Detailed structural studies have been undertaken on the eastern flank of the Anasagar gneiss and only reconnaissance work has been undertaken on the western flank.

3.1 Sedimentary Structures

3.1.1 Cross-bedding:

Cross stratification is quite common within the quartzite exposures on the Taragarh Fort ridge, near Makarwali and Kankariya Hill. The cross bedding is of both wedge shaped and trough type. (Fig. 3.1 a&b, 3.2 a&b&c, 3.3, 3.4). In some places, the foreset laminae are penecontemporaneously folded, due to sliding of the upper bed. Herringbone cross lamination is also present at some places. Cross stratification observed at different localities indicates normal sequence with easterly direction of younging away from the granite gneiss. On the overturned limbs of D2 folds, where the dip is steep westerly, the cross beds still indicate easterly younging.

3.1.2 Ripple marks:

Ripple marks are observed on the ridge south of Adhaidin-ka-jhonpara, on the ridges south of Taragarh Fort ridge, on 680 metres peak near Shastrinagar and the main ridge north of Kankariya. Some are of symmetrical oscillation type with sharp crests and rounded troughs; branching of axes of wave ripples is common (Fig. 3.5); linguoid ripples are seen locally (Fig. 3.6). Asymmetric current ripples are rarely observed.

The occurrences of ripple marks and cross stratification indicate a shallow water environment of deposition of the arenaceous sequence.

3.2 Structural elements:

3.2.1 Planar structure:

3.2.1.1 Bedding:

Bedding is easily recognizable in quartzite and quartz mica schist (Plate – 4A, 4B, 4C, 4D). In quartzite it is marked by compositional and colour variation. Most of the quartzites have thin micaceous laminae separating...
arenaceous bands. At places colour bands with thickness of the order of a few centimetres are present in the quartzite.

In some massive quartzites, bedding is difficult to recognize, and often the rocks are fractured with several sets of joint planes, which adds to the difficulty of identifying bedding.

In semipelitic schists, bedding is identified by alternate micaceous and siliceous layers. Bedding is less conspicuous in mica schists. In biotite-garnet-schist, biotite rich and garnet rich bands may represent original compositional layering, or metamorphic differentiation.

3.2.1.2 Schistosity:

Schistosity is well developed in mica schist, semipelitic schist and amphibolite (Plate 4A, 4B, 4C, 4D). It is defined by parallel alignment of mica flakes or amphibole blades. Fine streaks of feldspathic material parallel to the preferentially oriented amphibole grains highlight the schistosity in the fine-grained variety of amphibolite, found along the granite gneiss – supracrustal contact.

In garnetiferous quartz–biotite schist, the schistosity has an anastomosing pattern, with mica flakes swerving around the lenticular quartzose domains, and idioblastic to subidioblastic garnet porphyroblasts. (Fig 3.7 a, b).

In micaceous quartzite and quartzose schists, the schistosity is defined by parallel orientation of muscovite flakes and/or biotite flakes. The schistosity is in general parallel to the bedding in quartzite and quartz and feldspar grains are somewhat elongated parallel to the schistosity. Elongate garnet crystals with perpendicular extension cracks are found at places (Fig 4.68).

In quartzites, the mica flakes in thin micaceous laminae are parallel to the bedding except in the hinges of isoclinal folds where they are aligned parallel to the axial planes (Fig 3.8). In the quartzose bands on the other hand, a spaced cleavage (Powell, 1979) is observed at many places, which is oblique to the bedding parallel schistosity in the micaceous laminae. This spaced cleavage is defined by slender mica flakes, which show a wavy anastomosing pattern. This oblique cleavage is parallel to the axial planes of folds, which are generally asymmetrical and which have folded the bedding.
parallel schistosity. Hence, this is later than the schistosity observed in mica schists and is correlated with the crenulation cleavage observed in the latter. The difference in the nature of the planar fabric reflects the difference in response of the two compositional layers during $D_2$ deformation. The presence of a strong layer parallel anisotropy in the micaceous laminae favoured flexural slip and crenulation of the earlier fabric. In the quartzose bands the same compressive strain produced a spaced planar fabric by rotation of preexisting individual flakes (March, 1932, Hobbs, Means and Williams, 1976, p. 122, 247) probably accompanied by nucleation of new micas with a preferred orientation.

At a few places within the micaceous quartzite, a secondary compositional banding, defined by alternate quartzose bands and thin micaceous laminae, is developed at a small angle to the bedding (Fig. 3.63, 3.64, 3.65). This secondary banding at places becomes asymptotically parallel to the bedding parallel schistosity in the micaceous laminae (Fig 3.9). This secondary banding is a metamorphic differentiation structure and is interpreted to be a differentiated crenulation cleavage that developed in the rock during the first stage of the deformation and at a low metamorphic grade. The original bedding parallel depositional / diagenetic fabric was crenulated and quartzose and micaceous domains developed, parallel to the axial planes of the crenulations. The metamorphic grade was low and fluid rich environment probably helped in creating these compositional domains (Gray, 1977). The difference in orientation between this fabric in quartz rich layers and the bedding parallel schistosity in mica rich layers is a result of refraction. It is suggested that there was regular alternation of the limbs and hinges in the asymmetric crenulations and pressure solution process led to enrichment of the fold limbs in “insoluble” phyllosilicate minerals and depletion in soluble components such as quartz and calcite. Subsequent metamorphic recrystallisation obliterated the earlier crenulated fabric and only the axial planar compositional banding is now visible. This type of secondary compositional banding has been described as tectonically formed striping by Ramsay and Huber (1987, 439p).
3.2.1.3 **Gneissosity:**

Gneissosity is developed in granite gneiss and migmatised micaceous gneiss (Plate 4A, 4B, 4C, 4D) and is defined by alternation of quartzofeldspathic and micaceous bands. The gneissosity in granite gneiss has an anastomosing pattern with biotitic folia curving round lenticular quartzofeldspathic domains. The presences of micro cracks within these rocks indicate elongation parallel to foliation. Gneissic banding is also observed in some amphibolites, with alternate dark and light coloured bands. The K-Feldspar megacrysts exhibit variable relation to the gneissosity (Fig 3.10 a&b, 3.11):

(a) Nearly euhedral megacrysts athwart to the gneissosity are observed at several places. These truncate the gneissosity and appear to have grown after the formation of the latter (Fig 3.12). Some megacrysts have several internal biotitic septa parallel to the megacryst outline and demarcate different growth stages. (Fig 3.13)

(b) At places euhedral/subhedral rectangular K–Feldspar megacrysts are aligned parallel to the gneissosity. This is interpreted to be a magmatic fabric produced by the flowage of magma as a crystal mush. (Fig 3.14, 3.15). The fabric may be accentuated by post crystallisation deformation.

(c) Some megacrysts are deformed and recrystallised to rounded, elliptical/or lenticular granular aggregates parallel to gneissosity imparting an augen texture to the rock. The gneissosity is seen to wrap round the augen. The biotite flakes of the internal septa within the deformed megacrysts mentioned above are realigned during deformation to an orientation parallel to the external gneissosity. (Fig 3.16). A number of megacrysts are stretched and boudinaged. (Fig 3.17, 3.18, 3.19). At places, the biotitic laminae in the matrix are seen to penetrate into the deformed and elongated K-feldspar aggregates (Fig 3.20)

(d) Recrystallised “tails” against some deformed megacrysts are also observed. Flattening perpendicular to gneissosity has produced symmetrical tails against the megacrysts. (Fig 3.10b, 3.11, 3.21, 3.23). In rare instances shearing along the gneissosity surface has produced the asymmetric sigmoidal tails against the deformed megacrysts. (Fig 3.10b, 3.11, 3.22, 3.24).
At several places close to the contact with the supracrustal rocks, for example, near Christianganj and in the ridge east of Lohagal, the megacrysts are deformed to thin, elongated, granular aggregates and the rock becomes a finely banded gneiss. (Fig 3.25, 3.26).

From the features described above it is concluded that gneissosity is in part a primary fabric formed during emplacement of the magma as a crystal mush and it was accentuated during later deformation, involving flattening perpendicular to it and shearing along gneissosity. Most of the megacrysts, even those retaining the euhedral outline are recrystallised to aggregates of small crystals during deformation and metamorphism.

Aplitic veins within granite gneiss are observed cross cutting the gneissosity (Fig 3.25). At places an incipient foliation is observed within the aplite and this is parallel to the gneissosity in the coarse grained granite gneiss.

3.2.1.4 Axial planes of minor folds and crenulation cleavage:

Minor folds of different generation are observed in the different rock types and the orientations of their axial planes have been measured. In mica schist and quartz mica schist and also in mica rich layers within quartzite (Fig. 3.27, 3.29, 3.30) a crenulation cleavage has developed parallel to the axial planes of small scale folds on bedding parallel schistosity. In some mica schists the crenulation cleavage is so intensely developed, that it has the appearance of a schistosity, and the earlier fabric is almost totally transposed. (Fig. 3.31) As mentioned earlier, at many places, thin micaceous laminae in quartzites, show a crenulation cleavage, while in the quartzose layers, a spaced cleavage is developed parallel to the crenulation cleavage (Fig. 3.28). In the finely banded granite gneiss found along the contact has also developed a crenulation cleavage axial planar to minor corrugations on the gneissosity is observed.

3.2.2 Linear structures:

3.2.2.1 Mineral and striping lineation:

Mineral lineation is a prominent feature in all the lithological units (Plate 5A, 5B, 5C, 5D). In general the lineation has a low plunge.
In quartzites and mica schists the lineation is defined by parallel orientation of elongated mica flakes and micaceous streaks. At places parallel orientation of tourmaline needles has been noted. Aggregates of quartz – sillimanite are common on the bedding surface of quartzites at certain localities and these aggregates are sometimes elongated to give rise to a lineation.

At Parswanath colony, Baldevnagar and in areas west of Christianganj road near the Anasagar Lake, alignment of elongated streaks of feldspathic material and biotite streaks define a lineation on the gneissosity surface.

Striping lineation is defined by bands of different colours seen on gneissosity plane, produced due to elongation of streaks having different compositions.

In amphibolite parallely aligned amphibole needles and feldspathic streaks define a strong lineation.

All these lineations are parallel to the fold axes.

### 3.2.2 Fold axis lineation:

Minor folds are present within quartzite, mica schist, semipelitic schist and granite gneiss. Their axes generally have a low plunge.

