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Nature and time of emplacement of a pegmatoidal granite within the Delhi Fold Belt near Bayalan, Rajasthan, India

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The study area is situated about 70 km south east of Ajmer, in Rajasthan, India around the village Bayala (26o 02' 19 N"; 74o 21' 01") within the Ajmer district of Central Rajasthan. The area is along the eastern flank of the central portion of the Precambrian South Delhi Fold Belt (SDFB) and it stratigraphically belongs to the Bhim Group of rocks. Basement rocks of Archaean age, commonly known as the Banded gneissic Complex (BGC), is exposed to the east, where the rocks of the Bhim Group rests unconformably over BGC. To the west gneissic basement rocks of mid-Proterozoic times underlie the Bhim Group and have been referred to as the Beawar gneiss (BG). The Bhim Group of rocks comprises of metamorphosed marls and calc-silicate gneisses with minor amounts of quartzites and pelitic schists, indicative of its shallow marine origin.

Within the Bhim Group, a pegmatoidal granite has intruded the calc silicate gneisses of the area. The pegmatoidal granite body is elliptical in outline with the long dimension(20 km) trending N-S and covers an area of 300 sq. km. approximately. This granite have so far been mapped as basement rocks (BG) surrounding the Beawar town (26o 06' 05" N; 74o 19' 03" E), 50 km south east of Ajmer. Rafts of calc-silicate gneisses, belonging to the Bhim Group, are seen to be entrapped within granite. Fragments of BG and its equivalents have also been found as caught up blocks within this pegmatoidal granite body near Andheri Devari, a small hamlet east of Beawar.

The objective of the study was to map this pegmatoidal body, and decipher the mechanism and time of emplacement of this granite.

A detailed structural mapping of the area in a 1:20000 scale spread over a 30 sq. km area in the vicinity of Bayala was carried out to analyse the geometry and the time of emplacement of the pegmatitic granite. The ridges of calc silicates and marbles adjoining the area were studied for the structural analyses of the Delhi fold belt rocks of the area.

The calc silicate gneisses of the Bhim Group have been deformed by three major phases of folding, namely D1, D2 and D3. Of these the D1 folds defined by transposed compositional layering are intrafolial and isoclinal in nature. The D2 folds are asymmetric with alternate steeply and gently easterly dipping limbs and are defined by compositional banding and schistosity (S1). A good compositional layering parallel to the S2 fabric has been observed within the calc silicate gneisses. The D2 folds are close to tight, gently plunging with a modal plunge of 20o towards 40o; and has an inclined axial plane which has an easterly vergence. This is the most dominant phase of deformation. The D3 folds have developed on the gentle limbs of the D2 folds with a horizontal axis on a vertical axial plane. Interference of the D1 with D2 and D1 with D3 has produced Type III type of interference pattern.

The pegmatitic granite body is a coarse grained rock composed of quartz feldspar (dominantly K-feldspar), muscovite, biotite, and tourmaline. A weak foliation has developed within this rock which is parallel to the D3 axial planar structure found within the calc silicate gneisses. Thus from the structural study it is proposed that the pegmatitic granite was emplaced post-D2 and possibly syn D3.

The presence of narrow planar zones of hornfelsic rocks parallel to the D3 axial plane within the calc silicate rocks also attests to the above fact. Therefore the D3 axial planes provided the necessary conduits of the granite fluid movement within the calcsilicate rocks. The intrusions have scaled off the calc silicate gneisses into large continuous pieces along the gneissosity plane and got emplaced along the hinges of the D2 and D3 folds. Though disturbed, it has been seen that the orientation of the structural elements within these ripped off blocks of the calc silicate gneisses were quite similar to those found within the ridges, unaffected by the granite. The granites were thus emplaced lit-par-lit in the country rocks and on their contact with the calc gneisses shows hornfelsic textures

within the calcsilicates (Tremolite-actinolite schists).
It is thought of that this pegmatoidal granite has a bearing in age with the wide scale granite activity seen within this region. The structural study shows that this pegmatitic granite was emplaced synchronous to the D3 deformation episode which is the last major recognizable deformation within the Delhi Orogeny. Therefore this pegmatitic granite marks the closing stages of the Delhi Orogeny. Combined with the 1 Ga age of the formation of crust, in the western segment of the Delhi basin, a proper dating of this granite could give us the exact time span of the delhi orogenic cycle.