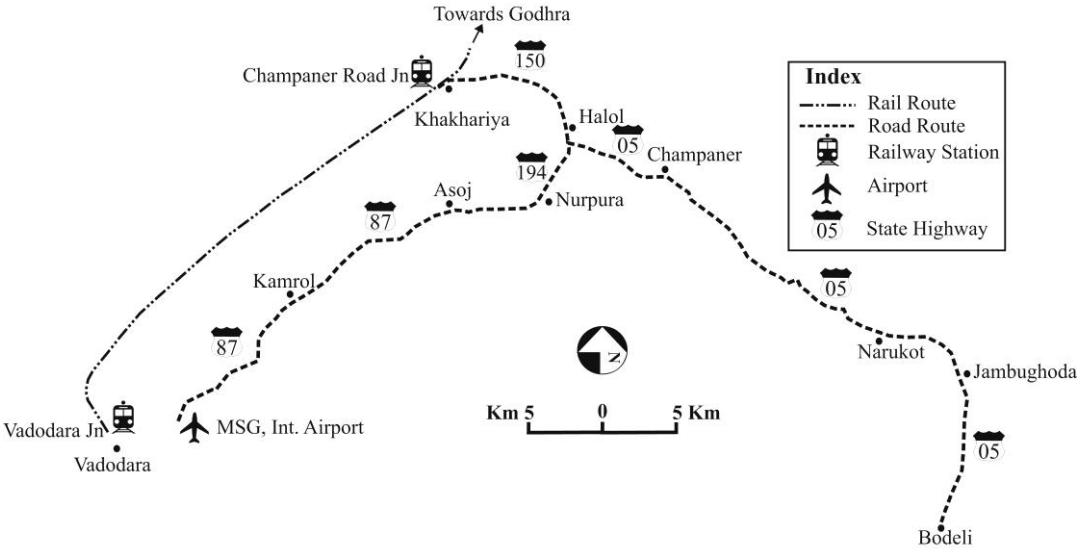

Figure 1.3: Communication map of the study area.

1.4 Research Objectives

1. To decipher the surface deformational history of the Pre-Cambrian rocks of the Champaner Group.
2. To appreciate the micro-scale derivatives of deformation.
3. To establish the time relationship between deformation and metamorphism of meta-sedimentary rocks of the Champaner Group.
4. To address the surface and sub-surface structural complexity of the Champaner Group.
5. To understand the role of Godhra granite in defining the structural framework of the Champaner Group.
6. To determine the tectonic setting of granite emplacement in response to the existing deformation.

1.5 Methodology

1. Detailed field work was carried out in order to record the planar and linear structural elements preserved within the rocks of the study area.

2. Anisotropy of Magnetic Susceptibility (AMS) of mono-mineralic and/or non-foliated rocks was carried out to understand the orientation of the magnetic foliation.

3. Microstructural analyses were carried out to understand micro-scale deformation and to establish time relationship between deformation and metamorphic crystallization.

4. Microtermor technique was applied in order to decode the depth, sub-surface extension and the structural complexity of the Mn-bearing meta-sedimentary rocks of the Champaner Group.

5. Granite samples were geo-chemically analyzed in order to understand the tectonic setting of the emplacement.

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