At a few localities the folds die in the direction of plunge of the axis (Fig. 3.32). At places the fold axes are doubly plunging (Fig 3.33) and neighbouring fold axes may show an en echelon arrangement (Campbell, 1958, Mendelsohn, 1959).

Ribbing lineations common in the massive quartzites are small-scale fold mullions. They are commonly developed at the interface of quartzite and mica schist and result from strong competency difference (Ramsay 1967, 386p).

### 3.2.2.3 Pucker axis lineation:

Pucker axes are very distinct in mica schist, finely foliated granite gneiss and mica rich schistose bands in quartzite. Several sets of puckers have been observed in many areas, the older pucker axes being bent by the later set (Fig. 3.34 a, b). The dominant set has low (3° – 10°) plunge.
3.2.2.4 **Intersection Lineation:**

Schistosity-bedding and cleavage-bedding intersection lineation is found in quartzite. Intersection mullions are produced in psammitic rocks due to intersection of spaced cleavage with bedding. When thin micaceous laminae defining schistosity intersect the bedding at low angle, differential weathering produces a structure, which may be confused with asymmetric ripples. In some quartzite, intersection of variously oriented mica flakes, resulting from later folding of an earlier fabric, produces a lineation which may sometimes be confused with mineral lineation (Fig. 3.35, 4.59).

3.2.2.5 **Pebble elongation lineation:**

Parallelism of long axis of ellipsoidal quartz pebbles in the pebbly horizons of quartzite defines the elongation lineation (Fig. 3.36). This is in general low plunging, parallel to mineral and fold axis lineation. The pebbles have in general prolate ellipsoidal shape and the elongation is parallel to the fold axes.

Elongation of pressure shadows around garnet porphyroblasts define a crude lineation in some micaceous schists.

3.3 **Minor folds:**

A large variety of minor folds are present in the area. They are most prominent in the banded quartzites. The minor folds belong to different sets and are formed during different episodes of deformation.

3.3.1 **Isoclinal folds:**

Small scale isoclinal folds ($D_1$) are found sporadically in quartzites near Taragarh, west of Shastrinagar (Fig. 3.37) and on the northwestern and southeastern slopes of the main ridge system east of Lohagal (Fig. 3.39) in the eastern part of the map. These folds have an axial planar schistosity, which is in general parallel to the banding, except in the hinge region. The schistosity is puckered by later folding (Fig. 3.38, 3.40a, 3.40b). The isoclinal folds are long limbed; sense of vergence is generally not decipherable, though at places distinct S, Z, M shapes are found. At places these folds appear as
rootless folds of quartzose bands in mica schists (Fig. 3.41), due to disruption of the bands.

3.3.2 Asymmetrical inclined folds:

The second set of folds ($D_2$) is the commonest one observed in the area. These are typically asymmetrical, at places overturned, with short steep limbs and long gentle, often horizontal, limbs. These folds are generally close to tight. There are small scale folds as well as folds of mappable dimension (Fig. 3.42, 3.43, 3.44a&b). Such folds have folded the bedding and schistosity in the supracrustal rocks and the gneissosity in the Anasagar gneiss. A crenulation cleavage is developed parallel to the axial planes of these folds. This is conspicuous in the more micaceous layers. Axial planes of these folds are generally westerly dipping but the amount of dip is variable from moderately steep to nearly horizontal. Variation of dips of the axial planes, within a short distance, even within a small exposure is observed. The folds are in general 'S' shaped (sinistral) in section looking from north (Fig. 3.45a&b, 3.46, 3.47). Small scale dextral folds, with inclined or horizontal axial planes are present on the steep or overturned limbs (Fig. 3.48, 3.49, 3.50a&b). Fanning of axial plane cleavage is observed at places. At places the short limbs are stretched and disrupted (Fig. 3.47).

In quartzites with thin intercalations of micaceous layers, the fold form differs in layers of different competency (Fig. 3.55, 3.51a). The competent quartzite layers show class 1B (parallel) to class 1C geometry, while the incompetent layers (mica rich) show class 2 (similar) or class 3 geometry (Ramsay, 1967). The quartzose layers show larger wavelength folds while the thinner mica rich layers are finely crenulated (Fig. 3.51b). The features suggest that the folds have been formed due to buckling, but are modified by flattening.

$D_1$ and $D_2$ fold axes are mostly subparallel. At places due to low angle between $D_1$ and $D_2$ fold axes, two sets of lineation, at small angle to each other are observed and the $D_1$ lineation is bent by $D_2$ folds. Where only a single set of lineation is observed it is not possible to decipher whether it is $D_1$ or $D_2$. 36
3.3.3 Upright folds:

Upright folds (D₃) are found on the gentle limbs of D₂ asymmetrical folds (Fig. 3.52). The folds are open to tight, and gently plunging. At one locality, west of Shastrinagar, D₂ crenulation cleavage is folded by an upright D₃ fold (Fig. 3.53). Bending of D₂ crenulation cleavage by D₃ fold is also seen in the scale of a thin section (Fig. 3.54). Among the D₂ and D₃ folds there is an almost continuous variation of dip of axial planes from vertical, through moderate, westerly dipping to horizontal. Hence it is possible that the D₂ and D₃ folds are formed during a continuous period of deformation, in a regime with combined shortening and layer parallel simple shear.

3.3.4 Transverse puckers:

A set of transverse puckers is observed within the mica schists, as well as in the mica rich layers, within the quartzite (Fig 3.34a, b). These puckers have nearly east-west axial planes and are at an angle to the dominant north-south trending puckers. At places they have refolded the earlier set.

3.3.5 Ptygmatic folds:

Ptygmatic folding is observed in thin pegmatitic veins (Fig 3.56) within semipelitic schists exposed in the northern low ground, north of Lohagal. A few other occurrences have also been noted where thin quartz veins, in laminated quartzite are ptygmatically folded.

3.4 Deformation sequence:

It is inferred that the first phase of deformation (D₁) produced the isoclinal folds. Such folds are found only in the metasedimentary rocks. Schistosity is axial planar to these isoclinal folds (Fig. 3.57) and, because of the isoclinal nature of the folds, is mostly parallel to bedding. The regional schistosity in mica schist belongs to this phase of deformation. Because of the long limbed nature of the D₁ folds, their sense of vergence is not clearly discernible everywhere. The isoclinal folds have not been observed within the granite gneiss or amphibolite lenses. The gneissosity in granite gneiss and schistosity in amphibolite are parallel to the formational contacts and at most
places parallel to the bedding and the bedding parallel schistosity in the metasediments. All are folded by the D₂ folds. It is thus likely that the emplacement of granite was syntectonic with D₁ deformation and the gneissosity is a magmatic-cum-deformational foliation formed during D₁ deformation. The mineral and striping lineation in the gneiss and metasedimentary rocks are also D₁ structures.

The second phase of deformation (D₂) produced the asymmetric, mappable, as well as minor folds (Fig. 3.58, 3.59). These D₂ folds have alternate gently dipping and steep dipping, occasionally overturned, limbs. The axial planes are commonly gently dipping towards west. Fold axes are gently plunging, nearly coaxial with D₁ fold axes and lineation. The folds are S-shaped in section looking from north and the consistent sense of vergence of the folds indicates existence of a simple shear regime, with top to the east sense of movement. These asymmetric folds have folded the bedding, the bedding parallel schistosity, and the gneissosity. The axial planar structure is generally a crenulation cleavage (Fig. 3.27, 3.29, 3.30), but in the micaceous quartzite, it is a disjunctive spaced cleavage (Fig. 3.28). Crenulation cleavage cuts across the D₁ isoclinal folds (Fig. 3.40a). Isoclinal folds have also become refolded by D₂ folds (Fig. 3.60, 3.61). The D₂ crenulation cleavage is so intensely developed at certain places that it almost obliterates the earlier schistosity (Fig. 3.31).

A particularly instructive exposure in Shastrinagar elucidates the relationship between the D₁ and D₂ folds (Fig. 3.62). The exposure lies on the easterly dipping limb of a major D₂ fold having westerly dipping axial plane. A large dextral D₁ fold (looking from north) with gentle easterly dipping axial plane is observed in the quartz mica schists. This is incongruous with the major D₂ fold. On the short limb of the D₁ fold, the easterly dipping secondary banding (S₁) cuts across the steep bedding (Figs. 3.63, 3.64, 3.65), and is crenulated on westerly dipping D₂ axial plane (Figs. 3.63, 3.64, 3.65). The crenulations have sinistral shape in cross section looking from north and are congruous with the major D₂ antiform.

Another exposure clearly illustrating the relationship of D₁ and D₂ structures is in the western flank of the Taragarh hill, south of Anasagar lake (Fig 3.66). Here D₂ folds with westerly dipping axial planes have refolded D₁
folds with axial planar schistosity. On the gentle limb of D2 folds, D1 folds have reclined or nearly recumbent geometry, whereas on the steep limb, D1 folds have steep subvertical or dipping axial planes (Fig. 3.76).

Upright folds and warps, coaxial with D2 folds, but with subvertical axial planes, are found on the gentle long limb of the D2 major folds (Fig. 3.40b). These folds are assigned to a third phase (D3) of deformation. Rarely such folds are seen to bend the D2 crenulation cleavage, suggesting that they are later than D2 (Figs. 3.53, 3.54). But refolding of D2 by D3 is not observed elsewhere in the area. It is possible that the two may represent the early and late stages of the same episode of deformation, in a regime with combined shortening and simple shear (Fig 3.69). In several outcrops, variation in the dips of the axial planes of the folds, from subhorizontal to steep is observed, which may be produced by progressive rotation of axial plane during shear.

Superposition of folds with transverse axial planes is evident in the folding of one set of puckers by a later set (D4). They are superposed on D2 / D3 and they represent the last phase of deformation with weak intensity. Later pucker axes are also seen to curve around hinge areas of earlier asymmetric folds.

3.5 Contact relationship between the gneiss and the supracrustals:

Intrusive nature of the Anasagar gneiss is indicated by the presence of xenoliths of schistose rocks and rarely of quartzite. On both eastern and western flanks of the Anasagar gneiss close to the contact the mica schist is migmatised showing lit per lit injection of quartzo-feldspathic veins.

It is notable that the contact between the gneiss and the supracrustal rocks is invariably parallel to the gneissosity and at most places also parallel to the bedding of the overlying rocks. In the vicinity of Ajmer and also east of Lohagal, the contact between the gneiss and the quartzite is folded by mappable asymmetrical D2 folds (Plate 3B, Fig 3.77). On a regional scale in the Anasagar area the contact is folded into a broad D3 antiformal arch whose core is occupied by the gneiss exposed in the plain land of the Anasagar lake and whose limbs are represented by the ridges of supracrustal rocks east and west of this plain land (Fig. 3.70).
At places there is evidence to indicate that the contact is a dislocation plane. This is indicated by the discordance between the bedding in the overlying rocks and the contact surface, which is parallel to the gneissosity of the underlying gneiss. In a spectacular outcrop near Makarwali, vertical bedding of overlying quartzite is sharply truncated by the subhorizontal contact with granite gneiss (Fig. 3.67). Minor $D_2$ folds on the vertical quartzite have subhorizontal to gentle westerly dipping $D_2$ axial planes. This vertical bedding is the steep limb of a large $D_2$ fold with westerly dipping axial plane. Westward, the bedding of quartzite becomes gentle on the other limb of the $D_2$ fold and is parallel to the gneissosity in underlying gneiss and the contact. (Fig. 3.84). The gneissosity in the underlying gneiss remains horizontal all through in this part. $D_2$ minor folds are present in the gneiss too and these have the same geometry as the $D_2$ minor folds in the overlying quartzite. A similar truncation is also seen at Lohagal, where the vertical limb of a $D_2$ fold, defined by quartzite and amphibolite in the main Shastrinagar valley, is truncated by the subhorizontal gneiss – quartzite contact. Such evidence points to dislocation along the contact. The dislocation plane must be broadly coeval with the $D_2$ folding because though it truncates the steep limb at places, at other places it is itself folded by the $D_2$ folds (Fig 3.77, 3.78).

At several places strong deformation has given rise to a finely banded nature of the gneiss, close to the contact. The megacrysts are deformed to thin lenticular streaks parallel to the gneissosity. Instead of the usual megacryst bearing nature the rock has a finely banded appearance.

3.6 Shear zones in granite gneiss:

The deformational features such as bookshelf sliding (Fig. 3.71), shear planes cutting across megacrysts, asymmetric recrystallised tails (Fig. 3.22, 3.24) shown by some megacrysts indicate shear movement along the gneissosity surface. This is probably related to the shear deformation during the $D_2$ folding. The sense of movement inferred from the asymmetrical tails and the movement on small shear planes cutting across the megacrysts conform with the top to the east sense of movement indicated by the vergence of $D_2$ folds.
Apart from this, small-scale shear zones are sporadically seen in the granite gneiss (Fig 3.73). These have disrupted the gneissosity (Fig 3.74), megacrysts and xenoliths (Fig 3.72). Within such shear zones, the gneiss is transformed to a finely grained, foliated quartzo-feldspathic schist with foliation parallel to the shear zone walls. Both dextral and sinistral sense of movement are observed in such shear zones. The temporal relation of these shear zones with the folding episodes is ambiguous.

3.7 Pegmatitic intrusions:

The pegmatitic intrusions, north of 702m peak and in the Shastrinagar area are post D₁ because they cut across the schistosity and gneissosity. The relation with D₂ deformation is uncertain, due to lack of evidence. But the pink pegmatitic veins, within the semipelitic schists in the low ground north of Lohagal is pre-D₂ because the pegmatitic bands have been asymmetrically folded by the D₂ folds.

3.8 Major structural pattern:

For convenience of study the area is divided into four sectors whose disposition is shown in the index map (Plate 2).

3.8.1 Taragarh ridge and the area south of Anasagar:

The bedding, the main schistosity and the gneissosity planes maintain a general NE-SW strike with moderate to steep easterly dip (Plate 4A). The relationship between the D₁ and D₂ folds is clearly established on the western flank of the Taragarh ridge south of the Anasagar Lake. On the eastern flank of the ridge the quartzite (Plate 3A) show a series of large step like D₂ folds, with westerly dipping axial planes. The steep limbs have moderate easterly dip or are vertical to overturned with steep westerly dip. One such steep limb forms the main Taragarh ridge. The granite gneiss to the west shows moderate easterly dip of the gneissosity representing the flat limb. The contact has moderate easterly dip and trends 40 degrees. The structural cross-section along a NW-SE line AB (Fig. 3.75) illustrates the structure.

South of Taragarh, in the steeply dipping quartzite there are large outcrop scale D₁ overturned folds with gentle to moderate easterly dipping
axial plane schematically shown in Fig 3.75. In contrast the $D_2$ folds have gentle to moderate westerly dipping axial planes. The sense of vergence of the $D_1$ folds and $D_2$ folds are also at many places opposite ($D_1$ — “S” shaped looking from north and $D_2$ — “Z” shaped looking from north). Axial planar schistosity truncates the bedding at the hinge region of $D_1$ folds. On the limbs, a small angle between the bedding and schistosity is at places observed though mostly the two are parallel. This schistosity, along with bedding is folded by $D_2$ folds, with alternate steep and gentle limbs and westerly dipping axial planes. On the gentle limbs of $D_2$ folds the congruous minor folds are S-shaped. On such limbs the $D_1$ folds have reclined or nearly recumbent geometry; whereas on the steep limb $D_1$ folds have steep dipping axial planes, but often the sense of vergence of the $D_1$ folds remains the same on both the limbs of $D_2$. The relationships are schematically illustrated in Fig. 3.76. Because of the isoclinal nature of the folds and lack of key bands, no major $D_1$ fold could be delineated in this region, though both ‘S’ and ‘Z’ shaped $D_1$ folds are present. It is likely that the great thickness of the quartzite in this region is a result of $D_1$ isoclinal folding. On the gentle limb of $D_2$ folds, $D_3$ puckers with subvertical axial planes and subhorizontal axes are present. $D_1$, $D_2$ and $D_3$ fold axes are generally parallel (Plate 5A) but at some localities deviation from strict coaxiality is seen, and $D_1$ striping lineation and $D_2$ puckers make low angles (20° – 30°). $D_2$ folds bend such oblique $D_1$ lineation (Fig. 3.68).

3.8.2 Area near Christianganj and Shastrinagar, north of Ajmer:

The NE-SW trending quartzite ridge, south of Anasagar, continues past the eastern side of the Anasagar lake and extends to the area near Christianganj (Plate 3B). The large-scale structures are a series of antiforms and synforms ($D_2$) with alternate flat and steep limbs. The cross section along the E-W line CD (Fig 3.77) and Fig 3.83 illustrates the structure.

The westernmost structure is a $D_2$ antiform which has an upper subhorizontal limb and a lower subvertical limb (Plate 4B), which is overturned at places; the axial plane is westerly dipping. The contacts of quartzite-amphibolites and amphibolite-granite gneiss are exposed on the steep eastern limb. The gentle limb is represented by a subhorizontal
gneissosity plane in granite gneiss. The hornblende biotite schist pinches out to the north and the granite gneiss come in direct contact with the quartzite in the northern part of this sector (Plate 3B).

Within the quartzite a large $D_2$ synform is present to the east. Congruous minor folds, dextral on steep limb and sinistral on gentle limb looking from north, are present. In the northern part of this area, the steep limb becomes overturned; the fold becomes nearly isoclinal with both limbs dipping westerly. The axial plane dips gently to the west. A small lens of hornblende biotite schist branches out as a sill from the main band within quartzites and pinches out eastward (Plate 3B).

East of this synform a large $D_2$ antiform with gentle western limb and steep locally overturned eastern limb is present; the axial plane is moderately westerly dipping. The broad 680m peak represents the hinge region of this fold. Congruous minor folds are present on the two limbs. On the gentle limb, large $D_3$ folds with subvertical axial planes are observed. The eastern vertical limb of the $D_2$ antiform extends upto the Ajmer – Lohagal road in the main Shastrinagar valley.

The gneiss – quartzite contact is subhorizontal and parallel to the bedding in quartzite and gneissosity in granite gneiss on the flat western limb of this fold, but near Lohagal the steep eastern limb in the quartzite is truncated by the flat dipping gneiss – quartzite contact which continues eastward along the ridge to the Kankariya region (Plates 3B, 4B and Fig 3.77). The contact is therefore a dislocation plane. This is further confirmed by the deformation effects along the contact in the granite gneiss. The megacrysts are transformed to long lenticular streaks, and the rock assumes a finely banded character. However no linear structure, which could be unequivocally related to the movement in the dislocation zone, has been observed. The reason may be recrystallisation postdating the movement. All the lineations are coaxial or at low angles with $D_2$ fold axes and are gently plunging to the south (Plate 5B).

3.8.3 Area north and north-west of Kankariya:

This sector is to the east of the Shastrinagar area on the eastern side of the Ajmer – Lohagal road. The map of Shastrinagar and Kankariya (Fig.
and cross sections along the line DE, eastern continuation of line CD and along line FG, north of DE illustrates the structure (Figs 3.77 and 3.78). The steep bedding in the quartzite of the Shastrinagar valley is followed to the east by a gently dipping domain defining a D₂ step like synform (Plate 4C). As mentioned in the previous section the gneiss – quartzite contact truncates the steep bedding but it again becomes parallel to bedding on the flat limb. Intense deformation along the contact has converted the granite to a finely banded and strongly foliated gneiss. Because of the overall gentle dip, the outcrop pattern of the contact has a sinuous outcrop on the undulating topography. The mica schist underlying the upper gneiss is exposed on the northern slopes of the ridge. In the eastern part of this sector, all the formational contacts are further folded, forming a series of D₂ folds with alternate gentle and steep limbs. The orientation of axial traces slightly changes and becomes northeast-southwest (Fig 3.83).

A main antiformal axial trace with NE-SW trend runs parallel to the ridge system. The hinge of this fold is well exposed in the peak about 1.25 Km. north of Kankariya (Fig 3.79a, b). The gneiss-quartzite contact is exposed on the steep eastern limb. The gentle upper limb and steep to subvertical, lower limb are clearly recognizable within the granite gneiss. As the fold is traced to the underlying mica schist, on the northern slopes of the ridge, it becomes overturned and more tight with both the upper and lower limbs becoming gently dipping to the northwest (Plates 3B, 4C and Figs. 3.77 and 3.78).

The synformal hinge, south east of the antiform is exposed within the quartzite in the low ground. The common steep limb of the antiform and the synform is exposed along the southeastern slope of the ridge system. The southeastern limb of the synform is subhorizontal. The continuation of the axial traces of the D₂ folds cannot be precisely marked out in the southwestern part due to lack of continuous outcrops and irregular variation in dip, caused by later D₃/ D₄ warping.

Smaller folds (Fig. 3.80a&b) are also observed in several parts of this region; their axial traces can be demarcated only for short distances. A pair of such folds have been mapped on the steep limb, in the eastern part of the map, about 500m north west of Kankariya (Fig 3.81, 3.82). The axial traces
can be delineated for about 500m. This pair dies out to the northeast through joining of the two axial traces. In the southwestern side, these axial traces join with those of the larger antiform and synform respectively, and as a result, the steep limb dies out, and on the southwestern part of the area, only gentle dips have been noted in quartzite.

A similar feature is present on the northern part also, near the termination of the ridges. A small fold pair is mapped approximately 2.5 Km. from Kankariya, on the main gentle limb. Their axial traces join together to the south, and the fold pair dies out. Another pair occurs in the overturned limb, which also dies out to the south by merger of their axial traces (Fig. 3.83).

On the wide flat limb of the major antiform, extending east of Lohagal, D₃ folds have caused curvature of the bedding in quartzite and the bedding parallel schistosity in the mica schist (Plate 4C). These broad warps have north-south trending subvertical axial planes. Similar warps due to D₃ folding are also observed in the long flat limb of the synform, in the eastern part of the map.

The plunge direction of the D₁, D₂ and D₃ folds in all the three domains described so far is southerly.

3.8.4 Area near Makarwali, north of Ajmer:

The plain land north of Lohagal, is occupied by the lower unit of granitic gneisses, lying below the mica schist horizon. As a result of plunge reversal towards north, quartzitic rocks are again exposed in the northern part of the area, in four isolated hillocks near Makarwali (Plate 3C). The lower mica schists are also exposed below the upper horizon of granitic gneiss. In the northeastern part of this sector, the variation in attitude of bedding plane in quartzite and acute angle relationship between D₂ cleavage and bedding, indicate the presence of a major antiformal fold (Plate 4D, Fig. 3.84). This is an inclined fold whose western limb is flat and the eastern limb is nearly vertical, to locally overturned. In contrast to the region extending from Ajmer to Kankariya, the major folds here are gently plunging to the north (Plate 5D).

The flat limb is exposed on the top of the hill and on the western slopes, while the overturned limb is exposed on the eastern slope. On the
southern slope of the hill, the cross-sections of a number of minor folds with steep and gentle limbs and westerly dipping axial planes, are exposed on the steep limb of the major fold. The contact between granite gneiss and quartzite is planar and subhorizontal and truncates the steep limb of the overlying quartzite but is parallel to the flat limb. Asymmetrical D₂ minor folds with steep and gentle limbs and westerly dipping axial planes fold the gneissosity in granite. As near Lohagal the evidence points to dislocation along the contact (Fig 3.84).

This major antiform in the quartzite is followed to the west by a complimentary synform and another antiform. The steep dipping western limb of the synform, at places overturned, is again seen to be sharply truncated by the subhorizontal gneiss – quartzite contact. Movement along the contact has dragged the bedding in quartzite to a subhorizontal attitude (Fig 3.85).

The westernmost subhorizontal limb of the second antiform is folded by a later D₃ synform with subvertical axial plane and gentle northerly plunge (Fig 3.84, Plates 3C & 4D). The gneiss quartzite contact is also folded by this D₃ synform. Because of lack of exposure this axial plane cannot be traced south of Makarwali.

3.8.5 Reconnaissance study on the western limb.

The western contact of the Anasagar granite gneiss (Fig. 3.86) represents the western limb of a major D₃ arch and is westerly dipping with gentle to steep angles. Here also the quartzite overlies the Anasagar gneiss. Mica schists occur as separate mappable lenticular bands within the granite gneiss. Some are migmatised with lit per lit injection of granite. There is a gradation from mica schists to migmatised gneisses. The gneissosity in granite gneiss, schistosity within the mica schists and bedding in quartzites constitute the dominant planar structures. The schistosity and gneissosity are parallel throughout the area both showing minor folds on gently dipping to subhorizontal axial planes. These form asymmetrical folds with a consistent “S” shape looking from north as seen in the eastern flank of the Anasagar gneiss. No major fold has been found in the area. General attitude of the gneissosity/schistosity is 225°/15° NW. The gneissosity and schistosity are more or less parallel to the bedding in quartzite.
3.9 Orientation patterns and geometrical analysis of structures in different sectors:

For analyzing the geometry of the structures, the orientation data (Plates 4A, 4B, 4C, 4D, 5A, 5B, 5C, 5D, 6A, 6B, 6C, 6D) from the three formations in four different sectors on the eastern flank of the Anasagar gneiss have been plotted separately on equal area projection diagrams. The statistical parameters for the orientation have been determined following Woodcock (Appendix).

3.9.1 Anasagar South Sector:

The orientation data come mostly from the steep dipping limb of a major D2 antiform (Plate 3A, Fig 3.75). The granite gneiss underlies the quartzite. Mica schist occurs as lenses within the quartzite and also at the contact of granite gneiss and quartzite.

3.9.1.1 Structural geometry in the quartzites:

The poles to the bedding show a point concentration representing the steep easterly dipping limb of the D2 fold (Fig 3.87). There is some variation in strike, which is caused by the presence of transverse warps (D4) plunging almost downdip, on the easterly dipping planes. The bedding plane corresponding to the modal attitude of the poles has the orientation 017° / 44° E. D2 and D3 folds have caused spread of the poles on a steeply dipping great circle. The pole to this great circle (β) plunges 12° towards 185°.

D2 and D3 folds and puckers are coaxial and are hence plotted together (Fig. 3.88). The fold axes are mostly gently plunging to the south with a modal orientation of 18° towards 193°, though a few northerly plunges are also observed.

The poles to D2 axial planes in quartzite fall on a subvertical great circle whose normal (β) plunges 1° towards 204° (Fig. 3.89). Field observations suggest that this pattern is due to variation of dip of axial planes of D2 folds (polycinal folding on nearly constant axis) rather than due to refolding by D3.
The D₃ axial planes have nearly N-S strike and steep dip (modal orientation of axial plane is 2° / 82° E (Fig. 3.90). Transverse D₄ puckers are rarely seen (Fig. 3.91).

Lineations in quartzite are defined by intersection of mica flakes and elongation of pebbles. As mentioned earlier some of the mica lineations represent pucker axes caused by D₂, D₃, and D₄ folding. D₁ striping and mineral elongation on the schistosity surface are seen at a few places and these are bent by D₂ folds. However, where such deformed lineation is not seen it is not possible to distinguish the D₁, D₂, and D₃ lineations in the field because they are nearly coaxial. The plots of lineation lie on a great circle corresponding to the bedding / schistosity maximum (Fig. 3.92). Those plunging gently towards S and SE belong to D₁ / D₂ / D₃ phases and the ESE-ly to ENE-ly plunging lineations represent D₄ deformation.

3.9.1.2 Structural geometry in the granite gneiss:

Poles to foliation in granite gneiss give a point concentration and the representative orientation of the plane is 024° / 37°E (Fig. 3.93). This represents the steep limb of the D₂ fold and is close to the modal orientation of the bedding pole in quartzite.

The axes of D₂ minor folds have variable, but overall southerly plunge (Fig. 3.94).

D₂ axial planes have mostly gentle westerly dip (Fig. 3.95).

Elongation of feldspathic streaks on gneissosity represents a D₁ structure and plunges 29° towards 134° (Fig. 3.96). Thus there is a small angle between the D₁ lineation and D₂ fold axes.

3.9.1.3 Structural geometry in the mica schist:

Poles to schistosity in the mica schist show a clustering, and the modal orientation of the plane is 030° / 45° E, conforming to the orientation of the gneissosity in granite gneiss and bedding in quartzite (Fig. 3.97).

D₂ fold axis show gentle southerly / south-southeasterly plunge (Fig. 3.98) and D₃ pucker axes have gentle NNEly or SSWly plunge (Fig. 3.99). At many places D₂ and D₃ puckers cannot be differentiated and these have gentle southerly plunge (modal orientation of 26° towards 181°) (Fig. 3.100).
Axial planes of D2 folds are mostly gently dipping (Fig. 3.101) whereas D3 axial planes are steep dipping, modal orientation of D3 axial planes being 208° / 88° W (Fig. 3.102).

Lineations in mica schist are defined by elongation of mica flakes, or intersection of oblique flakes, which have a modal plunge of 44° towards 140° (Fig. 3.103). Some of these are probably D1 structures subparallel to the elongation of feldspathic streaks in granite gneiss. Others represent D4 intersection lineation.

3.9.2 Shastrinagar and Christianganj sector:
A series of D2 step like folds are observed in this part. Near Lohagal the steep limb of one such fold is truncated by the flat granite-quartzite contact (Plate 3B, Fig 3.77).

3.9.2.1 Structural geometry in the quartzite and interlayered mica schist:
Poles to bedding and schistosity in the quartzite and mica schist lie on a broad girdle as a result of D2 and D3 folding. The pole to this great circle (β) plunges 22° towards 198° (Fig. 3.104).

Axes of D1 folds in quartzite and mica schist have a modal plunge of 18° towards 193° (Fig. 3.105). D2 folds and pucker axes show a modal plunge of 20° towards 184° (Fig. 3.106). D3 axes show a modal plunge of 23° towards 185° (Fig. 3.107). The undifferentiated D2, D3 and D4 fold axes have gentle southerly plunge (Fig. 3.108). The SSW'ly to SSE'ly trends belong to D2 / D3 sets. The D4 pucker axes have southeasterly plunge. Thus the axes of D1, D2 and D3 folds are nearly parallel, on both minor and major scales.

Poles to D1 axial planes lie on a great circle due to D2 folding and the pole (β) to this girdle plunges 12° towards 206° (Fig. 3.109) approximately coincident with the modal D2 axes. D2 axial planes have gentle to moderate westerly dip. The modal orientation of the axial planes is 168° / 33° W (Fig. 3.110). The D3 axial planes are steep dipping, the modal orientation of the planes is 180° / 73° (Fig 3.111). There are rare D4 transverse puckers (Fig 3.112).
Lineations in the quartzite and mica schist show a dominant southerly plunge, the modal orientation being 21° towards 183° (Fig 3.113). Because of the coaxiality of D₁ D₂ and D₃ these cannot be assigned to a particular generation.

3.9.2.2 Structural geometry in the granite gneiss:

Poles to foliation in granite gneiss show a point concentration representing a gently dipping plane, modal orientation of the plane being 057° / 17° SSE. This represents the flat limb of the D₂ antiform within the gneiss. The distribution on a great circle is due to D₂ / D₃ folding whose axis (β) plunges 15° towards 175° (Fig. 3.114).

D₂ fold axes gently plunge to the south-southwest, modal orientation being 19° towards 204° (Fig. 3.115) and D₃ axes also have gentle southerly plunge (Fig. 3.116). Undifferentiated D₂ and D₃ axes have a modal plunge of 21° towards 172° (Fig 3.117).

D₂ axial planes in the granite gneiss are generally gently dipping (Fig. 3.118) while D₃ axial planes are steep dipping (Fig. 3.119)

Southerly to southeasterly plunging D₁ lineations in granite gneiss, defined by elongation of feldspathic streaks have a modal plunge of 16° towards 166° (Fig. 3.120).

3.9.3 Kankariya sector:

In this sector a mica schist horizon intervenes between two granite gneiss horizons and the quartzite overlies the upper granite gneiss.

3.9.3.1 Structural geometry in the quartzite:

The poles to the bedding and schistosity in the quartzite lie on a broad girdle, (Fig. 3.121) as a result of D₂ and D₃ folding. A best-fit great circle can be drawn through the poles. The pole to this great circle (β) plunges 9° towards 207°. The deviation of poles from the mean great circle is ascribed to the presence of transverse D₄ folds superposed on varying attitudes of bedding and schistosity.
The minor folds and puckers in the quartzite mostly belong to the D2 set. They have a modal plunge of 19° towards 206° (Fig. 3.122). D3 folds have also gently southerly plunging axes (Fig. 3.123). Undifferentiated D2 and D3 axes have gently southerly to southwesterly plunge of 13° towards 193° (Fig. 3.124).

The D2 axial planes are gently dipping and the modal plane has an orientation of 195° / 27° W (Fig. 3.125). D3 axial planes are steeper with the modal orientation of 199° / 87° W (Fig. 3.126). Transverse axial planes are of D4 set.

Lineations in quartzite are defined by parallel alignment of tourmaline needles, elongated quartz-sillimanite aggregates and intersection of oblique mica flakes on bedding/schistosity surface. Lineation data display a large scatter (Fig. 3.127). The elongation on bedding parallel schistosity is probably a D1 structure coaxial with D2 axes and plunge southerly to southwesterly; a few also plunge north northwesterly. The southeasterly and northwesterly plunging lineations are D4 intersection lineation. There are a few D4 folds with SE'ly plunging fold axes on NW-SE axial planes.

3.9.3.2 Structural geometry in the granite gneiss:

Poles to gneissosity in granite gneiss lie on a great circle whose normal (β) plunges 14° towards 207° (Fig. 3.128). The gneissosity maximum (102° / 14° S) corresponds to the gently dipping limb of the D2 major fold.

Minor folds in granite gneiss belong to D2, whose axes have low south-southwesterly plunge (Fig. 3.129) with a modal orientation of 12° towards 197°; this is nearly coaxial with (β) in Fig. 3.128. Undifferentiated D2 and D3 puckers have axes plunging southerly to south-southeasterly (Fig. 3.130). Rare D4 axes have southeasterly plunge.

Axial planes of D2 folds are mostly gently dipping with a modal orientation of 189° / 26° W (Fig. 3.131). There are a few D3 folds with steep dipping axial planes.

Lineation in the granite gneiss, defined by elongated streaks of feldspathic aggregates, belong to D1 and have gentle southerly plunge (modal orientation of 15° towards 184°) (Fig. 3.132).
3.9.3.3 Structural geometry in the lower mica schist:

Schistosity in the lower mica schist is gently dipping (Fig. 3.133); the measurements all come from the gentle limb of the \( D_2 \) major antiform. The modal plane has the orientation of \( 115^\circ / 16^\circ \) S. A slight spread on a great circle is due to \( D_2/D_3 \) folding with \( \beta \) plunging \( 16^\circ \) towards \( 210^\circ \).

Axes of \( D_2 \) folds and puckers axes have gentle southerly plunge (Fig. 3.134). Undifferentiated \( D_2 \) and \( D_3 \) axes show a modal plunge of \( 14^\circ \) towards \( 171^\circ \) (Fig. 3.135).

The \( D_2 \) axial planes are gently dipping (Fig. 3.136).

3.9.4 Makarwali sector:

Upper granite gneiss overlies the mica schist and underlies the quartzite in this sector. A lower horizon of granite gneiss underlies the mica schist.

3.9.4.1 Structural geometry in the quartzite:

Poles to the bedding and schistosity in quartzite lie on a great circle due to the major \( D_2/D_3 \) folding with \( \beta \) plunging \( 29^\circ \) towards \( 345^\circ \) (Fig. 3.137).

\( D_2 \) fold axes have a modal plunge of \( 27^\circ \) towards \( 344^\circ \) (Fig. 3.138). \( D_3 \) folds are nearly coaxial with \( D_2 \) ones, the modal orientation of fold axes being \( 29^\circ \) towards \( 339^\circ \) (Fig. 3.139). Undifferentiated \( D_2 \) and \( D_3 \) axes plunge \( 30^\circ \) towards \( 346^\circ \) (Fig. 3.140).

\( D_2 \) axial planes are gently dipping with poles having an average orientation of \( 211^\circ / 32^\circ \) WNW (Fig. 3.141). \( D_3 \) axial planes are steep dipping, with the modal orientation of \( 177^\circ / 79^\circ \) W (Fig. 3.142).

Lineations in quartzite are north-northwesterly plunging with a modal orientation of \( 28^\circ \) towards \( 340^\circ \) (Fig. 3.143). It cannot be ascertained whether these are of \( D_1, D_2 \) or \( D_3 \) generation.
3.9.4.2 Structural geometry in the granite gneiss:

Poles to the foliation in granite gneiss show a cluster representing subhorizontal gneissosity. The gently dipping gneissosity truncates the vertical bedding in quartzite and is parallel to the flat bedding. The modal orientation of the foliation is $228^\circ / 29^\circ$ NW (Fig. 3.144).

$D_2$ and $D_3$ fold axes plunge northwesterly (Fig. 3.145). $D_2$ axial planes (Fig. 3.146) are gently dipping.

$D_1$ lineation in granite gneiss defined by elongated feldspathic streaks plunge northwesterly (Fig. 3.147), the average orientation being $21^\circ$ towards $341^\circ$.

3.9.4.3 Structural geometry in the mica schist:

Poles to the schistosity in the lower mica schist show a point concentration, the average orientation of the plane being $219^\circ / 31^\circ$ WNW (Fig. 3.148).

Lineations in mica schist plunge northwesterly (Fig. 3.149).

3.9.5 Synthesis of orientation data:

The summary of orientation data are given in Tables 3.1 - 3.4. Bedding in quartzite, gneissosity in granite gneiss and schistosity in mica schist are subparallel and show very similar great circle patterns caused by the presence of major $D_2$ and $D_3$ folds. A point concentration on the great circle represents dominance of one limb in a particular domain.

The $D_2$ folds are step like with alternate gentle and steep limbs. Their axial planes dip westerly at a gentle angle ($\leq 30$ degrees). The $D_3$ folds are nearly upright with steep dipping axial planes. $D_1$ structures are represented by isoclinal folds and the schistosity is axial planar to these isoclinal folds. Elongation of feldspathic streaks on the gneissosity surface represent $D_1$ structures.

The $D_1$, $D_2$ and $D_3$ linear structures are nearly coaxial. In the southern part of the area they show gentle southerly plunge, but trend varies slightly from $205^\circ$ to $165^\circ$ in different domains. In the southern Anasagar south sector,
the D₁ lineations have gentler southeasterly plunge and make a small angle with the D₂ / D₃ fold axes.

Near Ajmer, Shastrinagar and Kankariya the D₁, D₂ and D₃ fold axes have gentler southerly plunges whereas near Makarwali the plunge is to the north-northwest; this is the result of a broad plunge culmination between Lohagal and Makarwali.

D₄ pucker axes and lineations have highly variable plunges, their axial planes trend E-W to NW-SE transverse to the D₂ / D₃ structures.

3.10 Synoptic view of the structural geometry in the Anasagar region:
The map pattern in the Anasagar area is controlled by large scale D₂ and D₃ folds. East of the Anasagar valley a series of asymmetric D₂ folds occur with alternate flat and steep limbs and westerly dipping axial planes producing step like pattern of the folds. The earliest deformation produced isoclinal folds with axial planar schistosity, now observed only on minor scale in the supracrustal rocks. The emplacement of Anasagar gneiss as a concordant sheet was syntectonic with the first deformation. The gneissosity is folded by the D₂ / D₃ folds.

The consistent sense of asymmetry of the D₂ folds suggests that these developed under a deformation regime with combination of E-W shortening and simple shear. The vergence of the D₂ folds and the shear sense indicators in the Anasagar gneiss indicate top to the east sense of movement during their development. This easterly directed movement was accompanied by dislocation along the gneiss – supracrustal contact which truncated the steep limbs of some of these D₂ folds. The folding movement continued after the development of the dislocation as a result of which the dislocation plane itself got folded with the same sense of vergence. It is envisaged that the dislocation plane had an original ramp and flat geometry. The bedding truncations seen in the area are interpreted to correspond to the original hanging wall cut-offs. A model of the development of the observed geometry
Continued deformation during D₂ episode led to folding of the dislocation plane itself, of the gneissosity in the footwall and of bedding in the hanging wall. The steepening of the bed in the vicinity of the hanging wall cut-offs probably resulted from this continued deformation.

An alternative scheme of evolution is illustrated in Fig. 3.151. In this scheme, during D₂ deformation the contact was first folded into a set of asymmetrical folds. The dislocation developed at a later stage truncating the bedding in the overlying quartzite. Continued deformation led to further asymmetrical folding of the contact along with the dislocation and the upright D₃ folding. However this model is not favoured because according to it the dislocation plane cuts down into the sequence in the direction of transport. This is contrary to the common observation that in fold and thrust belts the dislocation ramps up the sequence in the direction of transport.

The long western flat limb of a major D₂ fold is arched into an antiform by a D₃ upright fold and the outcrop of the Anasagar gneiss in the Anasagar valley occupies the core of this arch. The western limb of this D₃ arch is westerly dipping at gentle to steep angles and is exposed west of the Anasagar valley. The quartzites of the eastern flank are repeated on the western limb of the D₃ antiform (Fig. 3.70).

The D₂ fold axes are gently plunging and show a broad regional culmination. In the vicinity of Ajmer the plunge is gentle to the south but further north near Makarwali the folds are plunging to the north.

As noted by Heron (1953) the outcrop of the Anasagar gneiss shows a southern closure near Ajesar, south of the studied area. This closure was interpreted by him as the southern closure of the Anasagar dome. Recent studies by Professor D. Mukhopadhyay and Dr. T. Bhattacharyya (personal communication) show that at the closure the quartzite is steeply dipping to the north and the sequence here is overturned with the gneiss structurally overlying the quartzite. The structural geometry here has been interpreted by Mukhopadhyay et al. (2000) to result from bending of the eastern limb and the axial trace of the D₂ antiform by a D₄ major fold (Fig. 3.152). The axial trace of the major D₂ antiform is bent by this D₄ fold and the hinge of the former is located in the south-western corner of the gneiss outcrop. Hence contrary to Heron's interpretation, the southern closure of the Anasagar is not due to
gentle southerly plunge of a domal structure. As is also shown in Heron's (1953) map, the outcrop of the gneiss closes at its southern end only without any corresponding closure in the north.
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Table 3.1 Structural data around Anasagar South area
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Table 3.2 Structural data around Shastrlnagar area
### Table 3.3 Structural data around Kankariya area

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Table 3.4 Structural data around Makarwall area
Fig. 3.1a  Trough Cross bedding within quartzite, in the isolated hill near Kankariya

Fig. 3.1b  Tabular Cross bedding within quartzite, in the isolated hill near Kankariya
Fig. 3.2a Sinistral fold with cross bedding within quartzite, in the isolated hill near Kankariya

Fig. 3.2b Broad synformal warp
Cross bedding within quartzite, in the isolated hill near Kankariya

Fig. 3.2c Cross Bedding and D₂ minor folds within quartzite near Kankariya.
Fig. 3.3 Cross lamination in quartzite on gentle limb of $D_2$ fold, south of Anasagar (diameter of the lens cap 52 mm).

Fig. 3.4 Cross lamination showing right side up relation in the quartzites of Taragarh ridge, south of Anasagar.

Fig. 3.5 Branching ripple marks in quartzites of 680 m broad peak of Shastrinagar (diameter of the coin 2.1 cm).

Fig. 3.6 Linguiod ripple marks in quartzite, south of Taragarh (diameter of the lens cap 52 mm).
Fig. 3.7 a, b Sketch showing swerving nature of schistosity formed by biotite around garnet porphyroblasts and quartz lenses producing anastomosing pattern as seen under the microscope.
Section looking from north
Mica flakes aligned parallel to axial plane of the isoclinal fold and at high angle to the bedding in the hinge region

Mica flakes aligned parallel to bedding in the limb region
Quartzose bands

Bedding
Micaceous laminae

Fig. 3.8 Field sketch of mica flakes aligned parallel to bedding at limbs and at high angles to bedding at hinge of isoclinal folds

Section looking from south
Thin micaceous laminae
Quartzose bands
Bedding parallel schistosity

Fig. 3.9 Field sketch of sigmoidal secondary banding defined by alternate thin micaceous laminae and quartzose bands at an angle to the bedding

65
Fig. 3.10 a Field sketches showing variable relationship of megacrysts with foliation south and southeast of Anasagar

Fig. 3.10 b Field sketches showing variable relationship of megacrysts with foliation along southeastern slope of 702 m peak, northwest of Kankariya.
Fig. 3.11 Field sketches showing variable relationship of megacrysts with gneissosity, near Christianganj.
Fig. 3.12 Euhedral K-feldspar megacryst athwart to the gneissosity which swerves round the megacryst, near Christianganj (diameter of the coin 2.4 cm).

Fig. 3.13 Rectangular, nearly euhedral K-feldspar megacryst with zones separated by biotitic septa. Note crude parallelism of megacrysts (diameter of the coin 2.4 cm).

Fig. 3.14 Megacrysts aligned parallel to the gneissosity with one megacryst showing zoning defined by biotitic septa on the southeastern slope of the 702 m peak (length of pencil 13.5 cm).

Fig. 3.15 Subparallel orientation of euhedral to subhedral K-feldspar megacrysts near Christianganj (diameter of the coin 2.4 cm).
Fig. 3.16 K-feldspar megacryst deformed to an elliptical shape, elongated parallel to the gneissosity. The megacryst is recrystallised to a granular aggregate. The internal biotitic septum is deformed into elliptical form. Individual biotite flakes in the septum are parallel to the outer gneissosity.

Fig. 3.17 Necking in feldspar megacryst in a vertical section looking from southwest, south of Anasagar (diameter of the coin 2.1 cm).

Fig. 3.18 Boudinaged K-feldspar megacryst within granite gneiss on the southwestern slope of the 702 m peak (diameter of coin 1.8 cm).

Fig. 3.19 Stretched and boudinaged K-feldspar megacryst.
Fig. 3.20 Field sketches showing penetration of micaceous laminae within K-feldspar megacrysts
Fig. 3.21 Field sketches of symmetric tails of megacryst

Fig. 3.22 Field sketches of asymmetric tails of megacryst
Fig. 3.23 Megacryst elongated parallel to external foliation with symmetrical pressure shadow tail, on Pushkar road (diameter of coin 2.3 cm).

Fig. 3.24 Asymmetric pressure shadow tail of megacryst on Pushkar road. (diameter of coin 1.8 cm).
Fig. 3.25  Thinly banded gneiss with megacrysts deformed to thin lenticles. Elongated xenolith parallel to the gneissosity. Aplite veins cut across the gneissosity. Note the elongated xenolith skirted by the aplite (diameter of coin 2cm).

Fig. 3.26  Well foliated Anasagar gneiss. Megacrysts are deformed to thin lenticles parallel to the gneissosity, with a few relict megacrysts still recognizable. D\textsubscript{2} crenulation on gneissosity on the steep limb of a mappable D\textsubscript{2} fold.

Fig. 3.27  Crenulation cleavage in laminated quartzite along the northwestern slope of Lohagal ridge. Sinistral fold in section looking from north (diameter of coin 2.3 cm).

Fig. 3.28  Spaced D\textsubscript{2} cleavage in quartzite in the low ground north of Lohagal (length of pencil 13.5 cm)
Section looking from north
Siliceous layer
Garnet porphyroblast
Micaceous layer
Crenulation cleavage

**Fig. 3.29** Field sketch showing crenulation cleavage in semipelitic schist in the low ground north of Lohagal

Section looking from north
Crenulation in the mica rich layers
Axial planar crenulation cleavage showing cleavage fanning
Bedding in quartzite

**Fig. 3.30** Field sketch showing crenulation cleavage in folded laminated quartzite on the eastern slope of the main Lohagal ridge
Fig. 3.31 Field sketch of intensely developed crenulation cleavage having the appearance of a schistosity almost transposing the earlier fabric.
Fig. 3.32 Field sketch showing dying out of fold axes

Fig. 3.33 Field sketch showing doubly plunging fold axes
Transversal pucker
Dominant set of pockets
Schistosity in mica schist

(a) Section looking from north

Fold axes of the dominant pucker set curved by the later set

(b) Section looking from north

Fig 3.34a,b Field sketch showing interfering pucker sets along the southeastern slope of the main Lohagal ridge

Fig.3.35 Field sketch of variously oriented mica flakes resulting from microfolding of an earlier fabric giving rise to intersection lineation
Fig. 3.36 Quartz pebbles defining elongation lineation on bedding surface of quartzite at Shastrinagar valley (length of the scale 15 cm).

Fig. 3.37 Isoclinal recumbent first fold west of Shastrinagar. (Width of the coin 2.5 cm)

Fig. 3.38 Isoclinal fold with axial planar schistosity folded by D2 fold. (Diameter of coin 2.5 cm)
Fig. 3.39 Field sketches of isoclinal $D_1$ folds
**Fig. 3.40a** Field sketch showing D. folds with axial planar schistosity folded by D₂ having variable dip of axial planes

**Fig. 3.40b** Field sketch showing D₁ folds with axial planar schistosity; schistosity folded by D₃ folds having steep dipping axial plane
Fig. 3.41 Rootless D, folds in quartzose bands within mica schist. (Length of the hammer 30 cm)

Fig. 3.42 Sinistral D2 minor fold in section looking from north on flat limb of major D1 antiform on the southeastern slope of the Lohagal ridge. (Diameter of coin 1.5 cm)

Fig. 3.43 Step-like D2 fold in quartzite with westerly dipping axial plane near Shastrinagar. (Length of pencil 13.5 cm)
Fig. 3.44a, b  Field sketch of asymmetrical overturned antiform and synform near Shastrinagar
Fig. 3.45a Field sketches of sinistral minor folds within semi-pelitic schists in the low ground north of Lohagla

Fig. 3.45b Field sketch of minor sinistral folds within laminated quartzite in the northeastern tip of the Kankariya ridge system
Fig. 3.46  Sinistral minor fold in semipelitic schist highlighted by pegmatite vein, low ground north of Lohagal, section looking from north. Note boudinaged pegmatite vein parallel to axial plane (length of pencil 13.5 cm).

Fig. 3.47  Sinistral D₂ fold within quartzite in section looking from north; local disruption along short inverted limb; northeastern tip of Kankariya ridge (length of hammer 30 cm)
Fig. 3.48  Dextral $D_2$ folds in quartzite in section looking from north, on southeastern slope of Lohagal ridge. (length of the scale 15 cm).

Fig. 3.49  Dextral minor fold on steep limb of antiform in section looking from north on southeastern slope of Lohagal ridge (length of hammer 30 cm).
**Fig. 3.50a** Field sketches of minor dextral folds looking from north in the laminated quartzite on the southern slope of the main ridge, west of Kankariya

**Fig. 3.50b** Field sketch of minor dextral folds seen within semi-pelitic schists along the southern slope of the main ridge, west of Kankariya
Fig. 3.51 a Field sketch showing differing folding styles in different layers with different competency

Fig. 3.51 b Field sketch showing large fold in quartzite layers and crenulations in micaceous layers
Fig. 3.52 Field sketch of upright $D_3$ folds on flat limb of $D_2$ folds.

Fig. 3.53 Field sketch of $D_2$ crenulation cleavage folded by an upright $D_3$ fold, west of Shastrinagar.
Fig. 3.54 Photomicrograph showing D₂ crenulation cleavage refolded by D₃ folds in mica schist near Lohagal. (Width of the photograph is 4.8 mm)
Fig. 3.55  Difference in fold forms in competent and incompetent layers in quartzite in section looking from north on the northeastern tip of the ridge, north of Kankariya (length of hammer 30 cm)

Fig. 3.56  Ptygmatic fold ($D_2$) in thin pegmatite vein within semipelitic schist in section looking from north on the low ground north of Lohagal (length of hammer 30 cm)

Fig. 3.57  Isoclinal fold with axial planar schistosity (length of pencil 13.5 cm).

Fig. 3.58  Asymmetric $D_2$ fold with sub horizontal axial plane, long flat limb, sub-vertical short limb. Sub-vertical face, east to the left near Christianganj (length of the hammer 30 cm).
Fig. 3.59 Asymmetric fold with long flat limb and short steep limb near Christianganj (length of the hammer 30cm).

Fig. 3.60 D$_1$ isoclinal fold refolded by D$_2$ asymmetric folds with westerly dipping axial plane. (Long edges of photograph 15 cm.)

Fig. 3.61 D$_1$ isoclinal folds refolded by D$_2$ folds with westerly dipping axial plane near Shastrinagar (length of the pencil 13.5 cm)
Fig. 3.62 Schematic representation of structure in a vertical section at Shastrinagar, showing the relationship of $D_1$ and $D_2$ folds and fabrics.
Steep eastward dipping bed on the steep limb of D₁ fold in quartzite. Gentler dipping D₁ secondary banding is crenulated by D₂ having westerly dipping axial planes, sub vertical face, east to the left (diameter of the lens cap is 52 mm)
Fig. 3.65  Steep eastward dipping bed on the steep limb of D₁ fold in quartzite. Gentler dipping D₁ secondary banding is crenulated by D₂ having westerly dipping axial planes, sub vertical face, east to the left (diameter of the coin in 3.65 is 2.3 cm).

Fig. 3.66  Relation of D₁ and D₂ south of Anasagar (diameter of the coin 2.3 cm)

Fig. 3.67  Quartzite with sub vertical bedding resting on granite gneiss with sub horizontal gneissosity near Makarwall. The sub horizontal contact is parallel to the gneissosity but truncates the bedding in quartzite.

Fig. 3.68  D₂ folds bend D₁ lineation near Taragarh, south of Anasagar (diameter of the coin 2.3 cm)
Fig. 3.69  Schematic illustration of variation of dip of axial planes 
as a result of shortening combined with simple shear. 
i, ii, iii & iv illustrate possible successive stages, which 
may have led to the development of the observed 
structure seen within the quartzites near Shastrinagar(v).
Interpretative cross section along XY (in Fig. 3.152) across the Anasagar gneiss and its envelope.

- **ANASAGAR LAKE**
- **Quartzite with bedding traces**
- **Mica Schist with schistosity**
- **Granite Gneiss with gneissic foliation**
- **Topography**

Fig. 3.70 Interpretative cross section along XY (in Fig. 3.152) across the Anasagar gneiss and its envelope.
Fig. 3.71 Field sketches showing book shelf sliding of megacrysts within granite gneiss as a result of shear deformation in the area south of Arasagar.

Fig. 3.72 Field sketch showing disruption of xenolith by small scale shear zones within the granite gneiss in the area south of Anasagar.
Fig. 3.73  Shear zone in Anasagar gneiss, with deformed megacryst within it near Christianganj (diameter of coin 2 cm).

Fig. 3.74  Dragging of foliation by dextral shear zone within granite gneiss east of Anasagar lake (length of pencil 13.5 cm)
Fig. 3.75 Structural cross-section across the Anasagar south area along AB in Plate 3A.

Fig. 3.76 Schematic representation of difference in geometry of $D_2$ folds on gentle and steep limbs of $D_1$ folds in the area south of Anasagar.
Fig. 3.77 Structural cross-section across Shastrinagar and Kankariya area along line CDE in Fig. 3.83
Fig. 3.78 Structural cross section, across an area north of Kankariya along line FG in Fig. 3.83.
Fig. 3.79a  Major overturned \((D_2)\) antiform, 1.25 km north of Kankariya

Fig. 3.79b  Field sketch of overturned major antiform \((D_2)\), shown in Fig. 3.79a.
Fig. 3.80 a, b  Field sketch of pairs of smaller folds on (a) common steep limb and (b) flat limb of major $D_2$ fold near Kankariya
Fig. 3.81  Map showing the disappearance of the common steep limb by merging of the axial traces at Kankariya.

Fig. 3.82  3-Dimensional sketch showing the disappearance of steep limb of $D_2$ folds shown in Fig. 3.81 (not to scale).
Fig. 3.83 Lithological map of Shastrinagar and Kankariya area showing the axial traces
Fig. 3.84 Structural cross-section across the Makarwali area along HI in Plate 3C.

Fig. 3.85 Field sketch of dragging of steep bedding within quartzite to a sub-horizontal attitude along the contact near Makarwali in a vertical section.
**Fig. 3.86** Geological map of the western contact of the Anasagar gneiss near Nai
Mean Orientation = 017/44
Mean Resultant dir’n = 109-38
Mean Resultant length = 0.81
(Variance = 0.19)
Calculated. girdle: 275/78
Calculated beta axis: 185-12

Fig. 3.87 Equal area projections of pole to bedding and schistosity in quartzites of Anasagar South (N=199).

Mean Direction = 193-18
Mean Resultant dir’n = 057/53
Mean Resultant length = 0.45

Fig. 3.88 Equal area projections of D2 and D3 axes in quartzites of Anasagar South (N=35).

Mean Orientation = 044/4
Mean Resultant dir’n = 309-0
Mean Resultant length = 0.80
(Variance = 0.20)
Calculated. girdle: 294/89
Calculated beta axis: 204-1

Fig. 3.89 Equal area projections of pole to D2 Axial plane in quartzites of Anasagar South (N=10).
Mean Orientation = 002/82
Mean Resultant dir'n = 083-64
Mean Resultant length = 0.55
(Variance = 0.45)

Fig. 3.90 Equal area projections of pole to $D_3$ axial plane in quartzites of Anasagar South (N=13).

Fig. 3.91 Equal area projections of pole to $D_4$ axial plane in quartzites of Anasagar South (N=3).

Fig. 3.92 Equal area projections of lineations in quartzites of Anasagar South (N=33).
Fig. 3.93 Equal area projections of pole to foliation in granite gneiss of Anasagar South (N=100).

Mean Orientation = 024/37
Mean Resultant dir'n = 113-36
Mean Resultant length = 0.91
(Variance = 0.09)
Calculated, girdle: 123/83
Calculated beta axis: 033-7

Fig. 3.94 Equal area projections of D_2 axes in granite gneiss of Anasagar South (N=15).

Mean Direction = 170-22
Mean Resultant dir'n = 058/34
Mean Resultant length = 0.59
(Variance = 0.41)

Fig. 3.95 Equal area projections of pole to D_2 axial plane in granite gneiss of Anasagar South (N=11).

Mean Orientation = 212/19
Mean Resultant dir'n = 302-18
Mean Resultant length = 0.92
(Variance = 0.08)
Calculated, girdle: 319/84
Calculated beta axis: 229-6
Mean Direction = 134-29
Mean Resultant dir’n = 044/29
Mean Resultant length = 0.95
(Variance = 0.05)

Fig. 3.96 Equal area projections of lineations in granite gneiss of Anasagar South (N=58).

Mean Orientation = 030/45
Mean Resultant dir’n = 121-44
Mean Resultant length = 0.90
(Variance = 0.10)

Fig. 3.97 Equal area projections of pole to schistosity in mica schists of Anasagar South (N=70).

Mean Direction = 134-29
Mean Resultant dir’n = 044/29
Mean Resultant length = 0.95
(Variance = 0.05)

Fig. 3.98 Equal area projections of D2 axes in mica schists of Anasagar South (N=10).
Mean Direction = 033-3
Mean Resultant dir'n = 308/39
Mean Resultant length = 0.33
(Variance = 0.67)

Fig. 3.99 Equal area projection of D₃ axes in mica schists of Anasagar South (N=16).

Mean Direction = 181-26
Mean Resultant dir'n = 086/32
Mean Resultant length = 0.82
(Variance = 0.18)

Fig. 3.100 Equal area projection of undifferentiated D₂ and D₃ axes in mica schists of Anasagar South (N=13).

Mean Direction = 033-3
Mean Resultant dir'n = 308/39
Mean Resultant length = 0.33
(Variance = 0.67)

Fig. 3.101 Equal area projection of poles to D₂ axial plane in mica schists of Anasagar South (N=10).
Mean Orientation = 208/88
Mean Resultant dir'n = 234-34
Mean Resultant length = 0.21
(Variance = 0.79)

Fig. 3.102 Equal area projection of poles to D₃ axial plane in mica schists of Anasagar South (N=15).

Mean Direction = 140-44
Mean Resultant dir'n = 048/45
Mean Resultant length = 0.85
(Variance = 0.15)

Fig. 3.103 Equal area projection of lineations in mica schists of Anasagar South (N=19).
Mean Orientation = 146/28
Mean Resultant dir'n = 226-24
Mean Resultant length = 0.75
(Variance = 0.25)
Calculated, girdle: 288/68
Calculated beta axis: 198-22

Fig. 3.104 Equal area projection of poles to bedding and schistosity in quartzites of Shastrinagar (N=897).

Mean Direction = 193-18
Mean Resultant dir'n = 103/18
Mean Resultant length = 0.95
(Variance = 0.05)

Fig. 3.105 Equal area projection of D_1 axes in quartzites of Shastrinagar (N=18).

Mean Direction = 184-20
Mean Resultant dir'n = 095/23
Mean Resultant length = 0.88
(Variance = 0.12)

Fig. 3.106 Equal area projection of D_2 axes in quartzites of Shastrinagar (N=52).
Mean Direction = 185-23
Mean Resultant dir’n = 095/25
Mean Resultant length = 0.85
(Variance = 0.15)

Fig. 3.107 Equal area projection of $D_3$ axes in quartzites of Shastrinagar (N=40).

Mean Direction = 168-19
Mean Resultant dir’n = 082/29
Mean Resultant length = 0.72
(Variance = 0.28)

Fig. 3.108 Equal area projection of undifferentiated $D_2$, $D_3$ and $D_4$ axes in quartzites of Shastrinagar (N=42).

Mean Orientation = 162/17
Mean Resultant dir’n = 223-12
Mean Resultant length = 0.76
(Variance = 0.24)
Calculated girdle: 296/78
Calculated beta axis: 206-12

Fig. 3.109 Equal area projection of poles to $D_1$ axial plane in quartzites of Shastrinagar (N=13).
Mean Orientation = 168/33
Mean Resultant dir'n = 257-32
Mean Resultant length = 0.91
(Variance = 0.09)

Fig. 3.110 Equal area projection of poles to D2 axial plane in quartzites of Shastrinagar (N=56).

Mean Orientation = 180/73
Mean Resultant dir'n = 270-68
Mean Resultant length = 0.80
(Variance = 0.20)

Fig. 3.111 Equal area projection of poles to D3 axial plane in quartzites of Shastrinagar (N=47).

Fig. 3.112 Equal area projection of poles to D4 axial plane in quartzites of Shastrinagar (N=3).
Mean Direction = 183-21
Mean Resultant dir’n = 095/25
Mean Resultant length = 0.84
(Variance = 0.16)

Fig. 3.113 Equal area projection of lineations in quartzites of Shastrinagar (N=353).

Mean Orientation = 057/17
Mean Resultant dir’n = 145-18
Mean Resultant length = 0.94
(Variance = 0.06)
Calculated girdle: 265/75
Calculated beta axis: 175-15

Fig. 3.114 Equal area projection of poles to foliation in granite gneiss of Shastrinagar (N=299).

Mean Direction = 204-19
Mean Resultant dir’n = 114/19
Mean Resultant length = 0.96
(Variance = 0.04)

Fig. 3.115 Equal area projection of D₂ axes in granite gneiss of Shastrinagar (N=9).
Fig. 3.116 Equal area projection of D$_3$ axes in granite gneiss of Shastrinagar (N=8).

Mean Direction = 172-21
Mean Resultant dir'n = 083/21
Mean Resultant length = 0.90
(Variance = 0.10)

Fig. 3.117 Equal area projection of undifferentiated D$_2$ and D$_3$ axes in granite gneiss of Shastrinagar (N=28).

Fig. 3.118 Equal area projection of poles to D$_2$ axial plane in granite gneiss of Shastrinagar (N=7).
Fig. 3.119 Equal area projection of poles to $D_2$ axial plane in granite gneiss of Shastrinagar (N=4).

Fig. 3.120 Equal area projection of lineations in granite gneiss of Shastrinagar (N=252).

Mean Direction = 166.16
Mean Resultant dir'n = 077/16
Mean Resultant length = 0.96
(Variance = 0.04)
Mean Orientation = 139/10
Mean Resultant dir'n = 227.8
Mean Resultant length = 0.76
(Variance = 0.24)
Calculated girdle: 297/81
Calculated beta axis: 207.9

Fig. 3.121 Equal area projection of poles to bedding and schistosity in quartzites of Kankariya (N=678).

Mean Direction = 206.19
Mean Resultant dir'n = 116/21
Mean Resultant length = 0.90
(Variance = 0.10)

Fig. 3.122 Equal area projection of D1 axes in quartzites of Kankariya (N=59).

Fig. 3.123 Equal area projection of D3 axes in quartzites of Kankariya (N=7).
Mean Direction = 193-13
Mean Resultant dir’n = 108/20
Mean Resultant length = 0.73
(Variance = 0.27)

Fig. 3.124 Equal area projection of undifferentiated D₂ and D₃ axes in quartzites of Kankariya (N=43).

Mean Orientation = 195/27
Mean Resultant dir’n = 285-27
Mean Resultant length = 0.96
(Variance = 0.04)

Fig. 3.125 Equal area projection of poles to D₂ axial plane in quartzites of Kankariya (N=45).

Mean Orientation = 199/87
Mean Resultant dir’n = 100-52
Mean Resultant length = 0.27
(Variance = 0.73)

Fig. 3.126 Equal area projection of poles to D₃ axial plane in quartzites of Kankariya (N=20).
Fig. 3.127 Equal area projection of lineations in quartzites of Kankariya (N=41).

Mean Direction = 192-6
Mean Resultant dir'n = 112/34
Mean Resultant length = 0.50
(Variance = 0.50)

Fig. 3.128 Equal area projection of poles to foliation in granite gneiss of Kankariya (N=215).

Mean Orientation = 102/14
Mean Resultant dir'n = 195-14
Mean Resultant length = 0.88
(Variance = 0.12)
Calculated girdle: 297/76
Calculated beta axis: 207-14

Fig. 3.129 Equal area projection of D₂ axes in granite gneiss of Kankariya (N=36).

Mean Direction = 197-12
Mean Resultant dir'n = 107/13
Mean Resultant length = 0.89
(Variance = 0.11)
Mean Direction = 183-18
Mean Resultant dir'n = 094/18
Mean Resultant length = 0.93
(Variance = 0.07)

Fig. 3.130 Equal area projection of undifferentiated $D_2$ and $D_3$ axes in granite gneiss of Kankariya (N=25).

Mean Orientation = 189/26
Mean Resultant dir'n = 279-26
Mean Resultant length = 0.93
(Variance = 0.07)

Fig. 3.131 Equal area projection of poles to $D_2$ axial plane in granite gneiss of Kankariya (N=39).

Mean Direction = 184-15
Mean Resultant dir'n = 094/15
Mean Resultant length = 0.95
(Variance = 0.05)

Fig. 3.132 Equal area projection of lineations in granite gneiss of Kankariya (N=21).
**Fig. 3.133** Equal area projection of poles to schistosity in mica schists of Kankariya (N=151).

**Mean Orientation** = 115/16
Mean Resultant dir'n = 204-16
Mean Resultant length = 0.94
(Variance = 0.06)

**Fig. 3.134** Equal area projection of $D_2$ axes in mica schists of Kankariya (N=9).

**Mean Direction** = 171-14
Mean Resultant dir'n = 080/14
Mean Resultant length = 0.96
(Variance = 0.04)

**Fig. 3.135** Equal area projection of undifferentiated $D_2$ and $D_3$ axes in mica schists of Kankariya (N=50).
Fig. 3.136 Equal area projection of poles to $D_2$ axial plane in mica schists of Kankariya ($N=9$).
Fig. 3.137 Equal area projection of poles to bedding and schistosity in quartzites of Makarwali. (N=390).

Mean Orientation = 217/35
Mean Resultant dir'n = 322-29
Mean Resultant length = 0.71
(Variance = 0.29)
Calculated: girdle: 075/61
Calculated beta axis: 345-29

Fig. 3.138 Equal area projection of D₂ axes in quartzites of Makarwali. (N=11).

Mean Direction = 344-27
Mean Resultant dir'n = 254/27
Mean Resultant length = 0.95
(Variance = 0.05)

Fig. 3.139 Equal area projection of D₃ axes in quartzites of Makarwali. (N=7).

Mean Direction = 339-29
Mean Resultant dir'n = 249/29
Mean Resultant length = 0.97
(Variance = 0.03)
**Fig. 3.140** Equal area projection of undifferentiated D₂ and D₃ in quartzites of Makarwali (N=16).

**Fig. 3.141** Equal area projection of poles to D₂ axial plane in quartzites of Makarwali (N=80).

**Fig. 3.142** Equal area projection of poles to D₃ axial plane in quartzites of Makarwali (N=8).
**Fig. 3.143** Equal area projection of lineations in quartzites of Makarwali. (N=98).

Mean Direction = 340-28  
Mean Resultant dir'n = 249/27  
Mean Resultant length = 0.95  
(Variance = 0.05)

**Fig. 3.144** Equal area projection of poles to foliation in granite gneiss of Makarwali. (N=69).

Mean Orientation = 228/29  
Mean Resultant dir'n = 318-29  
Mean Resultant length = 0.97  
(Variance = 0.03)

**Fig. 3.145** Equal area projection of D₂ and D₃ axes in granite gneiss of Makarwali. (N=9).

Mean Direction = 342-25  
Mean Resultant dir'n = 252/24  
Mean Resultant length = 0.93  
(Variance = 0.07)
Fig. 3.146 Equal area projection of pole to D, axial plane in granite gneiss of Makarwali. (N=3).

Mean Direction = 341-21
Mean Resultant dir'n = 251/21
Mean Resultant length = 0.95
(Variance = 0.05)

Fig. 3.147 Equal area projection of lineations in granite gneiss of Makarwali. (N=14).

Mean Orientation = 219/31
Mean Resultant dir'n = 309-31
Mean Resultant length = 0.99
(Variance = 0.01)

Fig. 3.148 Equal area projection of poles to schistosity in mica schists of Makarwali. (N=7).
Fig. 3.149 Equal area projection of lineations in mica schists of Makarwali. (N=2).
Fig. 3.150 Cartoon showing a model of evolution of D2 structures.
Stage 1: Before D2 deformation; postulated dislocation surface with ramp-flat geometry shown.
Stage 2: Eastward translation of hanging wall block. Fault bent folds and hanging wall cut-offs shown.
Stage 3: Continued deformation folded dislocation surface, hanging wall and footwall rocks into overturned (D2) and upright D3 folds. Approximate position of present day erosional surface shown.
Fig. 3.151 Cartoon showing an alternative model of evolution of D₂ structures.
Stage 1: Anasagar gneiss and overlying supracrustal rocks cofolded by D₂ asymmetrical folds. Position of postulated dislocation surface shown.
Stage 2: Pattern after eastward translation of the hanging wall block with truncation of D₂ folds.
Stage 3: Continued deformation folded dislocation surface, hanging wall and footwall rocks into overturned (D₂) and upright D₃ folds. Approximate position of present day erosional surface shown.
Fig. 3.152 Generalised geological map of Anasagar gneiss and its envelope, showing the bending of axial traces of major folds.
PLATE 2 Spatial distribution of the different sectors of the study area

1 Taragarh ridge and the area south of Anasagar
2 Area near Christianganj and Shastrinagar, north of Ajmer (west of Ajmer Lohagal road) and area north and northwest of Kankariya (east of Ajmer Lohagal road)
3 Area near Makarwali
Plate 3A Lithological Map of the area, south of Anasagar and Taragarh ridge.
Plate 3B: Lithological map of the area near Christiangani, Shastinagar and Kankariya.
Plate 3C Lithological map of the area near Makarwali